CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Subsidiary Level and Advanced Level
Advanced International Certificate of Education

MATHEMATICS **9709/06**

STATISTICS **0390/06**

Paper 6 Probability & Statistics 1 **(S1)**

May/June 2003

1 hour 15 minutes

Additional materials: Answer Booklet/Paper
Graph paper
List of Formulae (MF9)

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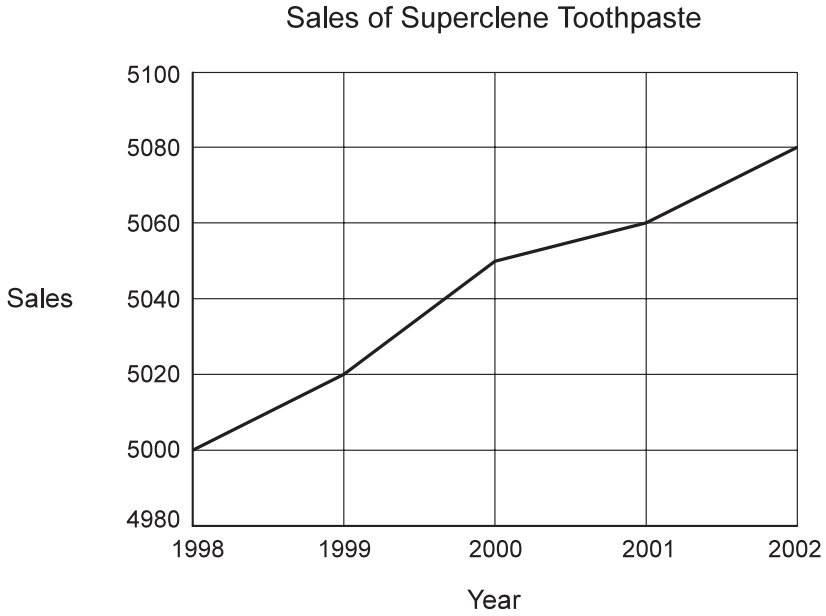
Local Examinations Syndicate

[Turn over

2

1 **(i)**



The diagram represents the sales of Superclene toothpaste over the last few years. Give a reason why it is misleading. [1]

(ii) The following data represent the daily ticket sales at a small theatre during three weeks.

52, 73, 34, 85, 62, 79, 89, 50, 45, 83, 84, 91, 85, 84, 87, 44, 86, 41, 35, 73, 86.

(a) Construct a stem-and-leaf diagram to illustrate the data. [3]

(b) Use your diagram to find the median of the data. [1]

2 A box contains 10 pens of which 3 are new. A random sample of two pens is taken.

(i) Show that the probability of getting exactly one new pen in the sample is $\frac{7}{15}$. [2]

(ii) Construct a probability distribution table for the number of new pens in the sample. [3]

(iii) Calculate the expected number of new pens in the sample. [1]

3 **(i)** The height of sunflowers follows a normal distribution with mean 112 cm and standard deviation 17.2 cm. Find the probability that the height of a randomly chosen sunflower is greater than 120 cm. [3]

(ii) When a new fertiliser is used, the height of sunflowers follows a normal distribution with mean 115 cm. Given that 80% of the heights are now greater than 103 cm, find the standard deviation. [3]

4 Kamal has 30 hens. The probability that any hen lays an egg on any day is 0.7. Hens do not lay more than one egg per day, and the days on which a hen lays an egg are independent.

(i) Calculate the probability that, on any particular day, Kamal's hens lay exactly 24 eggs. [2]

(ii) Use a suitable approximation to calculate the probability that Kamal's hens lay fewer than 20 eggs on any particular day. [5]

5 A committee of 5 people is to be chosen from 6 men and 4 women. In how many ways can this be done

(i) if there must be 3 men and 2 women on the committee, [2]

(ii) if there must be more men than women on the committee, [3]

(iii) if there must be 3 men and 2 women, and one particular woman refuses to be on the committee with one particular man? [3]

6 The people living in 3 houses are classified as children (C), parents (P) or grandparents (G). The numbers living in each house are shown in the table below.

House number 1	House number 2	House number 3
$4C,\ 1P,\ 2G$	$2C,\ 2P,\ 3G$	$1C,\ 1G$

(i) All the people in all 3 houses meet for a party. One person at the party is chosen at random. Calculate the probability of choosing a grandparent. [2]

(ii) A house is chosen at random. Then a person in that house is chosen at random. Using a tree diagram, or otherwise, calculate the probability that the person chosen is a grandparent. [3]

(iii) Given that the person chosen by the method in part **(ii)** is a grandparent, calculate the probability that there is also a parent living in the house. [4]

7 A random sample of 97 people who own mobile phones was used to collect data on the amount of time they spent per day on their phones. The results are displayed in the table below.

Time spent per day (t minutes)	$0 \leqslant t < 5$	$5 \leqslant t < 10$	$10 \leqslant t < 20$	$20 \leqslant t < 30$	$30 \leqslant t < 40$	$40 \leqslant t < 70$
Number of people	11	20	32	18	10	6

(i) Calculate estimates of the mean and standard deviation of the time spent per day on these mobile phones. [5]

(ii) On graph paper, draw a fully labelled histogram to represent the data. [4]

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STATISTICS **0390/06**

Paper 6 Probability & Statistics 1 **(S1)**

May/June 2004

1 hour 15 minutes

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1 Two cricket teams kept records of the number of runs scored by their teams in 8 matches. The scores are shown in the following table.

Team *A*	150	220	77	30	298	118	160	57
Team *B*	166	142	170	93	111	130	148	86

(i) Find the mean and standard deviation of the scores for team *A*. [2]

The mean and standard deviation for team *B* are 130.75 and 29.63 respectively.

(ii) State with a reason which team has the more consistent scores. [2]

2 In a recent survey, 640 people were asked about the length of time each week that they spent watching television. The median time was found to be 20 hours, and the lower and upper quartiles were 15 hours and 35 hours respectively. The least amount of time that anyone spent was 3 hours, and the greatest amount was 60 hours.

(i) On graph paper, show these results using a fully labelled cumulative frequency graph. [3]

(ii) Use your graph to estimate how many people watched more than 50 hours of television each week. [2]

3 Two fair dice are thrown. Let the random variable X be the smaller of the two scores if the scores are different, or the score on one of the dice if the scores are the same.

(i) Copy and complete the following table to show the probability distribution of X. [3]

x	1	2	3	4	5	6
$P(X = x)$						

(ii) Find $E(X)$. [2]

4 Melons are sold in three sizes: small, medium and large. The weights follow a normal distribution with mean 450 grams and standard deviation 120 grams. Melons weighing less than 350 grams are classified as small.

(i) Find the proportion of melons which are classified as small. [3]

(ii) The rest of the melons are divided in equal proportions between medium and large. Find the weight above which melons are classified as large. [5]

5 **(a)** The menu for a meal in a restaurant is as follows.

Starter Course
Melon
or
Soup
or
Smoked Salmon
Main Course
Chicken
or
Steak
or
Lamb Cutlets
or
Vegetable Curry
or
Fish
Dessert Course
Cheesecake
or
Ice Cream
or
Apple Pie
All the main courses are served with salad and either new potatoes or french fries.

(i) How many different three-course meals are there? [2]

(ii) How many different choices are there if customers may choose only two of the three courses? [3]

(b) In how many ways can a group of 14 people eating at the restaurant be divided between three tables seating 5, 5 and 4? [3]

6 When Don plays tennis, 65% of his first serves go into the correct area of the court. If the first serve goes into the correct area, his chance of winning the point is 90%. If his first serve does not go into the correct area, Don is allowed a second serve, and of these, 80% go into the correct area. If the second serve goes into the correct area, his chance of winning the point is 60%. If neither serve goes into the correct area, Don loses the point.

(i) Draw a tree diagram to represent this information. [4]

(ii) Using your tree diagram, find the probability that Don loses the point. [3]

(iii) Find the conditional probability that Don's first serve went into the correct area, given that he loses the point. [2]

7 A shop sells old video tapes, of which 1 in 5 on average are known to be damaged.

(i) A random sample of 15 tapes is taken. Find the probability that at most 2 are damaged. [3]

(ii) Find the smallest value of n if there is a probability of at least 0.85 that a random sample of n tapes contains at least one damaged tape. [3]

(iii) A random sample of 1600 tapes is taken. Use a suitable approximation to find the probability that there are at least 290 damaged tapes. [5]

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STATISTICS **0390/06**

Paper 6 Probability & Statistics 1 **(S1)**

May/June 2005

1 hour 15 minutes

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1 It is known that, on average, 2 people in 5 in a certain country are overweight. A random sample of 400 people is chosen. Using a suitable approximation, find the probability that fewer than 165 people in the sample are overweight. [5]

2 The following table shows the results of a survey to find the average daily time, in minutes, that a group of schoolchildren spent in internet chat rooms.

Time per day (t minutes)	Frequency
$0 \leqslant t < 10$	2
$10 \leqslant t < 20$	f
$20 \leqslant t < 40$	11
$40 \leqslant t < 80$	4

The mean time was calculated to be 27.5 minutes.

(i) Form an equation involving f and hence show that the total number of children in the survey was 26. [4]

(ii) Find the standard deviation of these times. [2]

3 A fair dice has four faces. One face is coloured pink, one is coloured orange, one is coloured green and one is coloured black. Five such dice are thrown and the number that fall on a green face are counted. The random variable X is the number of dice that fall on a green face.

(i) Show that the probability of 4 dice landing on a green face is 0.0146, correct to 4 decimal places. [2]

(ii) Draw up a table for the probability distribution of X, giving your answers correct to 4 decimal places. [5]

4 The following back-to-back stem-and-leaf diagram shows the cholesterol count for a group of 45 people who exercise daily and for another group of 63 who do not exercise. The figures in brackets show the number of people corresponding to each set of leaves.

	People who exercise		People who do not exercise	
(9)	9 8 7 6 4 3 2 2 1	3	1 5 7 7	(4)
(12)	9 8 8 8 7 6 6 5 3 3 2 2	4	2 3 4 4 5 8	(6)
(9)	8 7 7 7 6 5 3 3 1	5	1 2 2 2 3 4 4 5 6 7 8 8 9	(13)
(7)	6 6 6 6 4 3 2	6	1 2 3 3 3 4 5 5 5 7 7 8 9 9	(14)
(3)	8 4 1	7	2 4 5 5 6 6 7 8 8	(9)
(4)	9 5 5 2	8	1 3 3 4 6 7 9 9 9	(9)
(1)	4	9	1 4 5 5 8	(5)
(0)		10	3 3 6	(3)

Key: 2 | 8 | 1 represents a cholesterol count of 8.2 in the group who exercise and 8.1 in the group who do not exercise.

(i) Give one useful feature of a stem-and-leaf diagram. [1]

(ii) Find the median and the quartiles of the cholesterol count for the group who do not exercise. [3]

You are given that the lower quartile, median and upper quartile of the cholesterol count for the group who exercise are 4.25, 5.3 and 6.6 respectively.

(iii) On a single diagram on graph paper, draw two box-and-whisker plots to illustrate the data. [4]

5 Data about employment for males and females in a small rural area are shown in the table.

	Unemployed	Employed
Male	206	412
Female	358	305

A person from this area is chosen at random. Let M be the event that the person is male and let E be the event that the person is employed.

(i) Find P(M). [2]

(ii) Find P(M and E). [1]

(iii) Are M and E independent events? Justify your answer. [3]

(iv) Given that the person chosen is unemployed, find the probability that the person is female. [2]

6 Tyre pressures on a certain type of car independently follow a normal distribution with mean 1.9 bars and standard deviation 0.15 bars.

(i) Find the probability that all four tyres on a car of this type have pressures between 1.82 bars and 1.92 bars. [5]

(ii) Safety regulations state that the pressures must be between $1.9 - b$ bars and $1.9 + b$ bars. It is known that 80% of tyres are within these safety limits. Find the safety limits. [3]

7 **(a)** A football team consists of 3 players who play in a defence position, 3 players who play in a midfield position and 5 players who play in a forward position. Three players are chosen to collect a gold medal for the team. Find in how many ways this can be done

(i) if the captain, who is a midfield player, must be included, together with one defence and one forward player, [2]

(ii) if exactly one forward player must be included, together with any two others. [2]

(b) Find how many different arrangements there are of the nine letters in the words GOLD MEDAL

(i) if there are no restrictions on the order of the letters, [2]

(ii) if the two letters D come first and the two letters L come last. [2]

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May/June 2006

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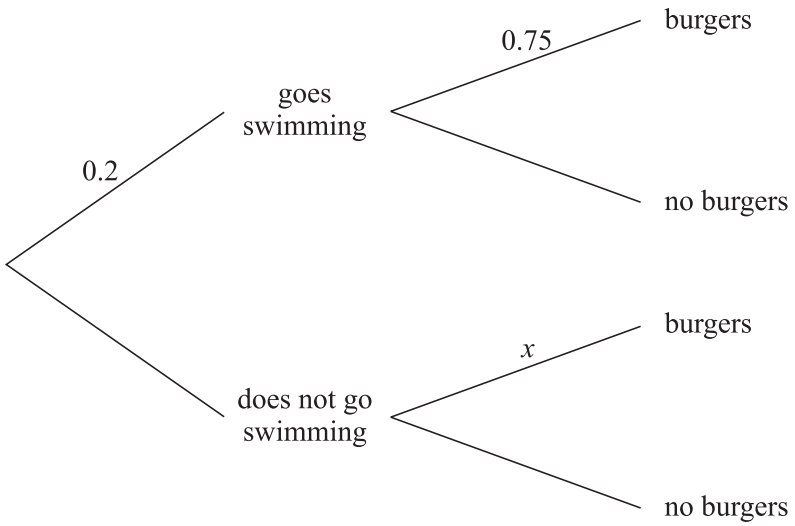
1 The salaries, in thousands of dollars, of 11 people, chosen at random in a certain office, were found to be:

40, 42, 45, 41, 352, 40, 50, 48, 51, 49, 47.

Choose and calculate an appropriate measure of central tendency (mean, mode or median) to summarise these salaries. Explain briefly why the other measures are not suitable. [3]

2 The probability that Henk goes swimming on any day is 0.2. On a day when he goes swimming, the probability that Henk has burgers for supper is 0.75. On a day when he does not go swimming the probability that he has burgers for supper is x. This information is shown on the following tree diagram.



The probability that Henk has burgers for supper on any day is 0.5.

(i) Find x. [4]

(ii) Given that Henk has burgers for supper, find the probability that he went swimming that day. [2]

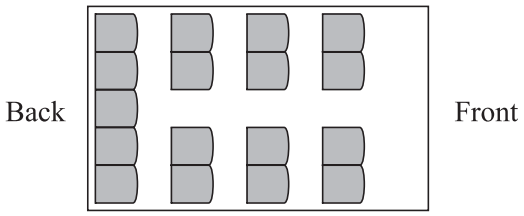
3 The lengths of fish of a certain type have a normal distribution with mean 38 cm. It is found that 5% of the fish are longer than 50 cm.

(i) Find the standard deviation. [3]

(ii) When fish are chosen for sale, those shorter than 30 cm are rejected. Find the proportion of fish rejected. [3]

(iii) 9 fish are chosen at random. Find the probability that at least one of them is longer than 50 cm. [2]

4



The diagram shows the seating plan for passengers in a minibus, which has 17 seats arranged in 4 rows. The back row has 5 seats and the other 3 rows have 2 seats on each side. 11 passengers get on the minibus.

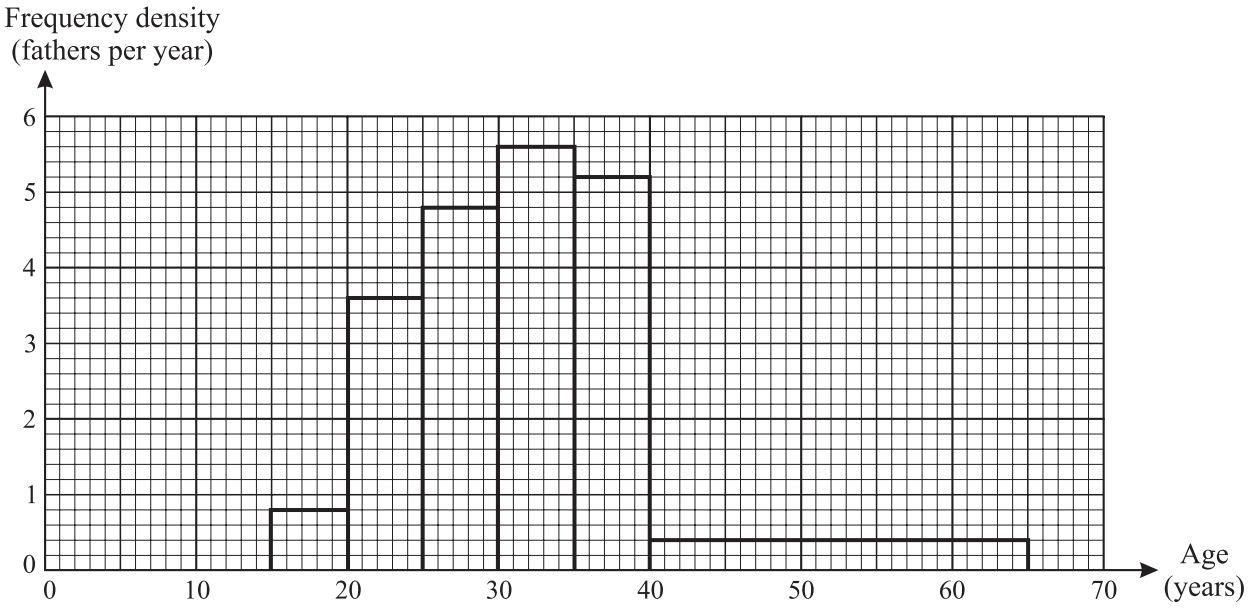
(i) How many possible seating arrangements are there for the 11 passengers? [2]

(ii) How many possible seating arrangements are there if 5 particular people sit in the back row? [3]

Of the 11 passengers, 5 are unmarried and the other 6 consist of 3 married couples.

(iii) In how many ways can 5 of the 11 passengers on the bus be chosen if there must be 2 married couples and 1 other person, who may or may not be married? [3]

5 Each father in a random sample of fathers was asked how old he was when his first child was born. The following histogram represents the information.



(i) What is the modal age group? [1]

(ii) How many fathers were between 25 and 30 years old when their first child was born? [2]

(iii) How many fathers were in the sample? [2]

(iv) Find the probability that a father, chosen at random from the group, was between 25 and 30 years old when his first child was born, given that he was older than 25 years. [2]

6 32 teams enter for a knockout competition, in which each match results in one team winning and the other team losing. After each match the winning team goes on to the next round, and the losing team takes no further part in the competition. Thus 16 teams play in the second round, 8 teams play in the third round, and so on, until 2 teams play in the final round.

(i) How many teams play in only 1 match? [1]

(ii) How many teams play in exactly 2 matches? [1]

(iii) Draw up a frequency table for the numbers of matches which the teams play. [3]

(iv) Calculate the mean and variance of the numbers of matches which the teams play. [4]

7 A survey of adults in a certain large town found that 76% of people wore a watch on their left wrist, 15% wore a watch on their right wrist and 9% did not wear a watch.

(i) A random sample of 14 adults was taken. Find the probability that more than 2 adults did not wear a watch. [4]

(ii) A random sample of 200 adults was taken. Using a suitable approximation, find the probability that more than 155 wore a watch on their left wrist. [5]

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MATHEMATICS **9709/06**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2007**

1 hour 15 minutes

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1 The length of time, t minutes, taken to do the crossword in a certain newspaper was observed on 12 occasions. The results are summarised below.

$$\Sigma(t - 35) = -15 \qquad \Sigma(t - 35)^2 = 82.23$$

Calculate the mean and standard deviation of these times taken to do the crossword. [4]

2 Jamie is equally likely to attend or not to attend a training session before a football match. If he attends, he is certain to be chosen for the team which plays in the match. If he does not attend, there is a probability of 0.6 that he is chosen for the team.

(i) Find the probability that Jamie is chosen for the team. [3]

(ii) Find the conditional probability that Jamie attended the training session, given that he was chosen for the team. [3]

3 **(a)** The random variable X is normally distributed. The mean is twice the standard deviation. It is given that $P(X > 5.2) = 0.9$. Find the standard deviation. [4]

(b) A normal distribution has mean μ and standard deviation σ. If 800 observations are taken from this distribution, how many would you expect to be between $\mu - \sigma$ and $\mu + \sigma$? [3]

4 The lengths of time in minutes to swim a certain distance by the members of a class of twelve 9-year-olds and by the members of a class of eight 16-year-olds are shown below.

9-year-olds:	13.0	16.1	16.0	14.4	15.9	15.1	14.2	13.7	16.7	16.4	15.0	13.2
16-year-olds:	14.8	13.0	11.4	11.7	16.5	13.7	12.8	12.9				

(i) Draw a back-to-back stem-and-leaf diagram to represent the information above. [4]

(ii) A new pupil joined the 16-year-old class and swam the distance. The mean time for the class of nine pupils was now 13.6 minutes. Find the new pupil's time to swim the distance. [3]

5 **(i)** Find the number of ways in which all twelve letters of the word REFRIGERATOR can be arranged

(a) if there are no restrictions, [2]

(b) if the Rs must all be together. [2]

(ii) How many different selections of four letters from the twelve letters of the word REFRIGERATOR contain no Rs and two Es? [3]

6 The probability that New Year's Day is on a Saturday in a randomly chosen year is $\frac{1}{7}$.

(i) 15 years are chosen randomly. Find the probability that at least 3 of these years have New Year's Day on a Saturday. [4]

(ii) 56 years are chosen randomly. Use a suitable approximation to find the probability that more than 7 of these years have New Year's Day on a Saturday. [5]

7 A vegetable basket contains 12 peppers, of which 3 are red, 4 are green and 5 are yellow. Three peppers are taken, at random and without replacement, from the basket.

(i) Find the probability that the three peppers are all different colours. [3]

(ii) Show that the probability that exactly 2 of the peppers taken are green is $\frac{12}{55}$. [2]

(iii) The number of **green** peppers taken is denoted by the discrete random variable X. Draw up a probability distribution table for X. [5]

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Paper 6 Probability & Statistics 1 **(S1)** **May/June 2008**

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1 The stem-and-leaf diagram below represents data collected for the number of hits on an internet site on each day in March 2007. There is one missing value, denoted by x.

0	0 1 5 6	(4)
1	1 3 5 6 6 8	(6)
2	1 1 2 3 4 4 4 8 9	(9)
3	1 2 2 2 x 8 9	(7)
4	2 5 6 7 9	(5)

Key: 1 | 5 represents 15 hits

(i) Find the median and lower quartile for the number of hits each day. [2]

(ii) The interquartile range is 19. Find the value of x. [2]

2 In country A 30% of people who drink tea have sugar in it. In country B 65% of people who drink tea have sugar in it. There are 3 million people in country A who drink tea and 12 million people in country B who drink tea. A person is chosen at random from these 15 million people.

(i) Find the probability that the person chosen is from country A. [1]

(ii) Find the probability that the person chosen does not have sugar in their tea. [2]

(iii) Given that the person chosen does not have sugar in their tea, find the probability that the person is from country B. [2]

3 Issam has 11 different CDs, of which 6 are pop music, 3 are jazz and 2 are classical.

(i) How many different arrangements of all 11 CDs on a shelf are there if the jazz CDs are all next to each other? [3]

(ii) Issam makes a selection of 2 pop music CDs, 2 jazz CDs and 1 classical CD. How many different possible selections can be made? [3]

4 In a certain country the time taken for a common infection to clear up is normally distributed with mean μ days and standard deviation 2.6 days. 25% of these infections clear up in less than 7 days.

(i) Find the value of μ. [4]

In another country the standard deviation of the time taken for the infection to clear up is the same as in part **(i)**, but the mean is 6.5 days. The time taken is normally distributed.

(ii) Find the probability that, in a randomly chosen case from this country, the infection takes longer than 6.2 days to clear up. [3]

5 As part of a data collection exercise, members of a certain school year group were asked how long they spent on their Mathematics homework during one particular week. The times are given to the nearest 0.1 hour. The results are displayed in the following table.

Time spent (t hours)	$0.1 \leqslant t \leqslant 0.5$	$0.6 \leqslant t \leqslant 1.0$	$1.1 \leqslant t \leqslant 2.0$	$2.1 \leqslant t \leqslant 3.0$	$3.1 \leqslant t \leqslant 4.5$
Frequency	11	15	18	30	21

(i) Draw, on graph paper, a histogram to illustrate this information. [5]

(ii) Calculate an estimate of the mean time spent on their Mathematics homework by members of this year group. [3]

6 Every day Eduardo tries to phone his friend. Every time he phones there is a 50% chance that his friend will answer. If his friend answers, Eduardo does not phone again on that day. If his friend does not answer, Eduardo tries again in a few minutes' time. If his friend has not answered after 4 attempts, Eduardo does not try again on that day.

(i) Draw a tree diagram to illustrate this situation. [3]

(ii) Let X be the number of unanswered phone calls made by Eduardo on a day. Copy and complete the table showing the probability distribution of X. [4]

x	0	1	2	3	4
$\mathrm{P}(X = x)$		$\frac{1}{4}$			

(iii) Calculate the expected number of unanswered phone calls on a day. [2]

7 A die is biased so that the probability of throwing a 5 is 0.75 and the probabilities of throwing a 1, 2, 3, 4 or 6 are all equal.

(i) The die is thrown three times. Find the probability that the result is a 1 followed by a 5 followed by any even number. [3]

(ii) Find the probability that, out of 10 throws of this die, at least 8 throws result in a 5. [3]

(iii) The die is thrown 90 times. Using an appropriate approximation, find the probability that a 5 is thrown more than 60 times. [5]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/06**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2009**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 The volume of milk in millilitres in cartons is normally distributed with mean μ and standard deviation 8. Measurements were taken of the volume in 900 of these cartons and it was found that 225 of them contained more than 1002 millilitres.

(i) Calculate the value of μ. [3]

(ii) Three of these 900 cartons are chosen at random. Calculate the probability that exactly 2 of them contain more than 1002 millilitres. [2]

2 Gohan throws a fair tetrahedral die with faces numbered 1, 2, 3, 4. If she throws an even number then her score is the number thrown. If she throws an odd number then she throws again and her score is the sum of both numbers thrown. Let the random variable X denote Gohan's score.

(i) Show that $\mathrm{P}(X = 2) = \frac{5}{16}$. [2]

(ii) The table below shows the probability distribution of X.

x	2	3	4	5	6	7
$\mathrm{P}(X = x)$	$\frac{5}{16}$	$\frac{1}{16}$	$\frac{3}{8}$	$\frac{1}{8}$	$\frac{1}{16}$	$\frac{1}{16}$

Calculate $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. [4]

3 On a certain road 20% of the vehicles are trucks, 16% are buses and the remainder are cars.

(i) A random sample of 11 vehicles is taken. Find the probability that fewer than 3 are buses. [3]

(ii) A random sample of 125 vehicles is now taken. Using a suitable approximation, find the probability that more than 73 are cars. [5]

4 A choir consists of 13 sopranos, 12 altos, 6 tenors and 7 basses. A group consisting of 10 sopranos, 9 altos, 4 tenors and 4 basses is to be chosen from the choir.

(i) In how many different ways can the group be chosen? [2]

(ii) In how many ways can the 10 chosen sopranos be arranged in a line if the 6 tallest stand next to each other? [3]

(iii) The 4 tenors and 4 basses in the group stand in a single line with all the tenors next to each other and all the basses next to each other. How many possible arrangements are there if three of the tenors refuse to stand next to any of the basses? [3]

5 At a zoo, rides are offered on elephants, camels and jungle tractors. Ravi has money for only one ride. To decide which ride to choose, he tosses a fair coin twice. If he gets 2 heads he will go on the elephant ride, if he gets 2 tails he will go on the camel ride and if he gets 1 of each he will go on the jungle tractor ride.

(i) Find the probabilities that he goes on each of the three rides. [2]

The probabilities that Ravi is frightened on each of the rides are as follows:

$$\text{elephant ride } \tfrac{6}{10}, \quad \text{camel ride } \tfrac{7}{10}, \quad \text{jungle tractor ride } \tfrac{8}{10}.$$

(ii) Draw a fully labelled tree diagram showing the rides that Ravi could take and whether or not he is frightened. [2]

Ravi goes on a ride.

(iii) Find the probability that he is frightened. [2]

(iv) Given that Ravi is **not** frightened, find the probability that he went on the camel ride. [3]

6 During January the numbers of people entering a store during the first hour after opening were as follows.

Time after opening, x minutes	Frequency	Cumulative frequency
$0 < x \leqslant 10$	210	210
$10 < x \leqslant 20$	134	344
$20 < x \leqslant 30$	78	422
$30 < x \leqslant 40$	72	a
$40 < x \leqslant 60$	b	540

(i) Find the values of a and b. [2]

(ii) Draw a cumulative frequency graph to represent this information. Take a scale of 2 cm for 10 minutes on the horizontal axis and 2 cm for 50 people on the vertical axis. [4]

(iii) Use your graph to estimate the median time after opening that people entered the store. [2]

(iv) Calculate estimates of the mean, m minutes, and standard deviation, s minutes, of the time after opening that people entered the store. [4]

(v) Use your graph to estimate the number of people entering the store between $(m - \frac{1}{2}s)$ and $(m + \frac{1}{2}s)$ minutes after opening. [2]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2010**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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2

1 The probability distribution of the discrete random variable X is shown in the table below.

x	−3	−1	0	4
$P(X = x)$	a	b	0.15	0.4

Given that $E(X) = 0.75$, find the values of a and b. [4]

2 The numbers of people travelling on a certain bus at different times of the day are as follows.

17	5	2	23	16	31	8
22	14	25	35	17	27	12
6	23	19	21	23	8	26

(i) Draw a stem-and-leaf diagram to illustrate the information given above. [3]

(ii) Find the median, the lower quartile, the upper quartile and the interquartile range. [3]

(iii) State, in this case, which of the median and mode is preferable as a measure of central tendency, and why. [1]

3 The random variable X is the length of time in minutes that Jannon takes to mend a bicycle puncture. X has a normal distribution with mean μ and variance σ^2. It is given that $P(X > 30.0) = 0.1480$ and $P(X > 20.9) = 0.6228$. Find μ and σ. [5]

4 The numbers of rides taken by two students, Fei and Graeme, at a fairground are shown in the following table.

	Roller coaster	Water slide	Revolving drum
Fei	4	2	0
Graeme	1	3	6

(i) The mean cost of Fei's rides is \$2.50 and the standard deviation of the costs of Fei's rides is \$0. Explain how you can tell that the roller coaster and the water slide each cost \$2.50 per ride. [2]

(ii) The mean cost of Graeme's rides is \$3.76. Find the standard deviation of the costs of Graeme's rides. [5]

5 In the holidays Martin spends 25% of the day playing computer games. Martin's friend phones him once a day at a randomly chosen time.

(i) Find the probability that, in one holiday period of 8 days, there are exactly 2 days on which Martin is playing computer games when his friend phones. [2]

(ii) Another holiday period lasts for 12 days. State with a reason whether it is appropriate to use a normal approximation to find the probability that there are fewer than 7 days on which Martin is playing computer games when his friend phones. [1]

(iii) Find the probability that there are at least 13 days of a 40-day holiday period on which Martin is playing computer games when his friend phones. [5]

6 **(i)** Find the number of different ways that a set of 10 different mugs can be shared between Lucy and Monica if each receives an odd number of mugs. [3]

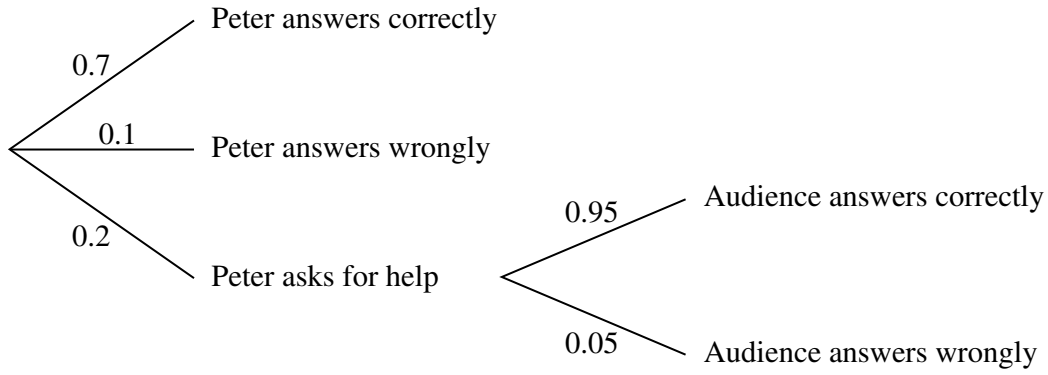
(ii) Another set consists of 6 plastic mugs each of a different design and 3 china mugs each of a different design. Find in how many ways these 9 mugs can be arranged in a row if the china mugs are all separated from each other. [3]

(iii) Another set consists of 3 identical red mugs, 4 identical blue mugs and 7 identical yellow mugs. These 14 mugs are placed in a row. Find how many different arrangements of the colours are possible if the red mugs are kept together. [3]

7 In a television quiz show Peter answers questions one after another, stopping as soon as a question is answered wrongly.

- The probability that Peter gives the correct answer himself to any question is 0.7.
- The probability that Peter gives a wrong answer himself to any question is 0.1.
- The probability that Peter decides to ask for help for any question is 0.2.

On the first occasion that Peter decides to ask for help he asks the audience. The probability that the audience gives the correct answer to any question is 0.95. This information is shown in the tree diagram below.



(i) Show that the probability that the first question is answered correctly is 0.89. [1]

On the second occasion that Peter decides to ask for help he phones a friend. The probability that his friend gives the correct answer to any question is 0.65.

(ii) Find the probability that the first two questions are both answered correctly. [6]

(iii) Given that the first two questions were both answered correctly, find the probability that Peter asked the audience. [3]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2010**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 The times in minutes for seven students to become proficient at a new computer game were measured. The results are shown below.

15 10 48 10 19 14 16

(i) Find the mean and standard deviation of these times. [2]

(ii) State which of the mean, median or mode you consider would be most appropriate to use as a measure of central tendency to represent the data in this case. [1]

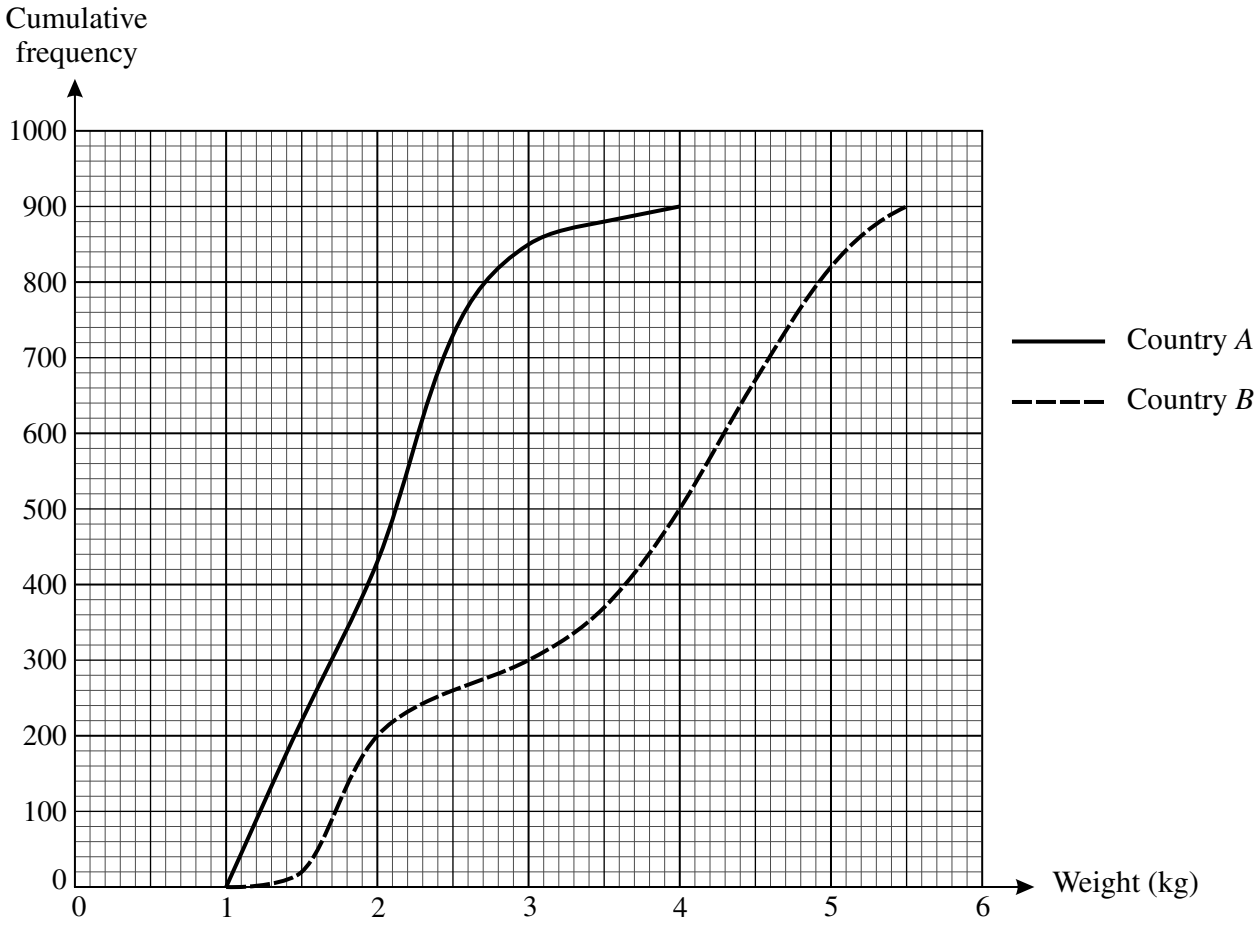
(iii) For each of the two measures of average you did not choose in part **(ii)**, give a reason why you consider it inappropriate. [2]

2 The lengths of new pencils are normally distributed with mean 11 cm and standard deviation 0.095 cm.

(i) Find the probability that a pencil chosen at random has a length greater than 10.9 cm. [2]

(ii) Find the probability that, in a random sample of 6 pencils, at least two have lengths less than 10.9 cm. [3]

3



The birth weights of random samples of 900 babies born in country *A* and 900 babies born in country *B* are illustrated in the cumulative frequency graphs. Use suitable data from these graphs to compare the central tendency and spread of the birth weights of the two sets of babies. [6]

4 The random variable X is normally distributed with mean μ and standard deviation σ.

(i) Given that $5\sigma = 3\mu$, find $\mathrm{P}(X < 2\mu)$. [3]

(ii) With a different relationship between μ and σ, it is given that $\mathrm{P}(X < \frac{1}{3}\mu) = 0.8524$. Express μ in terms of σ. [3]

5 Two fair twelve-sided dice with sides marked 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 are thrown, and the numbers on the sides which land face down are noted. Events Q and R are defined as follows.

Q : the product of the two numbers is 24.

R : both of the numbers are greater than 8.

(i) Find $\mathrm{P}(Q)$. [2]

(ii) Find $\mathrm{P}(R)$. [2]

(iii) Are events Q and R exclusive? Justify your answer. [2]

(iv) Are events Q and R independent? Justify your answer. [2]

6 A small farm has 5 ducks and 2 geese. Four of these birds are to be chosen at random. The random variable X represents the number of geese chosen.

(i) Draw up the probability distribution of X. [3]

(ii) Show that $\mathrm{E}(X) = \frac{8}{7}$ and calculate $\mathrm{Var}(X)$. [3]

(iii) When the farmer's dog is let loose, it chases either the ducks with probability $\frac{3}{5}$ or the geese with probability $\frac{2}{5}$. If the dog chases the ducks there is a probability of $\frac{1}{10}$ that they will attack the dog. If the dog chases the geese there is a probability of $\frac{3}{4}$ that they will attack the dog. Given that the dog is not attacked, find the probability that it was chasing the geese. [4]

7 Nine cards, each of a different colour, are to be arranged in a line.

(i) How many different arrangements of the 9 cards are possible? [1]

The 9 cards include a pink card and a green card.

(ii) How many different arrangements do not have the pink card next to the green card? [3]

Consider all possible choices of 3 cards from the 9 cards with the 3 cards being arranged in a line.

(iii) How many different arrangements in total of 3 cards are possible? [2]

(iv) How many of the arrangements of 3 cards in part **(iii)** contain the pink card? [2]

(v) How many of the arrangements of 3 cards in part **(iii)** do not have the pink card next to the green card? [2]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2010**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 A bottle of sweets contains 13 red sweets, 13 blue sweets, 13 green sweets and 13 yellow sweets. 7 sweets are selected at random. Find the probability that exactly 3 of them are red. [3]

2 The heights, x cm, of a group of 82 children are summarised as follows.

$$\Sigma(x - 130) = -287, \qquad \text{standard deviation of } x = 6.9.$$

(i) Find the mean height. [2]

(ii) Find $\Sigma(x - 130)^2$. [2]

3 Christa takes her dog for a walk every day. The probability that they go to the park on any day is 0.6. If they go to the park there is a probability of 0.35 that the dog will bark. If they do not go to the park there is a probability of 0.75 that the dog will bark.

(i) Find the probability that they go to the park on more than 5 of the next 7 days. [2]

(ii) Find the probability that the dog barks on any particular day. [2]

(iii) Find the variance of the number of times they go to the park in 30 days. [1]

4 Three identical cans of cola, 2 identical cans of green tea and 2 identical cans of orange juice are arranged in a row. Calculate the number of arrangements if

(i) the first and last cans in the row are the same type of drink, [3]

(ii) the 3 cans of cola are all next to each other and the 2 cans of green tea are not next to each other. [5]

5 Set A consists of the ten digits 0, 0, 0, 0, 0, 0, 2, 2, 2, 4.

Set B consists of the seven digits 0, 0, 0, 0, 2, 2, 2.

One digit is chosen at random from each set. The random variable X is defined as the sum of these two digits.

(i) Show that $\mathrm{P}(X = 2) = \frac{3}{7}$. [2]

(ii) Tabulate the probability distribution of X. [2]

(iii) Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. [3]

(iv) Given that $X = 2$, find the probability that the digit chosen from set A was 2. [2]

6 The lengths of some insects of the same type from two countries, X and Y, were measured. The stem-and-leaf diagram shows the results.

Country X		Country Y	
(10)	9 7 6 6 6 4 4 4 3 2	80	
(18)	8 8 8 7 7 6 6 5 5 5 4 4 3 3 3 2 2 0	81	1 1 2 2 3 3 3 5 5 6 7 8 9 (13)
(16)	9 9 9 8 8 7 7 6 5 5 3 2 2 1 0 0	82	0 0 1 2 3 3 3 q 4 5 6 6 7 8 8 (15)
(16)	8 7 6 5 5 5 3 3 2 2 2 1 1 1 0 0	83	0 1 2 2 4 4 4 4 5 5 6 6 7 7 7 8 9 (17)
(11)	8 7 6 5 5 4 4 3 3 1 1	84	0 0 1 2 4 4 5 5 6 6 7 7 7 8 9 (15)
		85	1 2 r 3 3 5 5 6 6 7 8 8 (12)
		86	0 1 2 2 3 5 5 5 8 9 9 (11)

Key: 5 | 81 | 3 means an insect from country X has length 0.815 cm and an insect from country Y has length 0.813 cm.

(i) Find the median and interquartile range of the lengths of the insects from country X. [2]

(ii) The interquartile range of the lengths of the insects from country Y is 0.028 cm. Find the values of q and r. [2]

(iii) Represent the data by means of a pair of box-and-whisker plots in a single diagram on graph paper. [4]

(iv) Compare the lengths of the insects from the two countries. [2]

7 The heights that children of a particular age can jump have a normal distribution. On average, 8 children out of 10 can jump a height of more than 127 cm, and 1 child out of 3 can jump a height of more than 135 cm.

(i) Find the mean and standard deviation of the heights the children can jump. [5]

(ii) Find the probability that a randomly chosen child will **not** be able to jump a height of 145 cm. [3]

(iii) Find the probability that, of 8 randomly chosen children, at least 2 will be able to jump a height of more than 135 cm. [3]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2011**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 Biscuits are sold in packets of 18. There is a constant probability that any biscuit is broken, independently of other biscuits. The mean number of broken biscuits in a packet has been found to be 2.7. Find the probability that a packet contains between 2 and 4 (inclusive) broken biscuits. [4]

2 When Ted is looking for his pen, the probability that it is in his pencil case is 0.7. If his pen is in his pencil case he always finds it. If his pen is somewhere else, the probability that he finds it is 0.2. Given that Ted finds his pen when he is looking for it, find the probability that it was in his pencil case. [4]

3 The possible values of the random variable X are the 8 integers in the set $\{-2, -1, 0, 1, 2, 3, 4, 5\}$. The probability of X being 0 is $\frac{1}{10}$. The probabilities for all the other values of X are equal. Calculate

(i) $P(X < 2)$, [2]

(ii) the variance of X, [3]

(iii) the value of a for which $P(-a \leqslant X \leqslant 2a) = \frac{17}{35}$. [1]

4 A cricket team of 11 players is to be chosen from 21 players consisting of 10 batsmen, 9 bowlers and 2 wicketkeepers. The team must include at least 5 batsmen, at least 4 bowlers and at least 1 wicketkeeper.

(i) Find the number of different ways in which the team can be chosen. [4]

Each player in the team is given a present. The presents consist of 5 identical pens, 4 identical diaries and 2 identical notebooks.

(ii) Find the number of different arrangements of the presents if they are all displayed in a row. [1]

(iii) 10 of these 11 presents are chosen and arranged in a row. Find the number of different arrangements that are possible. [3]

5 **(a)** The random variable X is normally distributed with mean μ and standard deviation σ. It is given that $3\mu = 7\sigma^2$ and that $P(X > 2\mu) = 0.1016$. Find μ and σ. [4]

(b) It is given that $Y \sim N(33, 21)$. Find the value of a given that $P(33 - a < Y < 33 + a) = 0.5$. [4]

6 There are 5000 schools in a certain country. The cumulative frequency table shows the number of pupils in a school and the corresponding number of schools.

Number of pupils in a school	$\leqslant 100$	$\leqslant 150$	$\leqslant 200$	$\leqslant 250$	$\leqslant 350$	$\leqslant 450$	$\leqslant 600$
Cumulative frequency	200	800	1600	2100	4100	4700	5000

(i) Draw a cumulative frequency graph with a scale of 2 cm to 100 pupils on the horizontal axis and a scale of 2 cm to 1000 schools on the vertical axis. Use your graph to estimate the median number of pupils in a school. [3]

(ii) 80% of the schools have more than n pupils. Estimate the value of n correct to the nearest ten. [2]

(iii) Find how many schools have between 201 and 250 (inclusive) pupils. [1]

(iv) Calculate an estimate of the mean number of pupils per school. [4]

7 **(a)** **(i)** Find the probability of getting at least one 3 when 9 fair dice are thrown. [2]

(ii) When n fair dice are thrown, the probability of getting at least one 3 is greater than 0.9. Find the smallest possible value of n. [4]

(b) A bag contains 5 green balls and 3 yellow balls. Ronnie and Julie play a game in which they take turns to draw a ball from the bag at random without replacement. The winner of the game is the first person to draw a yellow ball. Julie draws the first ball. Find the probability that Ronnie wins the game. [4]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2011**

1 hour 15 minutes

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1 A biased die was thrown 20 times and the number of 5s was noted. This experiment was repeated many times and the average number of 5s was found to be 4.8. Find the probability that in the next 20 throws the number of 5s will be less than three. [4]

2 In Scotland, in November, on average 80% of days are cloudy. Assume that the weather on any one day is independent of the weather on other days.

(i) Use a normal approximation to find the probability of there being fewer than 25 cloudy days in Scotland in November (30 days). [4]

(ii) Give a reason why the use of a normal approximation is justified. [1]

3 A sample of 36 data values, x, gave $\Sigma(x - 45) = -148$ and $\Sigma(x - 45)^2 = 3089$.

(i) Find the mean and standard deviation of the 36 values. [3]

(ii) One extra data value of 29 was added to the sample. Find the standard deviation of all 37 values. [4]

4 **(i)** Find the number of different ways that the 9 letters of the word HAPPINESS can be arranged in a line. [1]

(ii) The 9 letters of the word HAPPINESS are arranged in random order in a line. Find the probability that the 3 vowels (A, E, I) are not all next to each other. [4]

(iii) Find the number of different selections of 4 letters from the 9 letters of the word HAPPINESS which contain no Ps and either one or two Ss. [3]

5 A hotel has 90 rooms. The table summarises information about the number of rooms occupied each day for a period of 200 days.

Number of rooms occupied	1 – 20	21 – 40	41 – 50	51 – 60	61 – 70	71 – 90
Frequency	10	32	62	50	28	18

(i) Draw a cumulative frequency graph on graph paper to illustrate this information. [4]

(ii) Estimate the number of days when over 30 rooms were occupied. [2]

(iii) On 75% of the days at most n rooms were occupied. Estimate the value of n. [2]

6 The lengths, in centimetres, of drinking straws produced in a factory have a normal distribution with mean μ and variance 0.64. It is given that 10% of the straws are shorter than 20 cm.

(i) Find the value of μ. [3]

(ii) Find the probability that, of 4 straws chosen at random, fewer than 2 will have a length between 21.5 cm and 22.5 cm. [6]

7 Judy and Steve play a game using five cards numbered 3, 4, 5, 8, 9. Judy chooses a card at random, looks at the number on it and replaces the card. Then Steve chooses a card at random, looks at the number on it and replaces the card. If their two numbers are equal the score is 0. Otherwise, the smaller number is subtracted from the larger number to give the score.

(i) Show that the probability that the score is 6 is 0.08. [1]

(ii) Draw up a probability distribution table for the score. [2]

(iii) Calculate the mean score. [1]

If the score is 0 they play again. If the score is 4 or more Judy wins. Otherwise Steve wins. They continue playing until one of the players wins.

(iv) Find the probability that Judy wins with the second choice of cards. [3]

(v) Find an expression for the probability that Judy wins with the nth choice of cards. [2]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2011**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 Red Street Garage has 9 used cars for sale. Fairwheel Garage has 15 used cars for sale. The mean age of the cars in Red Street Garage is 3.6 years and the standard deviation is 1.925 years. In Fairwheel Garage, $\Sigma x = 64$ and $\Sigma x^2 = 352$, where x is the age of a car in years.

(i) Find the mean age of all 24 cars. [2]

(ii) Find the standard deviation of the ages of all 24 cars. [4]

2 Fahad has 4 different coloured pairs of shoes (white, red, blue and black), 3 different coloured pairs of jeans (blue, black and brown) and 7 different coloured tee shirts (red, orange, yellow, blue, green, white and purple).

(i) Fahad chooses an outfit consisting of one pair of shoes, one pair of jeans and one tee shirt. How many different outfits can he choose? [1]

(ii) How many different ways can Fahad arrange his 3 jeans and 7 tee shirts in a row if the two blue items are not next to each other? [2]

Fahad also has 9 different books about sport. When he goes on holiday he chooses at least one of these books to take with him.

(iii) How many different selections are there if he can take any number of books ranging from just one of them to all of them? [3]

3 The following cumulative frequency table shows the examination marks for 300 candidates in country *A* and 300 candidates in country *B*.

Mark	<10	<20	<35	<50	<70	<100
Cumulative frequency, *A*	25	68	159	234	260	300
Cumulative frequency, *B*	10	46	72	144	198	300

(i) Without drawing a graph, show that the median for country *B* is higher than the median for country *A*. [2]

(ii) Find the number of candidates in country *A* who scored between 20 and 34 marks inclusive. [1]

(iii) Calculate an estimate of the mean mark for candidates in country *A*. [4]

4 Tim throws a fair die twice and notes the number on each throw.

(i) Tim calculates his final score as follows. If the number on the second throw is a 5 he multiplies the two numbers together, and if the number on the second throw is not a 5 he adds the two numbers together. Find the probability that his final score is

(a) 12, [1]

(b) 5. [3]

(ii) Events A, B, C are defined as follows.

A: the number on the second throw is 5

B: the sum of the numbers is 6

C: the product of the numbers is even

By calculation find which pairs, if any, of the events A, B and C are independent. [5]

5 The random variable X is normally distributed with mean μ and standard deviation $\frac{1}{4}\mu$. It is given that $P(X > 20) = 0.04$.

(i) Find μ. [3]

(ii) Find $P(10 < X < 20)$. [3]

(iii) 250 independent observations of X are taken. Find the probability that at least 235 of them are less than 20. [5]

6 The probability that Sue completes a Sudoku puzzle correctly is 0.75.

(i) Sue attempts n Sudoku puzzles. Find the least value of n for which the probability that she completes all n puzzles correctly is less than 0.06. [3]

Sue attempts 14 Sudoku puzzles every month. The number that she completes successfully is denoted by X.

(ii) Find the value of X that has the highest probability. You may assume that this value is one of the two values closest to the mean of X. [3]

(iii) Find the probability that in exactly 3 of the next 5 months Sue completes more than 11 Sudoku puzzles correctly. [5]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2012**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 It is given that $X \sim N(28.3, 4.5)$. Find the probability that a randomly chosen value of X lies between 25 and 30. [3]

2 Maria has 3 pre-set stations on her radio. When she switches her radio on, there is a probability of 0.3 that it will be set to station 1, a probability of 0.45 that it will be set to station 2 and a probability of 0.25 that it will be set to station 3. On station 1 the probability that the presenter is male is 0.1, on station 2 the probability that the presenter is male is 0.85 and on station 3 the probability that the presenter is male is p. When Maria switches on the radio, the probability that it is set to station 3 and the presenter is male is 0.075.

(i) Show that the value of p is 0.3. [1]

(ii) Given that Maria switches on and hears a male presenter, find the probability that the radio was set to station 2. [4]

3 A spinner has 5 sides, numbered 1, 2, 3, 4 and 5. When the spinner is spun, the score is the number of the side on which it lands. The score is denoted by the random variable X, which has the probability distribution shown in the table.

x	1	2	3	4	5
$P(X = x)$	0.3	0.15	$3p$	$2p$	0.05

(i) Find the value of p. [1]

A second spinner has 3 sides, numbered 1, 2 and 3. The score when this spinner is spun is denoted by the random variable Y. It is given that $P(Y = 1) = 0.3$, $P(Y = 2) = 0.5$ and $P(Y = 3) = 0.2$.

(ii) Find the probability that, when both spinners are spun together,

(a) the sum of the scores is 4, [3]

(b) the product of the scores is less than 8. [3]

4 In a certain mountainous region in winter, the probability of more than 20 cm of snow falling on any particular day is 0.21.

(i) Find the probability that, in any 7-day period in winter, fewer than 5 days have more than 20 cm of snow falling. [3]

(ii) For 4 randomly chosen 7-day periods in winter, find the probability that exactly 3 of these periods will have at least 1 day with more than 20 cm of snow falling. [4]

5 The lengths of the diagonals in metres of the 9 most popular flat screen TVs and the 9 most popular conventional TVs are shown below.

Flat screen :	0.85	0.94	0.91	0.96	1.04	0.89	1.07	0.92	0.76
Conventional :	0.69	0.65	0.85	0.77	0.74	0.67	0.71	0.86	0.75

(i) Represent this information on a back-to-back stem-and-leaf diagram. [4]

(ii) Find the median and the interquartile range of the lengths of the diagonals of the 9 conventional TVs. [3]

(iii) Find the mean and standard deviation of the lengths of the diagonals of the 9 flat screen TVs. [2]

6 The lengths of body feathers of a particular species of bird are modelled by a normal distribution. A researcher measures the lengths of a random sample of 600 body feathers from birds of this species and finds that 63 are less than 6 cm long and 155 are more than 12 cm long.

(i) Find estimates of the mean and standard deviation of the lengths of body feathers of birds of this species. [5]

(ii) In a random sample of 1000 body feathers from birds of this species, how many would the researcher expect to find with lengths more than 1 standard deviation from the mean? [4]

7 **(a)** Seven friends together with their respective partners all meet up for a meal. To commemorate the occasion they arrange for a photograph to be taken of all 14 of them standing in a line.

(i) How many different arrangements are there if each friend is standing next to his or her partner? [3]

(ii) How many different arrangements are there if the 7 friends all stand together and the 7 partners all stand together? [2]

(b) A group of 9 people consists of 2 boys, 3 girls and 4 adults. In how many ways can a team of 4 be chosen if

(i) both boys are in the team, [1]

(ii) the adults are either all in the team or all not in the team, [2]

(iii) at least 2 girls are in the team? [2]

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61

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2012**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 The ages, x years, of 150 cars are summarised by $\Sigma x = 645$ and $\Sigma x^2 = 8287.5$. Find $\Sigma(x - \bar{x})^2$, where $\bar{x}$ denotes the mean of x. [4]

2 The random variable X has the probability distribution shown in the table.

x	2	4	6
$P(X = x)$	0.5	0.4	0.1

Two independent values of X are chosen at random. The random variable Y takes the value 0 if the two values of X are the same. Otherwise the value of Y is the larger value of X minus the smaller value of X.

(i) Draw up the probability distribution table for Y. [4]

(ii) Find the expected value of Y. [1]

3 In Restaurant Bijoux 13% of customers rated the food as 'poor', 22% of customers rated the food as 'satisfactory' and 65% rated it as 'good'. A random sample of 12 customers who went for a meal at Restaurant Bijoux was taken.

(i) Find the probability that more than 2 and fewer than 12 of them rated the food as 'good'. [3]

On a separate occasion, a random sample of n customers who went for a meal at the restaurant was taken.

(ii) Find the smallest value of n for which the probability that at least 1 person will rate the food as 'poor' is greater than 0.95. [3]

4 The back-to-back stem-and-leaf diagram shows the values taken by two variables A and B.

	A		B	
(3)	3 1 0	15	1 3 3 5	(4)
(2)	4 1	16	2 2 3 4 4 5 7 7 7 8	(10)
(3)	8 3 3	17	0 1 3 3 3 4 6 6 7 9 9	(11)
(12)	9 8 8 6 5 5 4 3 2 1 1 0	18	2 4 7	(3)
(8)	9 9 8 8 6 5 4 2	19	1 5	(2)
(5)	9 8 7 1 0	20	4	(1)

Key: 4 | 16 | 7 means $A = 0.164$ and $B = 0.167$.

(i) Find the median and the interquartile range for variable A. [3]

(ii) You are given that, for variable B, the median is 0.171, the upper quartile is 0.179 and the lower quartile is 0.164. Draw box-and-whisker plots for A and B in a single diagram on graph paper. [3]

5 An English examination consists of 8 questions in Part *A* and 3 questions in Part *B*. Candidates must choose 6 questions. The order in which questions are chosen does not matter. Find the number of ways in which the 6 questions can be chosen in each of the following cases.

(i) There are no restrictions on which questions can be chosen. [1]

(ii) Candidates must choose at least 4 questions from Part *A*. [3]

(iii) Candidates must either choose both question 1 and question 2 in Part *A*, or choose neither of these questions. [3]

6 A box of biscuits contains 30 biscuits, some of which are wrapped in gold foil and some of which are unwrapped. Some of the biscuits are chocolate-covered. 12 biscuits are wrapped in gold foil, and of these biscuits, 7 are chocolate-covered. There are 17 chocolate-covered biscuits in total.

(i) Copy and complete the table below to show the number of biscuits in each category. [2]

	Wrapped in gold foil	Unwrapped	Total
Chocolate-covered			
Not chocolate-covered			
Total			30

A biscuit is selected at random from the box.

(ii) Find the probability that the biscuit is wrapped in gold foil. [1]

The biscuit is returned to the box. An unwrapped biscuit is then selected at random from the box.

(iii) Find the probability that the biscuit is chocolate-covered. [1]

The biscuit is returned to the box. A biscuit is then selected at random from the box.

(iv) Find the probability that the biscuit is unwrapped, given that it is chocolate-covered. [1]

The biscuit is returned to the box. Nasir then takes 4 biscuits without replacement from the box.

(v) Find the probability that he takes exactly 2 wrapped biscuits. [4]

7 The times taken to play Beethoven's Sixth Symphony can be assumed to have a normal distribution with mean 41.1 minutes and standard deviation 3.4 minutes. Three occasions on which this symphony is played are chosen at random.

(i) Find the probability that the symphony takes longer than 42 minutes to play on exactly 1 of these occasions. [4]

The times taken to play Beethoven's Fifth Symphony can also be assumed to have a normal distribution. The probability that the time is less than 26.5 minutes is 0.1, and the probability that the time is more than 34.6 minutes is 0.05.

(ii) Find the mean and standard deviation of the times to play this symphony. [5]

(iii) Assuming that the times to play the two symphonies are independent of each other, find the probability that, when both symphonies are played, both of the times are less than 34.6 minutes. [4]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2012**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 Ashfaq and Kuljit have done a school statistics project on the prices of a particular model of headphones for MP3 players. Ashfaq collected prices from 21 shops. Kuljit used the internet to collect prices from 163 websites.

(i) Name a suitable statistical diagram for Ashfaq to represent his data, together with a reason for choosing this particular diagram. [2]

(ii) Name a suitable statistical diagram for Kuljit to represent her data, together with a reason for choosing this particular diagram. [2]

2 The heights, x cm, of a group of young children are summarised by

$$\Sigma(x - 100) = 72, \qquad \Sigma(x - 100)^2 = 499.2.$$

The mean height is 104.8 cm.

(i) Find the number of children in the group. [2]

(ii) Find $\Sigma(x - 104.8)^2$. [3]

3 **(i)** In how many ways can all 9 letters of the word TELEPHONE be arranged in a line if the letters P and L must be at the ends? [2]

How many different selections of 4 letters can be made from the 9 letters of the word TELEPHONE if

(ii) there are no Es, [1]

(iii) there is exactly 1 E, [2]

(iv) there are no restrictions? [4]

4 The six faces of a fair die are numbered 1, 1, 1, 2, 3, 3. The score for a throw of the die, denoted by the random variable W, is the number on the top face after the die has landed.

(i) Find the mean and standard deviation of W. [3]

(ii) The die is thrown twice and the random variable X is the sum of the two scores. Draw up a probability distribution table for X. [4]

(iii) The die is thrown n times. The random variable Y is the number of times that the score is 3. Given that $\mathrm{E}(Y) = 8$, find $\mathrm{Var}(Y)$. [3]

5 Suzanne has 20 pairs of shoes, some of which have designer labels. She has 6 pairs of high-heeled shoes, of which 2 pairs have designer labels. She has 4 pairs of low-heeled shoes, of which 1 pair has designer labels. The rest of her shoes are pairs of sports shoes. Suzanne has 8 pairs of shoes with designer labels in total.

(i) Copy and complete the table below to show the number of pairs in each category. [2]

	Designer labels	No designer labels	Total
High-heeled shoes			
Low-heeled shoes			
Sports shoes			
Total			20

Suzanne chooses 1 pair of shoes at random to wear.

(ii) Find the probability that she wears the pair of low-heeled shoes with designer labels. [1]

(iii) Find the probability that she wears a pair of sports shoes. [1]

(iv) Find the probability that she wears a pair of high-heeled shoes, given that she wears a pair of shoes with designer labels. [1]

(v) State with a reason whether the events 'Suzanne wears a pair of shoes with designer labels' and 'Suzanne wears a pair of sports shoes' are independent. [2]

Suzanne chooses 1 pair of shoes at random each day.

(vi) Find the probability that Suzanne wears a pair of shoes with designer labels on at most 4 days out of the next 7 days. [3]

6 The lengths, in cm, of trout in a fish farm are normally distributed. 96% of the lengths are less than 34.1 cm and 70% of the lengths are more than 26.7 cm.

(i) Find the mean and the standard deviation of the lengths of the trout. [5]

In another fish farm, the lengths of salmon, X cm, are normally distributed with mean 32.9 cm and standard deviation 2.4 cm.

(ii) Find the probability that a randomly chosen salmon is 34 cm long, correct to the nearest centimetre. [3]

(iii) Find the value of t such that $P(31.8 < X < t) = 0.5$. [4]

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Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2013**

1 hour 15 minutes

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1 A summary of 30 values of x gave the following information:

$$\Sigma(x - c) = 234, \qquad \Sigma(x - c)^2 = 1957.5,$$

where c is a constant.

(i) Find the standard deviation of these values of x. [2]

(ii) Given that the mean of these values is 86, find the value of c. [2]

2 Assume that, for a randomly chosen person, their next birthday is equally likely to occur on any day of the week, independently of any other person's birthday. Find the probability that, out of 350 randomly chosen people, at least 47 will have their next birthday on a Monday. [5]

3 The following back-to-back stem-and-leaf diagram shows the annual salaries of a group of 39 females and 39 males.

Females											Males										
(4)						5	2	0	0	20	3										(1)
(9)	9	8	8	7	6	4	0	0	0	21	0	0	7								(3)
(8)		8	7	5	3	3	1	0	0	22	0	0	4	5	6	6					(6)
(6)				6	4	2	1	0	0	23	0	0	2	3	3	5	6	7	7		(9)
(6)				7	5	4	0	0	0	24	0	1	1	2	5	5	6	8	8	9	(10)
(4)						9	5	0	0	25	3	4	5	7	7	8	9				(7)
(2)								5	0	26	0	4	6								(3)

Key: 2 | 20 | 3 means \$20 200 for females and \$20 300 for males.

(i) Find the median and the quartiles of the females' salaries. [2]

You are given that the median salary of the males is \$24 000, the lower quartile is \$22 600 and the upper quartile is \$25 300.

(ii) Represent the data by means of a pair of box-and-whisker plots in a single diagram on graph paper. [3]

4 **(a)** The random variable Y is normally distributed with positive mean μ and standard deviation $\frac{1}{2}\mu$. Find the probability that a randomly chosen value of Y is negative. [3]

(b) The weights of bags of rice are normally distributed with mean 2.04 kg and standard deviation σ kg. In a random sample of 8000 such bags, 253 weighed over 2.1 kg. Find the value of σ. [4]

5 Fiona uses her calculator to produce 12 random integers between 7 and 21 inclusive. The random variable X is the number of these 12 integers which are multiples of 5.

(i) State the distribution of X and give its parameters. [3]

(ii) Calculate the probability that X is between 3 and 5 inclusive. [3]

Fiona now produces n random integers between 7 and 21 inclusive.

(iii) Find the least possible value of n if the probability that none of these integers is a multiple of 5 is less than 0.01. [3]

6 Four families go to a theme park together. Mr and Mrs Lin take their 2 children. Mr O'Connor takes his 2 children. Mr and Mrs Ahmed take their 3 children. Mrs Burton takes her son. The 14 people all have to go through a turnstile one at a time to enter the theme park.

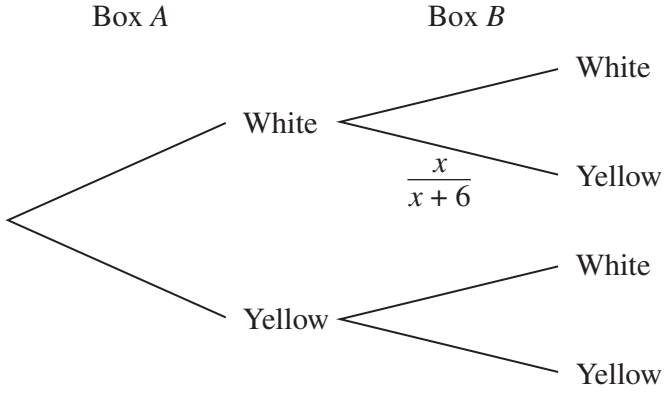
(i) In how many different orders can the 14 people go through the turnstile if each family stays together? [3]

(ii) In how many different orders can the 8 children and 6 adults go through the turnstile if no two adults go consecutively? [3]

Once inside the theme park, the children go on the roller-coaster. Each roller-coaster car holds 3 people.

(iii) In how many different ways can the 8 children be divided into two groups of 3 and one group of 2 to go on the roller-coaster? [3]

7 Box A contains 8 white balls and 2 yellow balls. Box B contains 5 white balls and x yellow balls. A ball is chosen at random from box A and placed in box B. A ball is then chosen at random from box B. The tree diagram below shows the possibilities for the colours of the balls chosen.



(i) Justify the probability $\frac{x}{x+6}$ on the tree diagram. [1]

(ii) Copy and complete the tree diagram. [4]

(iii) If the ball chosen from box A is white then the probability that the ball chosen from box B is also white is $\frac{1}{3}$. Show that the value of x is 12. [2]

(iv) Given that the ball chosen from box B is yellow, find the conditional probability that the ball chosen from box A was yellow. [4]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2013**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 The random variable Y is normally distributed with mean equal to five times the standard deviation. It is given that $P(Y > 20) = 0.0732$. Find the mean. [3]

2 A summary of the speeds, x kilometres per hour, of 22 cars passing a certain point gave the following information:

$$\Sigma(x - 50) = 81.4 \qquad \text{and} \qquad \Sigma(x - 50)^2 = 671.0.$$

Find the variance of the speeds and hence find the value of Σx^2. [4]

3 Cans of lemon juice are supposed to contain 440 ml of juice. It is found that the actual volume of juice in a can is normally distributed with mean 445 ml and standard deviation 3.6 ml.

(i) Find the probability that a randomly chosen can contains less than 440 ml of juice. [3]

It is found that 94% of the cans contain between $(445 - c)$ ml and $(445 + c)$ ml of juice.

(ii) Find the value of c. [3]

4 Robert uses his calculator to generate 5 random integers between 1 and 9 inclusive.

(i) Find the probability that at least 2 of the 5 integers are less than or equal to 4. [3]

Robert now generates n random integers between 1 and 9 inclusive. The random variable X is the number of these n integers which are less than or equal to a certain integer k between 1 and 9 inclusive. It is given that the mean of X is 96 and the variance of X is 32.

(ii) Find the values of n and k. [4]

5 The following are the annual amounts of money spent on clothes, to the nearest \$10, by 27 people.

10	40	60	80	100	130	140	140	140
150	150	150	160	160	160	160	170	180
180	200	210	250	270	280	310	450	570

(i) Construct a stem-and-leaf diagram for the data. [3]

(ii) Find the median and the interquartile range of the data. [3]

An 'outlier' is defined as any data value which is more than 1.5 times the interquartile range above the upper quartile, or more than 1.5 times the interquartile range below the lower quartile.

(iii) List the outliers. [3]

6 A town council plans to plant 12 trees along the centre of a main road. The council buys the trees from a garden centre which has 4 different hibiscus trees, 9 different jacaranda trees and 2 different oleander trees for sale.

(i) How many different selections of 12 trees can be made if there must be at least 2 of each type of tree? [4]

The council buys 4 hibiscus trees, 6 jacaranda trees and 2 oleander trees.

(ii) How many different arrangements of these 12 trees can be made if the hibiscus trees have to be next to each other, the jacaranda trees have to be next to each other and the oleander trees have to be next to each other? [3]

(iii) How many different arrangements of these 12 trees can be made if no hibiscus tree is next to another hibiscus tree? [3]

7 Susan has a bag of sweets containing 7 chocolates and 5 toffees. Ahmad has a bag of sweets containing 3 chocolates, 4 toffees and 2 boiled sweets. A sweet is taken at random from Susan's bag and put in Ahmad's bag. A sweet is then taken at random from Ahmad's bag.

(i) Find the probability that the two sweets taken are a toffee from Susan's bag and a boiled sweet from Ahmad's bag. [2]

(ii) Given that the sweet taken from Ahmad's bag is a chocolate, find the probability that the sweet taken from Susan's bag was also a chocolate. [4]

(iii) The random variable X is the number of times a chocolate is taken. State the possible values of X and draw up a table to show the probability distribution of X. [5]

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77

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
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MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2013**

1 hour 15 minutes

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1 Q is the event 'Nicola throws two fair dice and gets a total of 5'. S is the event 'Nicola throws two fair dice and gets one low score (1, 2 or 3) and one high score (4, 5 or 6)'. Are events Q and S independent? Justify your answer. [4]

2 The 12 houses on one side of a street are numbered with even numbers starting at 2 and going up to 24. A free newspaper is delivered on Monday to 3 different houses chosen at random from these 12. Find the probability that at least 2 of these newspapers are delivered to houses with numbers greater than 14. [4]

3 Buildings in a certain city centre are classified by height as tall, medium or short. The heights can be modelled by a normal distribution with mean 50 metres and standard deviation 16 metres. Buildings with a height of more than 70 metres are classified as tall.

(i) Find the probability that a building chosen at random is classified as tall. [2]

(ii) The rest of the buildings are classified as medium and short in such a way that there are twice as many medium buildings as there are short ones. Find the height below which buildings are classified as short. [5]

4 In a certain country, on average one student in five has blue eyes.

(i) For a random selection of n students, the probability that none of the students has blue eyes is less than 0.001. Find the least possible value of n. [3]

(ii) For a random selection of 120 students, find the probability that fewer than 33 have blue eyes. [4]

5 **(a)** John plays two games of squash. The probability that he wins his first game is 0.3. If he wins his first game, the probability that he wins his second game is 0.6. If he loses his first game, the probability that he wins his second game is 0.15. Given that he wins his second game, find the probability that he won his first game. [4]

(b) Jack has a pack of 15 cards. 10 cards have a picture of a robot on them and 5 cards have a picture of an aeroplane on them. Emma has a pack of cards. 7 cards have a picture of a robot on them and $x - 3$ cards have a picture of an aeroplane on them. One card is taken at random from Jack's pack and one card is taken at random from Emma's pack. The probability that both cards have pictures of robots on them is $\frac{7}{18}$. Write down an equation in terms of x and hence find the value of x. [4]

6 The weights, x kilograms, of 144 people were recorded. The results are summarised in the cumulative frequency table below.

Weight (x kilograms)	$x < 40$	$x < 50$	$x < 60$	$x < 65$	$x < 70$	$x < 90$
Cumulative frequency	0	12	34	64	92	144

(i) On graph paper, draw a cumulative frequency graph to represent these results. [2]

(ii) 64 people weigh more than c kg. Use your graph to find the value of c. [2]

(iii) Calculate estimates of the mean and standard deviation of the weights. [6]

7 There are 10 spaniels, 14 retrievers and 6 poodles at a dog show. 7 dogs are selected to go through to the final.

(i) How many selections of 7 different dogs can be made if there must be at least 1 spaniel, at least 2 retrievers and at least 3 poodles? [4]

2 spaniels, 2 retrievers and 3 poodles go through to the final. They are placed in a line.

(ii) How many different arrangements of these 7 dogs are there if the spaniels stand together and the retrievers stand together? [3]

(iii) How many different arrangements of these 7 dogs are there if no poodle is next to another poodle? [3]

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

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1 The petrol consumption of a certain type of car has a normal distribution with mean 24 kilometres per litre and standard deviation 4.7 kilometres per litre. Find the probability that the petrol consumption of a randomly chosen car of this type is between 21.6 kilometres per litre and 28.7 kilometres per litre. [4]

2 Lengths of a certain type of white radish are normally distributed with mean μ cm and standard deviation σ cm. 4% of these radishes are longer than 12 cm and 32% are longer than 9 cm. Find μ and σ. [5]

3 **(i)** State three conditions which must be satisfied for a situation to be modelled by a binomial distribution. [2]

George wants to invest some of his monthly salary. He invests a certain amount of this every month for 18 months. For each month there is a probability of 0.25 that he will buy shares in a large company, there is a probability of 0.15 that he will buy shares in a small company and there is a probability of 0.6 that he will invest in a savings account.

(ii) Find the probability that George will buy shares in a small company in at least 3 of these 18 months. [3]

4 A book club sends 6 paperback and 2 hardback books to Mrs Hunt. She chooses 4 of these books at random to take with her on holiday. The random variable X represents the number of paperback books she chooses.

(i) Show that the probability that she chooses exactly 2 paperback books is $\frac{3}{14}$. [2]

(ii) Draw up the probability distribution table for X. [3]

(iii) You are given that $\mathrm{E}(X) = 3$. Find $\mathrm{Var}(X)$. [2]

5 Playground equipment consists of swings (S), roundabouts (R), climbing frames (C) and play-houses (P). The numbers of pieces of equipment in each of 3 playgrounds are as follows.

Playground X	Playground Y	Playground Z
$3S$, $2R$, $4P$	$6S$, $3R$, $1C$, $2P$	$8S$, $3R$, $4C$, $1P$

Each day Nur takes her child to one of the playgrounds. The probability that she chooses playground X is $\frac{1}{4}$. The probability that she chooses playground Y is $\frac{1}{4}$. The probability that she chooses playground Z is $\frac{1}{2}$. When she arrives at the playground, she chooses one piece of equipment at random.

(i) Find the probability that Nur chooses a play-house. [4]

(ii) Given that Nur chooses a climbing frame, find the probability that she chose playground Y. [4]

6 Find the number of different ways in which all 8 letters of the word TANZANIA can be arranged so that

(i) all the letters A are together, [2]

(ii) the first letter is a consonant (T, N, Z), the second letter is a vowel (A, I), the third letter is a consonant, the fourth letter is a vowel, and so on alternately. [3]

4 of the 8 letters of the word TANZANIA are selected. How many possible selections contain

(iii) exactly 1 N and 1 A, [2]

(iv) exactly 1 N? [3]

7 A typing test is taken by 111 people. The numbers of typing errors they make in the test are summarised in the table below.

Number of typing errors	1 – 5	6 – 20	21 – 35	36 – 60	61 – 80
Frequency	24	9	21	15	42

(i) Draw a histogram on graph paper to represent this information. [5]

(ii) Calculate an estimate of the mean number of typing errors for these 111 people. [3]

(iii) State which class contains the lower quartile and which class contains the upper quartile. Hence find the least possible value of the interquartile range. [3]

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Cambridge International Advanced Subsidiary and Advanced Level

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1 In a certain country 12% of houses have solar heating. 19 houses are chosen at random. Find the probability that fewer than 4 houses have solar heating. [4]

2 A school club has members from 3 different year-groups: Year 1, Year 2 and Year 3. There are 7 members from Year 1, 2 members from Year 2 and 2 members from Year 3. Five members of the club are selected. Find the number of possible selections that include at least one member from each year-group. [4]

3 Roger and Andy play a tennis match in which the first person to win two sets wins the match. The probability that Roger wins the first set is 0.6. For sets after the first, the probability that Roger wins the set is 0.7 if he won the previous set, and is 0.25 if he lost the previous set. No set is drawn.

(i) Find the probability that there is a winner of the match after exactly two sets. [3]

(ii) Find the probability that Andy wins the match given that there is a winner of the match after exactly two sets. [2]

4 Coin A is weighted so that the probability of throwing a head is $\frac{2}{3}$. Coin B is weighted so that the probability of throwing a head is $\frac{1}{4}$. Coin A is thrown twice and coin B is thrown once.

(i) Show that the probability of obtaining exactly 1 head and 2 tails is $\frac{13}{36}$. [3]

(ii) Draw up the probability distribution table for the number of heads obtained. [4]

(iii) Find the expectation of the number of heads obtained. [2]

5 Find how many different numbers can be made from some or all of the digits of the number 1 345 789 if

(i) all seven digits are used, the odd digits are all together and no digits are repeated, [2]

(ii) the numbers made are even numbers between 3000 and 5000, and no digits are repeated, [3]

(iii) the numbers made are multiples of 5 which are less than 1000, and digits can be repeated. [3]

6 The times taken by 57 athletes to run 100 metres are summarised in the following cumulative frequency table.

Time (seconds)	<10.0	<10.5	<11.0	<12.0	<12.5	<13.5
Cumulative frequency	0	4	10	40	49	57

(i) State how many athletes ran 100 metres in a time between 10.5 and 11.0 seconds. [1]

(ii) Draw a histogram on graph paper to represent the times taken by these athletes to run 100 metres. [4]

(iii) Calculate estimates of the mean and variance of the times taken by these athletes. [4]

7 The time Rafa spends on his homework each day in term-time has a normal distribution with mean 1.9 hours and standard deviation σ hours. On 80% of these days he spends more than 1.35 hours on his homework.

(i) Find the value of σ. [3]

(ii) Find the probability that, on a randomly chosen day in term-time, Rafa spends less than 2 hours on his homework. [2]

(iii) A random sample of 200 days in term-time is taken. Use an approximation to find the probability that the number of days on which Rafa spends more than 1.35 hours on his homework is between 163 and 173 inclusive. [6]

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1 Some adults and some children each tried to estimate, without using a watch, the number of seconds that had elapsed in a fixed time-interval. Their estimates are shown below.

Adults:	55	58	67	74	63	61	63	71	56	53	54	78	73	64	62
Children:	86	95	89	72	61	84	77	92	81	54	43	68	62	67	83

(i) Draw a back-to-back stem-and-leaf diagram to represent the data. [3]

(ii) Make two comparisons between the estimates of the adults and the children. [2]

2 There is a probability of $\frac{1}{7}$ that Wenjie goes out with her friends on any particular day. 252 days are chosen at random.

(i) Use a normal approximation to find the probability that the number of days on which Wenjie goes out with her friends is less than than 30 or more than 44. [5]

(ii) Give a reason why the use of a normal approximation is justified. [1]

3 A pet shop has 6 rabbits and 3 hamsters. 5 of these pets are chosen at random. The random variable X represents the number of hamsters chosen.

(i) Show that the probability that exactly 2 hamsters are chosen is $\frac{10}{21}$. [2]

(ii) Draw up the probability distribution table for X. [4]

4 The heights, x cm, of a group of 28 people were measured. The mean height was found to be 172.6 cm and the standard deviation was found to be 4.58 cm. A person whose height was 161.8 cm left the group.

(i) Find the mean height of the remaining group of 27 people. [2]

(ii) Find Σx^2 for the original group of 28 people. Hence find the standard deviation of the heights of the remaining group of 27 people. [4]

5 When Moses makes a phone call, the amount of time that the call takes has a normal distribution with mean 6.5 minutes and standard deviation 1.76 minutes.

(i) 90% of Moses's phone calls take longer than t minutes. Find the value of t. [3]

(ii) Find the probability that, in a random sample of 9 phone calls made by Moses, more than 7 take a time which is within 1 standard deviation of the mean. [5]

6 Tom and Ben play a game repeatedly. The probability that Tom wins any game is 0.3. Each game is won by either Tom or Ben. Tom and Ben stop playing when one of them (to be called the champion) has won two games.

(i) Find the probability that Ben becomes the champion after playing exactly 2 games. [1]

(ii) Find the probability that Ben becomes the champion. [3]

(iii) Given that Tom becomes the champion, find the probability that he won the 2nd game. [4]

7 Nine cards are numbered 1, 2, 2, 3, 3, 4, 6, 6, 6.

(i) All nine cards are placed in a line, making a 9-digit number. Find how many different 9-digit numbers can be made in this way

(a) if the even digits are all together, [4]

(b) if the first and last digits are both odd. [3]

(ii) Three of the nine cards are chosen and placed in a line, making a 3-digit number. Find how many different numbers can be made in this way

(a) if there are no repeated digits, [2]

(b) if the number is between 200 and 300. [2]

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Cambridge International Advanced Subsidiary and Advanced Level

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1 The lengths, in metres, of cars in a city are normally distributed with mean μ and standard deviation 0.714. The probability that a randomly chosen car has a length more than 3.2 metres and less than μ metres is 0.475. Find μ. [4]

2 The table summarises the lengths in centimetres of 104 dragonflies.

Length (cm)	2.0 – 3.5	3.5 – 4.5	4.5 – 5.5	5.5 – 7.0	7.0 – 9.0
Frequency	8	25	28	31	12

(i) State which class contains the upper quartile. [1]

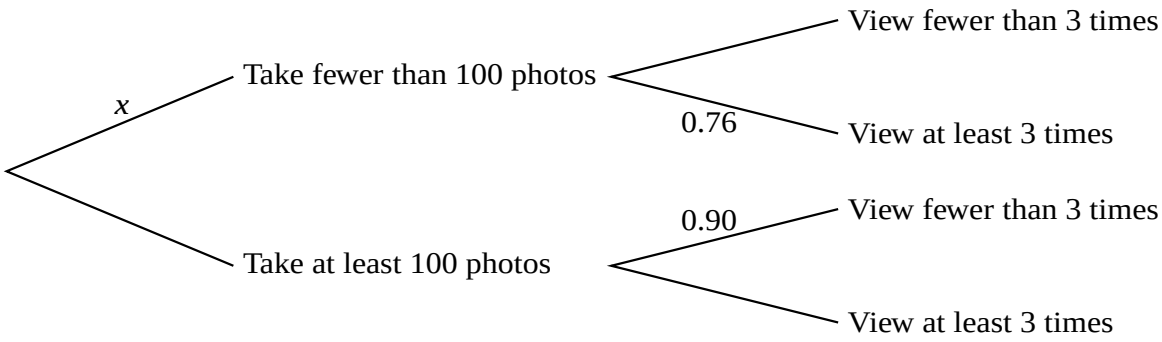
(ii) Draw a histogram, on graph paper, to represent the data. [4]

3 Jason throws two fair dice, each with faces numbered 1 to 6. Event A is 'one of the numbers obtained is divisible by 3 and the other number is not divisible by 3'. Event B is 'the product of the two numbers obtained is even'.

(i) Determine whether events A and B are independent, showing your working. [5]

(ii) Are events A and B mutually exclusive? Justify your answer. [1]

4



A survey is undertaken to investigate how many photos people take on a one-week holiday and also how many times they view past photos. For a randomly chosen person, the probability of taking fewer than 100 photos is x. The probability that these people view past photos at least 3 times is 0.76. For those who take at least 100 photos, the probability that they view past photos fewer than 3 times is 0.90. This information is shown in the tree diagram. The probability that a randomly chosen person views past photos fewer than 3 times is 0.801.

(i) Find x. [3]

(ii) Given that a person views past photos at least 3 times, find the probability that this person takes at least 100 photos. [4]

5 The table shows the mean and standard deviation of the weights of some turkeys and geese.

	Number of birds	Mean (kg)	Standard deviation (kg)
Turkeys	9	7.1	1.45
Geese	18	5.2	0.96

(i) Find the mean weight of the 27 birds. [2]

(ii) The weights of individual turkeys are denoted by x_t kg and the weights of individual geese by x_g kg. By first finding Σx_t^2 and Σx_g^2, find the standard deviation of the weights of all 27 birds. [5]

6 **(i)** In a certain country, 68% of households have a printer. Find the probability that, in a random sample of 8 households, 5, 6 or 7 households have a printer. [4]

(ii) Use an approximation to find the probability that, in a random sample of 500 households, more than 337 households have a printer. [5]

(iii) Justify your use of the approximation in part **(ii)**. [1]

7 **(a)** Find how many different numbers can be made by arranging all nine digits of the number 223 677 888 if

(i) there are no restrictions, [2]

(ii) the number made is an even number. [4]

(b) Sandra wishes to buy some applications (apps) for her smartphone but she only has enough money for 5 apps in total. There are 3 train apps, 6 social network apps and 14 games apps available. Sandra wants to have at least 1 of each type of app. Find the number of different possible selections of 5 apps that Sandra can choose. [5]

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97

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2015**

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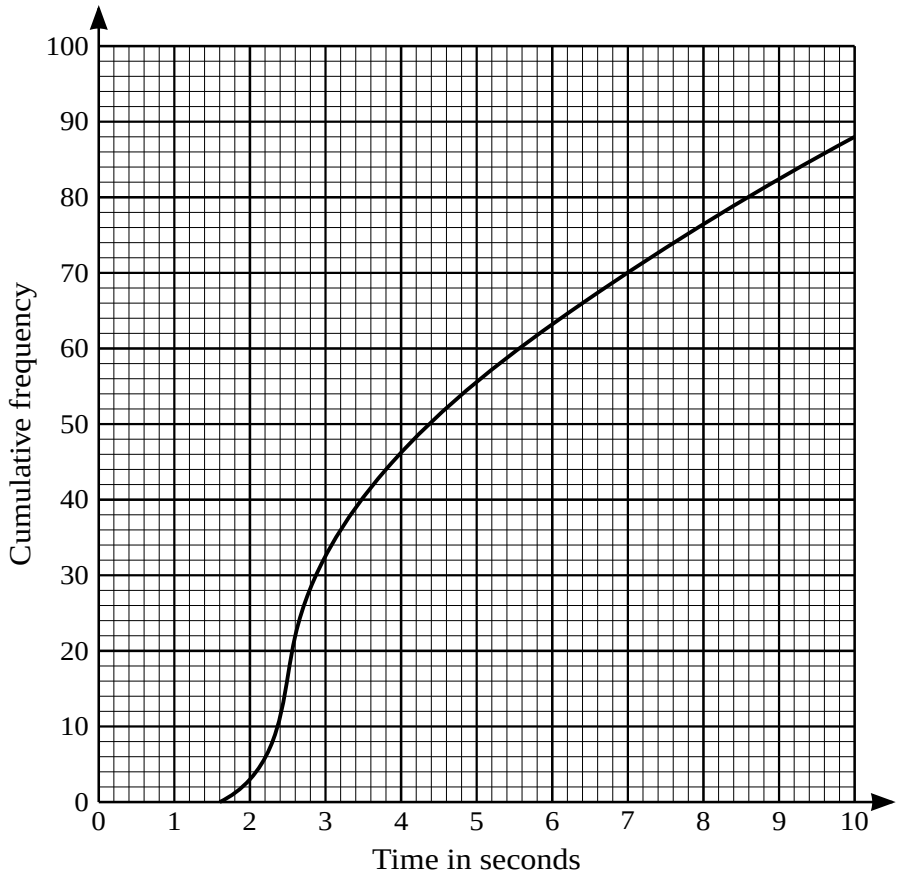
1 A fair die is thrown 10 times. Find the probability that the number of sixes obtained is between 3 and 5 inclusive. [3]

2 120 people were asked to read an article in a newspaper. The times taken, to the nearest second, by the people to read the article are summarised in the following table.

Time (seconds)	1 – 25	26 – 35	36 – 45	46 – 55	56 – 90
Number of people	4	24	38	34	20

Calculate estimates of the mean and standard deviation of the reading times. [5]

3



In an open-plan office there are 88 computers. The times taken by these 88 computers to access a particular web page are represented in the cumulative frequency diagram.

(i) On graph paper draw a box-and-whisker plot to summarise this information. [4]

An 'outlier' is defined as any data value which is more than 1.5 times the interquartile range above the upper quartile, or more than 1.5 times the interquartile range below the lower quartile.

(ii) Show that there are no outliers. [2]

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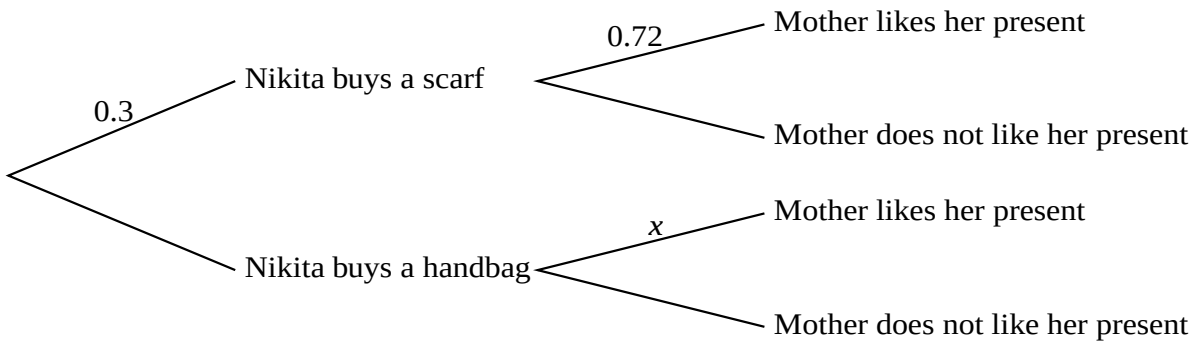

Nikita goes shopping to buy a birthday present for her mother. She buys either a scarf, with probability 0.3, or a handbag. The probability that her mother will like the choice of scarf is 0.72. The probability that her mother will like the choice of handbag is x. This information is shown on the tree diagram. The probability that Nikita's mother likes the present that Nikita buys is 0.783.

(i) Find x. [3]

(ii) Given that Nikita's mother does not like her present, find the probability that the present is a scarf. [4]

5 A box contains 5 discs, numbered 1, 2, 4, 6, 7. William takes 3 discs at random, without replacement, and notes the numbers on the discs.

(i) Find the probability that the numbers on the 3 discs are two even numbers and one odd number. [3]

The smallest of the numbers on the 3 discs taken is denoted by the random variable S.

(ii) By listing all possible selections (126, 246 and so on) draw up the probability distribution table for S. [5]

6 **(a)** Find the number of different ways the 7 letters of the word BANANAS can be arranged

(i) if the first letter is N and the last letter is B, [3]

(ii) if all the letters A are next to each other. [3]

(b) Find the number of ways of selecting a group of 9 people from 14 if two particular people cannot both be in the group together. [3]

7 **(a)** Once a week Zak goes for a run. The time he takes, in minutes, has a normal distribution with mean 35.2 and standard deviation 4.7.

(i) Find the expected number of days during a year (52 weeks) for which Zak takes less than 30 minutes for his run. [4]

(ii) The probability that Zak's time is between 35.2 minutes and t minutes, where $t > 35.2$, is 0.148. Find the value of t. [3]

(b) The random variable X has the distribution $N(\mu, \sigma^2)$. It is given that $P(X < 7) = 0.2119$ and $P(X < 10) = 0.6700$. Find the values of μ and σ. [5]

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2015**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

6355909940

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

This document consists of **3** printed pages and **1** blank page.

CAMBRIDGE International Examinations

1 The weights, in grams, of onions in a supermarket have a normal distribution with mean μ and standard deviation 22. The probability that a randomly chosen onion weighs more than 195 grams is 0.128. Find the value of μ. [3]

2 When Joanna cooks, the probability that the meal is served on time is $\frac{1}{5}$. The probability that the kitchen is left in a mess is $\frac{3}{5}$. The probability that the meal is not served on time and the kitchen is not left in a mess is $\frac{3}{10}$. Some of this information is shown in the following table.

	Kitchen left in a mess	Kitchen not left in a mess	Total
Meal served on time			$\frac{1}{5}$
Meal not served on time		$\frac{3}{10}$	
Total			1

(i) Copy and complete the table. [3]

(ii) Given that the kitchen is left in a mess, find the probability that the meal is not served on time. [2]

3 On a production line making cameras, the probability of a randomly chosen camera being substandard is 0.072. A random sample of 300 cameras is checked. Find the probability that there are fewer than 18 cameras which are substandard. [5]

4 A pet shop has 9 rabbits for sale, 6 of which are white. A random sample of two rabbits is chosen without replacement.

(i) Show that the probability that exactly one of the two rabbits in the sample is white is $\frac{1}{2}$. [2]

(ii) Construct the probability distribution table for the number of white rabbits in the sample. [3]

(iii) Find the expected value of the number of white rabbits in the sample. [1]

5 The heights of books in a library, in cm, have a normal distribution with mean 21.7 and standard deviation 6.5. A book with a height of more than 29 cm is classified as 'large'.

(i) Find the probability that, of 8 books chosen at random, fewer than 2 books are classified as large. [6]

(ii) n books are chosen at random. The probability of there being at least 1 large book is more than 0.98. Find the least possible value of n. [3]

6 Seventy samples of fertiliser were collected and the nitrogen content was measured for each sample. The cumulative frequency distribution is shown in the table below.

Nitrogen content	$\leqslant 3.5$	$\leqslant 3.8$	$\leqslant 4.0$	$\leqslant 4.2$	$\leqslant 4.5$	$\leqslant 4.8$
Cumulative frequency	0	6	18	41	62	70

(i) On graph paper draw a cumulative frequency graph to represent the data. [3]

(ii) Estimate the percentage of samples with a nitrogen content greater than 4.4. [2]

(iii) Estimate the median. [1]

(iv) Construct the frequency table for these results and draw a histogram on graph paper. [5]

7 Rachel has 3 types of ornament. She has 6 different wooden animals, 4 different sea-shells and 3 different pottery ducks.

(i) She lets her daughter Cherry choose 5 ornaments to play with. Cherry chooses at least 1 of each type of ornament. How many different selections can Cherry make? [5]

Rachel displays 10 of the 13 ornaments in a row on her window-sill. Find the number of different arrangements that are possible if

(ii) she has a duck at each end of the row and no ducks anywhere else, [3]

(iii) she has a duck at each end of the row and wooden animals and sea-shells are placed alternately in the positions in between. [3]

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MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2016**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

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1 The height of maize plants in Mpapwa is normally distributed with mean 1.62 m and standard deviation σ m. The probability that a randomly chosen plant has a height greater than 1.8 m is 0.15. Find the value of σ. [3]

2 The faces of a biased die are numbered 1, 2, 3, 4, 5 and 6. The random variable X is the score when the die is thrown. The following is the probability distribution table for X.

x	1	2	3	4	5	6
$P(X = x)$	p	p	p	p	0.2	0.2

The die is thrown 3 times. Find the probability that the score is 4 on not more than 1 of the 3 throws. [5]

3 The probability that the school bus is on time on any particular day is 0.6. If the bus is on time the probability that Sam the driver gets a cup of coffee is 0.9. If the bus is not on time the probability that Sam gets a cup of coffee is 0.3.

(i) Find the probability that Sam gets a cup of coffee. [2]

(ii) Given that Sam does not get a cup of coffee, find the probability that the bus is not on time. [3]

4 A box contains 2 green sweets and 5 blue sweets. Two sweets are taken at random from the box, without replacement. The random variable X is the number of green sweets taken. Find $E(X)$ and $Var(X)$. [6]

5 Plastic drinking straws are manufactured to fit into drinks cartons which have a hole in the top. A straw fits into the hole if the diameter of the straw is less than 3 mm. The diameters of the straws have a normal distribution with mean 2.6 mm and standard deviation 0.25 mm.

(i) A straw is chosen at random. Find the probability that it fits into the hole in a drinks carton. [3]

(ii) 500 straws are chosen at random. Use a suitable approximation to find the probability that at least 480 straws fit into the holes in drinks cartons. [5]

(iii) Justify the use of your approximation. [1]

6 **(a)** **(i)** Find how many numbers there are between 100 and 999 in which all three digits are different. [3]

(ii) Find how many of the numbers in part **(i)** are odd numbers greater than 700. [4]

(b) A bunch of flowers consists of a mixture of roses, tulips and daffodils. Tom orders a bunch of 7 flowers from a shop to give to a friend. There must be at least 2 of each type of flower. The shop has 6 roses, 5 tulips and 4 daffodils, all different from each other. Find the number of different bunches of flowers that are possible. [4]

7 The amounts spent by 160 shoppers at a supermarket are summarised in the following table.

Amount spent ($\$x$)	$0 < x \leqslant 30$	$30 < x \leqslant 50$	$50 < x \leqslant 70$	$70 < x \leqslant 90$	$90 < x \leqslant 140$
Number of shoppers	16	40	48	26	30

(i) Draw a cumulative frequency graph of this distribution. [4]

(ii) Estimate the median and the interquartile range of the amount spent. [3]

(iii) Estimate the number of shoppers who spent more than \$115. [2]

(iv) Calculate an estimate of the mean amount spent. [2]

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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2016**

1 hour 15 minutes

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1 Ayman's breakfast drink is tea, coffee or hot chocolate with probabilities 0.65, 0.28, 0.07 respectively. When he drinks tea, the probability that he has milk in it is 0.8. When he drinks coffee, the probability that he has milk in it is 0.5. When he drinks hot chocolate he always has milk in it.

(i) Draw a fully labelled tree diagram to represent this information. [2]

(ii) Find the probability that Ayman's breakfast drink is coffee, given that his drink has milk in it. [3]

2 When visiting the dentist the probability of waiting less than 5 minutes is 0.16, and the probability of waiting less than 10 minutes is 0.88.

(i) Find the probability of waiting between 5 and 10 minutes. [1]

A random sample of 180 people who visit the dentist is chosen.

(ii) Use a suitable approximation to find the probability that more than 115 of these people wait between 5 and 10 minutes. [5]

3 A particular type of bird lays 1, 2, 3 or 4 eggs in a nest each year. The probability of x eggs is equal to kx, where k is a constant.

(i) Draw up a probability distribution table, in terms of k, for the number of eggs laid in a year and find the value of k. [3]

(ii) Find the mean and variance of the number of eggs laid in a year by this type of bird. [3]

4 When people visit a certain large shop, on average 34% of them do not buy anything, 53% spend less than \$50 and 13% spend at least \$50.

(i) 15 people visiting the shop are chosen at random. Calculate the probability that at least 14 of them buy something. [3]

(ii) n people visiting the shop are chosen at random. The probability that none of them spends at least \$50 is less than 0.04. Find the smallest possible value of n. [3]

5 The following are the maximum daily wind speeds in kilometres per hour for the first two weeks in April for two towns, Bronlea and Rogate.

Bronlea	21	45	6	33	27	3	32	14	28	24	13	17	25	22
Rogate	7	5	4	15	23	7	11	13	26	18	23	16	10	34

(i) Draw a back-to-back stem-and-leaf diagram to represent this information. [5]

(ii) Write down the median of the maximum wind speeds for Bronlea and find the interquartile range for Rogate. [3]

(iii) Use your diagram to make one comparison between the maximum wind speeds in the two towns. [1]

6 The time in minutes taken by Peter to walk to the shop and buy a newspaper is normally distributed with mean 9.5 and standard deviation 1.3.

(i) Find the probability that on a randomly chosen day Peter takes longer than 10.2 minutes. [3]

(ii) On 90% of days he takes longer than t minutes. Find the value of t. [3]

(iii) Calculate an estimate of the number of days in a year (365 days) on which Peter takes less than 8.8 minutes to walk to the shop and buy a newspaper. [3]

7 **(a)** Find the number of different arrangements which can be made of all 10 letters of the word WALLFLOWER if

(i) there are no restrictions, [1]

(ii) there are exactly six letters between the two Ws. [4]

(b) A team of 6 people is to be chosen from 5 swimmers, 7 athletes and 4 cyclists. There must be at least 1 from each activity and there must be more athletes than cyclists. Find the number of different ways in which the team can be chosen. [4]

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MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2016**

1 hour 15 minutes

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1 In a group of 30 adults, 25 are right-handed and 8 wear spectacles. The number who are right-handed and do not wear spectacles is 19.

(i) Copy and complete the following table to show the number of adults in each category. [2]

	Wears spectacles	Does not wear spectacles	Total
Right-handed			
Not right-handed			
Total			30

An adult is chosen at random from the group. Event X is 'the adult chosen is right-handed'; event Y is 'the adult chosen wears spectacles'.

(ii) Determine whether X and Y are independent events, justifying your answer. [3]

2 A group of children played a computer game which measured their time in seconds to perform a certain task. A summary of the times taken by girls and boys in the group is shown below.

	Minimum	Lower quartile	Median	Upper quartile	Maximum
Girls	5	5.5	7	9	13
Boys	4	6	8.5	11	16

(i) On graph paper, draw two box-and-whisker plots in a single diagram to illustrate the times taken by girls and boys to perform this task. [3]

(ii) State two comparisons of the times taken by girls and boys. [2]

3 Two ordinary fair dice are thrown. The resulting score is found as follows.

- If the two dice show different numbers, the score is the smaller of the two numbers.
- If the two dice show equal numbers, the score is 0.

(i) Draw up the probability distribution table for the score. [4]

(ii) Calculate the expected score. [2]

4 The monthly rental prices, $\$x$, for 9 apartments in a certain city are listed and are summarised as follows.

$$\Sigma(x - c) = 1845 \qquad \Sigma(x - c)^2 = 477\,450$$

The mean monthly rental price is \$2205.

(i) Find the value of the constant c. [2]

(ii) Find the variance of these values of x. [2]

(iii) Another apartment is added to the list. The mean monthly rental price is now \$2120.50. Find the rental price of this additional apartment. [2]

5 The heights of school desks have a normal distribution with mean 69 cm and standard deviation σ cm. It is known that 15.5% of these desks have a height greater than 70 cm.

(i) Find the value of σ. [3]

When Jodu sits at a desk, his knees are at a height of 58 cm above the floor. A desk is comfortable for Jodu if his knees are at least 9 cm below the top of the desk. Jodu's school has 300 desks.

(ii) Calculate an estimate of the number of these desks that are comfortable for Jodu. [5]

6 Find the number of ways all 9 letters of the word EVERGREEN can be arranged if

(i) there are no restrictions, [1]

(ii) the first letter is R and the last letter is G, [2]

(iii) the Es are all together. [2]

Three letters from the 9 letters of the word EVERGREEN are selected.

(iv) Find the number of selections which contain no Es and exactly 1 R. [1]

(v) Find the number of selections which contain no Es. [3]

7 Passengers are travelling to Picton by minibus. The probability that each passenger carries a backpack is 0.65, independently of other passengers. Each minibus has seats for 12 passengers.

(i) Find the probability that, in a full minibus travelling to Picton, between 8 passengers and 10 passengers inclusive carry a backpack. [3]

(ii) Passengers get on to an empty minibus. Find the probability that the fourth passenger who gets on to the minibus will be the first to be carrying a backpack. [2]

(iii) Find the probability that, of a random sample of 250 full minibuses travelling to Picton, more than 54 will contain exactly 7 passengers carrying backpacks. [6]

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MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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1 Kadijat noted the weights, x grams, of 30 chocolate buns. Her results are summarised by

$$\Sigma(x - k) = 315, \qquad \Sigma(x - k)^2 = 4022,$$

where k is a constant. The mean weight of the buns is 50.5 grams.

(i) Find the value of k. [2]

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(ii) Find the standard deviation of x. [2]

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2 Ashfaq throws two fair dice and notes the numbers obtained. R is the event 'The product of the two numbers is 12'. T is the event 'One of the numbers is odd and one of the numbers is even'. By finding appropriate probabilities, determine whether events R and T are independent. [5]

3 Redbury United soccer team play a match every week. Each match can be won, drawn or lost. At the beginning of the soccer season the probability that Redbury United win their first match is $\frac{3}{5}$, with equal probabilities of losing or drawing. If they win the first match, the probability that they win the second match is $\frac{7}{10}$ and the probability that they lose the second match is $\frac{1}{10}$. If they draw the first match they are equally likely to win, draw or lose the second match. If they lose the first match, the probability that they win the second match is $\frac{3}{10}$ and the probability that they draw the second match is $\frac{1}{20}$.

(i) Draw a fully labelled tree diagram to represent the first two matches played by Redbury United in the soccer season. [2]

(ii) Given that Redbury United win the second match, find the probability that they lose the first match. [4]

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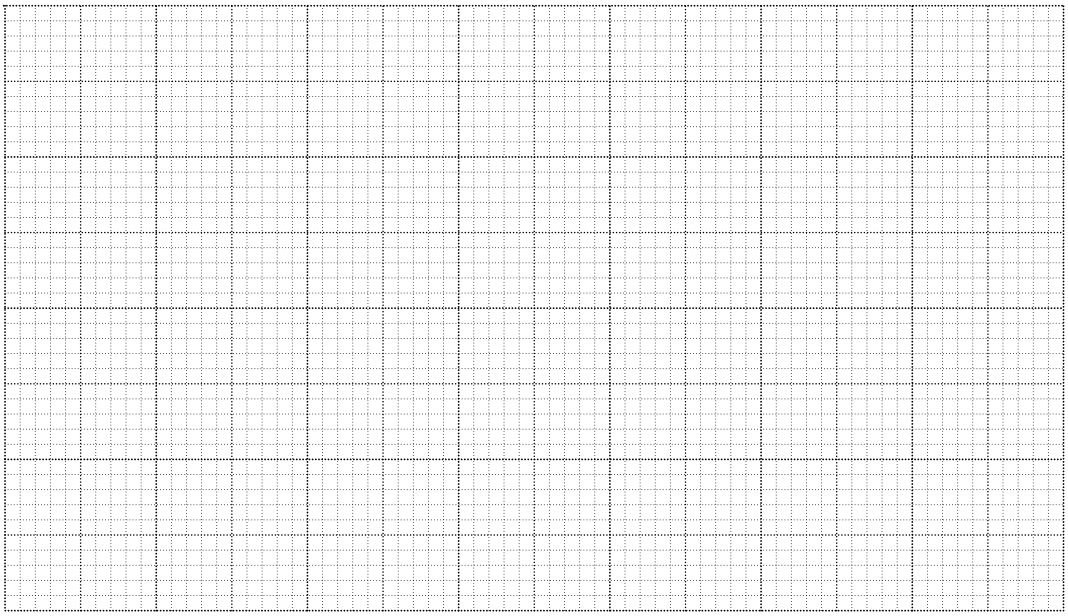
4 The times taken, t seconds, by 1140 people to solve a puzzle are summarised in the table.

Time (t seconds)	$0 \leqslant t < 20$	$20 \leqslant t < 40$	$40 \leqslant t < 60$	$60 \leqslant t < 100$	$100 \leqslant t < 140$
Number of people	320	280	220	220	100

(i) On the grid, draw a histogram to illustrate this information. [4]



(ii) Calculate an estimate of the mean of t. [2]

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5 Eggs are sold in boxes of 20. Cracked eggs occur independently and the mean number of cracked eggs in a box is 1.4.

(i) Calculate the probability that a randomly chosen box contains exactly 2 cracked eggs. [3]

(ii) Calculate the probability that a randomly chosen box contains at least 1 cracked egg. [2]

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(iii) A shop sells n of these boxes of eggs. Find the smallest value of n such that the probability of there being at least 1 cracked egg in each box sold is less than 0.01. [2]

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6 **(a)** The random variable X has a normal distribution with mean μ and standard deviation σ. You are given that $\sigma = 0.25\mu$ and $P(X < 6.8) = 0.75$.

(i) Find the value of μ. [4]

(ii) Find $P(X < 4.7)$. [3]

(b) The lengths of metal rods have a normal distribution with mean 16 cm and standard deviation 0.2 cm. Rods which are shorter than 15.75 cm or longer than 16.25 cm are not usable. Find the expected number of usable rods in a batch of 1000 rods. [4]

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7 **(a)** Eight children of different ages stand in a random order in a line. Find the number of different ways this can be done if none of the three youngest children stand next to each other. [3]

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(b) David chooses 5 chocolates from 6 different dark chocolates, 4 different white chocolates and 1 milk chocolate. He must choose at least one of each type. Find the number of different selections he can make. [4]

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(c) A password for Chelsea's computer consists of 4 characters in a particular order. The characters are chosen from the following.

- The 26 capital letters A to Z
- The 9 digits 1 to 9
- The 5 symbols # ~ * ? !

The password must include at least one capital letter, at least one digit and at least one symbol. No character can be repeated. Find the number of different passwords that Chelsea can make.

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Cambridge International AS & A Level

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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2017**

1 hour 15 minutes

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1 Rani and Diksha go shopping for clothes.

(i) Rani buys 4 identical vests, 3 identical sweaters and 1 coat. Each vest costs \$5.50 and the coat costs \$90. The mean cost of Rani's 8 items is \$29. Find the cost of a sweater. [3]

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(ii) Diksha buys 1 hat and 4 identical shirts. The mean cost of Diksha's 5 items is \$26 and the standard deviation is \$0. Explain how you can tell that Diksha spends \$104 on shirts. [2]

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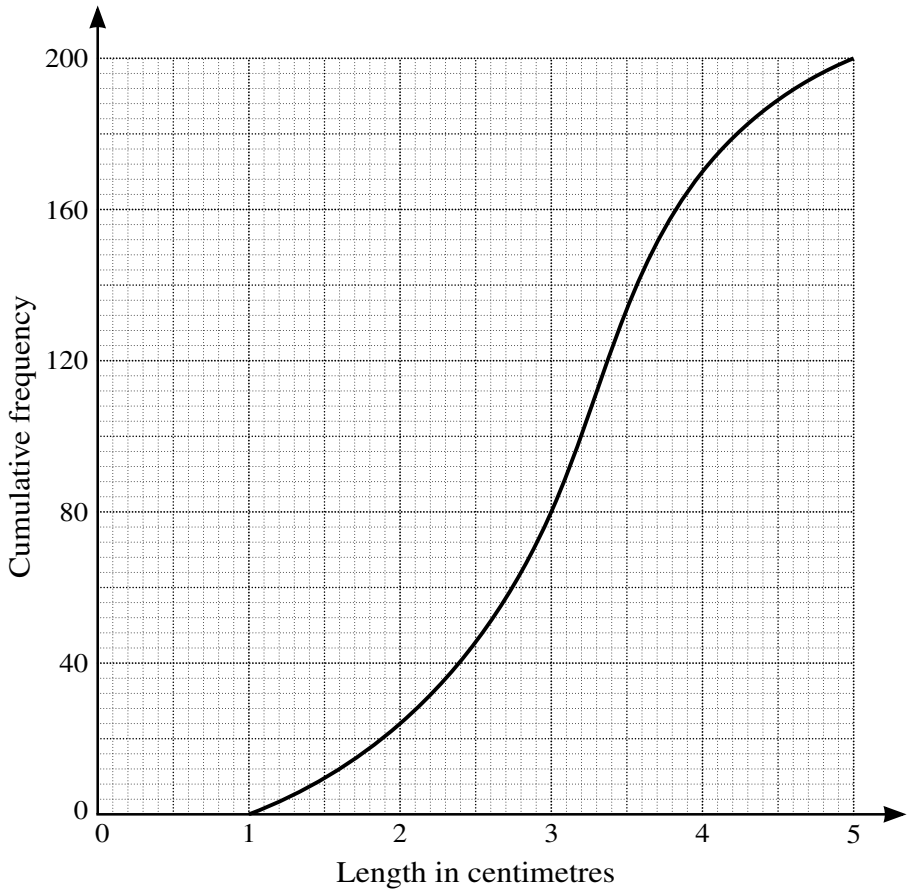
2 Anabel measured the lengths, in centimetres, of 200 caterpillars. Her results are illustrated in the cumulative frequency graph below.



(i) Estimate the median and the interquartile range of the lengths. [3]

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(ii) Estimate how many caterpillars had a length of between 2 and 3.5 cm. [1]

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(iii) 6% of caterpillars were of length l centimetres or more. Estimate l. [2]

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3 In a probability distribution the random variable X takes the value x with probability kx^2, where k is a constant and x takes values -2, -1, 2, 4 only.

(i) Show that $P(X = -2)$ has the same value as $P(X = 2)$. [1]

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(ii) Draw up the probability distribution table for X, in terms of k, and find the value of k. [3]

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(iii) Find $E(X)$. [2]

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4 Two identical biased triangular spinners with sides marked 1, 2 and 3 are spun. For each spinner, the probabilities of landing on the sides marked 1, 2 and 3 are p, q and r respectively. The score is the sum of the numbers on the sides on which the spinners land. You are given that P(score is 6) = $\frac{1}{36}$ and P(score is 5) = $\frac{1}{9}$. Find the values of p, q and r. [6]

5 The lengths of videos of a certain popular song have a normal distribution with mean 3.9 minutes. 18% of these videos last for longer than 4.2 minutes.

(i) Find the standard deviation of the lengths of these videos. [3]

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(ii) Find the probability that the length of a randomly chosen video differs from the mean by less than half a minute. [4]

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The lengths of videos of another popular song have a normal distribution with the same mean of 3.9 minutes but the standard deviation is twice the standard deviation in part **(i)**. The probability that the length of a randomly chosen video of this song differs from the mean by less than half a minute is denoted by p.

(iii) Without any further calculation, determine whether p is more than, equal to, or less than your answer to part **(ii)**. You must explain your reasoning. [2]

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6 A library contains 4 identical copies of book A, 2 identical copies of book B and 5 identical copies of book C. These 11 books are arranged on a shelf in the library.

(i) Calculate the number of different arrangements if the end books are either both book A or both book B. [4]

(ii) Calculate the number of different arrangements if all the books *A* are next to each other and none of the books *B* are next to each other. [5]

7 During the school holidays, each day Khalid either rides on his bicycle with probability 0.6, or on his skateboard with probability 0.4. Khalid does not ride on both on the same day. If he rides on his bicycle then the probability that he hurts himself is 0.05. If he rides on his skateboard the probability that he hurts himself is 0.75.

(i) Find the probability that Khalid hurts himself on any particular day. [2]

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(ii) Given that Khalid hurts himself on a particular day, find the probability that he is riding on his skateboard. [2]

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(iii) There are 45 days of school holidays. Show that the variance of the number of days Khalid rides on his skateboard is the same as the variance of the number of days that Khalid rides on his bicycle. [2]

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(iv) Find the probability that Khalid rides on his skateboard on at least 2 of 10 randomly chosen days in the school holidays. [3]

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

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0830110950

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

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The total number of marks for this paper is 50.

This document consists of **12** printed pages.

CAMBRIDGE International Examinations

1 A biased die has faces numbered 1 to 6. The probabilities of the die landing on 1, 3 or 5 are each equal to 0.1. The probabilities of the die landing on 2 or 4 are each equal to 0.2. The die is thrown twice. Find the probability that the sum of the numbers it lands on is 9. [4]

2 The probability that George goes swimming on any day is $\frac{1}{3}$. Use an approximation to calculate the probability that in 270 days George goes swimming at least 100 times. [5]

3 A shop sells two makes of coffee, Café Premium and Café Standard. Both coffees come in two sizes, large jars and small jars. Of the jars on sale, 65% are Café Premium and 35% are Café Standard. Of the Café Premium, 40% of the jars are large and of the Café Standard, 25% of the jars are large. A jar is chosen at random.

(i) Find the probability that the jar is small. [2]

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(ii) Find the probability that the jar is Café Standard given that it is large. [3]

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4 **(a)** The random variable X has the distribution $N(\mu, \sigma^2)$, where $\mu = 1.5\sigma$. A random value of X is chosen. Find the probability that this value of X is greater than 0. [3]

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(b) The life of a particular type of torch battery is normally distributed with mean 120 hours and standard deviation s hours. It is known that 87.5% of these batteries last longer than 70 hours. Find the value of s. [3]

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5 Hebe attempts a crossword puzzle every day. The number of puzzles she completes in a week (7 days) is denoted by X.

(i) State two conditions that are required for X to have a binomial distribution. [2]

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On average, Hebe completes 7 out of 10 of these puzzles.

(ii) Use a binomial distribution to find the probability that Hebe completes at least 5 puzzles in a week. [3]

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(iii) Use a binomial distribution to find the probability that, over the next 10 weeks, Hebe completes 4 or fewer puzzles in exactly 3 of the 10 weeks. [3]

6 **(a)** Find how many numbers between 3000 and 5000 can be formed from the digits 1, 2, 3, 4 and 5,

(i) if digits are not repeated, [2]

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(ii) if digits can be repeated and the number formed is odd. [3]

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(b) A box of 20 biscuits contains 4 different chocolate biscuits, 2 different oatmeal biscuits and 14 different ginger biscuits. 6 biscuits are selected from the box at random.

(i) Find the number of different selections that include the 2 oatmeal biscuits. [2]

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(ii) Find the probability that fewer than 3 chocolate biscuits are selected. [4]

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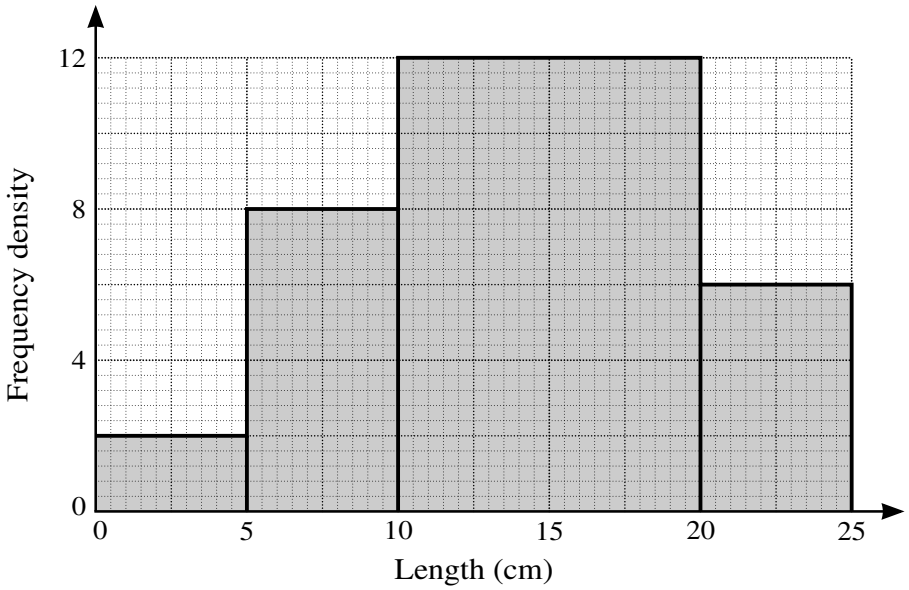
7 The following histogram represents the lengths of worms in a garden.



(i) Calculate the frequencies represented by each of the four histogram columns. [2]

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(ii) On the grid on the next page, draw a cumulative frequency graph to represent the lengths of worms in the garden. [4]

(iii) Use your graph to estimate the median and interquartile range of the lengths of worms in the garden. [3]

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[Question 7 (iv) is printed on the next page.]

(iv) Calculate an estimate of the mean length of worms in the garden. [2]

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

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MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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The total number of marks for this paper is 50.

This document consists of **13** printed pages and **3** blank pages.

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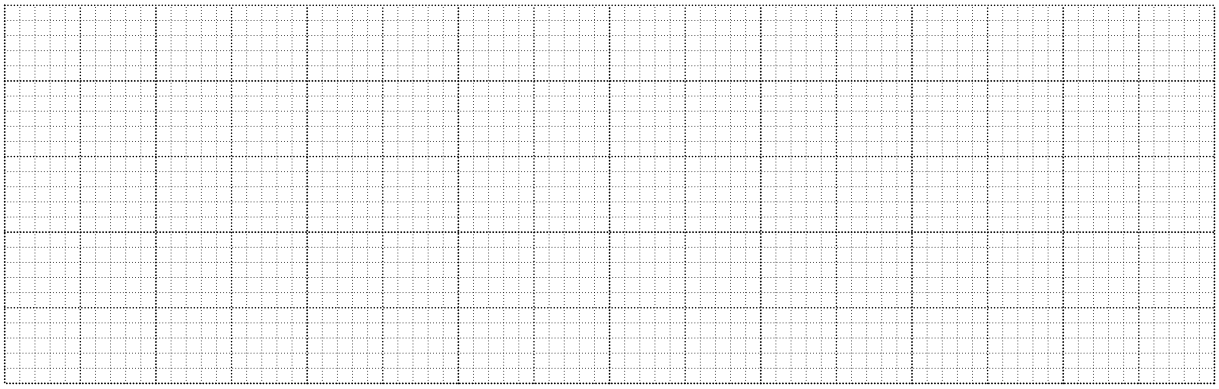
1 In a statistics lesson 12 people were asked to think of a number, x, between 1 and 20 inclusive. From the results Tom found that $\Sigma x = 186$ and that the standard deviation of x is 4.5. Assuming that Tom's calculations are correct, find the values of $\Sigma(x - 10)$ and $\Sigma(x - 10)^2$. [3]

2 In a survey 55 students were asked to record, to the nearest kilometre, the total number of kilometres they travelled to school in a particular week. The results are shown below.

5	5	9	10	13	13	13	15	15	15	15
16	18	18	18	19	19	20	20	20	20	21
21	21	21	23	25	25	27	27	29	30	33
35	38	39	40	42	45	48	50	50	51	51
52	55	57	57	60	61	64	65	66	69	70

(i) On the grid, draw a box-and-whisker plot to illustrate the data. [5]



An 'outlier' is defined as any data value which is more than 1.5 times the interquartile range above the upper quartile, or more than 1.5 times the interquartile range below the lower quartile.

(ii) Show that there are no outliers. [2]

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3 Andy has 4 red socks and 8 black socks in his drawer. He takes 2 socks at random from his drawer.

(i) Find the probability that the socks taken are of different colours. [2]

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The random variable X is the number of red socks taken.

(ii) Draw up the probability distribution table for X. [3]

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(iii) Find $\mathrm{E}(X)$. [1]

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4 **(a)** The distance that car tyres of a certain make can travel before they need to be replaced has a normal distribution. A survey of a large number of these tyres found that the probability of this distance being more than 36 800 km is 0.0082 and the probability of this distance being more than 31 000 km is 0.6915. Find the mean and standard deviation of the distribution. [5]

(b) The random variable X has the distribution $N(\mu, \sigma^2)$, where $3\sigma = 4\mu$ and $\mu \neq 0$. Find $P(X < 3\mu)$. [3]

5 In Pelmerdon 22% of families own a dishwasher.

(i) Find the probability that, of 15 families chosen at random from Pelmerdon, between 4 and 6 inclusive own a dishwasher. [3]

(ii) A random sample of 145 families from Pelmerdon is chosen. Use a suitable approximation to find the probability that more than 26 families own a dishwasher. [5]

6 Vehicles approaching a certain road junction from town A can either turn left, turn right or go straight on. Over time it has been noted that of the vehicles approaching this particular junction from town A, 55% turn left, 15% turn right and 30% go straight on. The direction a vehicle takes at the junction is independent of the direction any other vehicle takes at the junction.

(i) Find the probability that, of the next three vehicles approaching the junction from town A, one goes straight on and the other two either both turn left or both turn right. [4]

(ii) Three vehicles approach the junction from town A. Given that all three drivers choose the same direction at the junction, find the probability that they all go straight on. [4]

7 Find the number of different ways in which all 9 letters of the word MINCEMEAT can be arranged in each of the following cases.

(i) There are no restrictions. [1]

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(ii) No vowel (A, E, I are vowels) is next to another vowel. [4]

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5 of the 9 letters of the word MINCEMEAT are selected.

(iii) Find the number of possible selections which contain exactly 1 M and exactly 1 E. [2]

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(iv) Find the number of possible selections which contain at least 1 M and at least 1 E. [3]

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Additional Page

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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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The total number of marks for this paper is 50.

1 Each of a group of 10 boys estimates the length of a piece of string. The estimates, in centimetres, are as follows.

37 40 45 38 36 38 42 38 40 39

(i) Find the mode. [1]

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(ii) Find the median and the interquartile range. [3]

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2 In a group of students, $\frac{3}{4}$ are male. The proportion of male students who like their curry hot is $\frac{3}{5}$ and the proportion of female students who like their curry hot is $\frac{4}{5}$. One student is chosen at random.

(i) Find the probability that the student chosen is either female, or likes their curry hot, or is both female and likes their curry hot. [4]

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(ii) Showing your working, determine whether the events 'the student chosen is male' and 'the student chosen likes their curry hot' are independent. [2]

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3 **(i)** The volume of soup in Super Soup cartons has a normal distribution with mean μ millilitres and standard deviation 9 millilitres. Tests have shown that 10% of cartons contain less than 440 millilitres of soup. Find the value of μ. [3]

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(ii) A food retailer orders 150 Super Soup cartons. Calculate the number of these cartons for which you would expect the volume of soup to be more than 1.8 standard deviations above the mean. [3]

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4 Mrs Rupal chooses 3 animals at random from 5 dogs and 2 cats. The random variable X is the number of cats chosen.

(i) Draw up the probability distribution table for X. [4]

(ii) You are given that $\mathrm{E}(X) = \frac{6}{7}$. Find the value of $\mathrm{Var}(X)$. [2]

5 The lengths, t minutes, of 242 phone calls made by a family over a period of 1 week are summarised in the frequency table below.

Length of phone call (t minutes)	$0 < t \leqslant 1$	$1 < t \leqslant 2$	$2 < t \leqslant 5$	$5 < t \leqslant 10$	$10 < t \leqslant 30$
Frequency	14	46	102	a	40

(i) Find the value of a. [1]

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(ii) Calculate an estimate of the mean length of these phone calls. [2]

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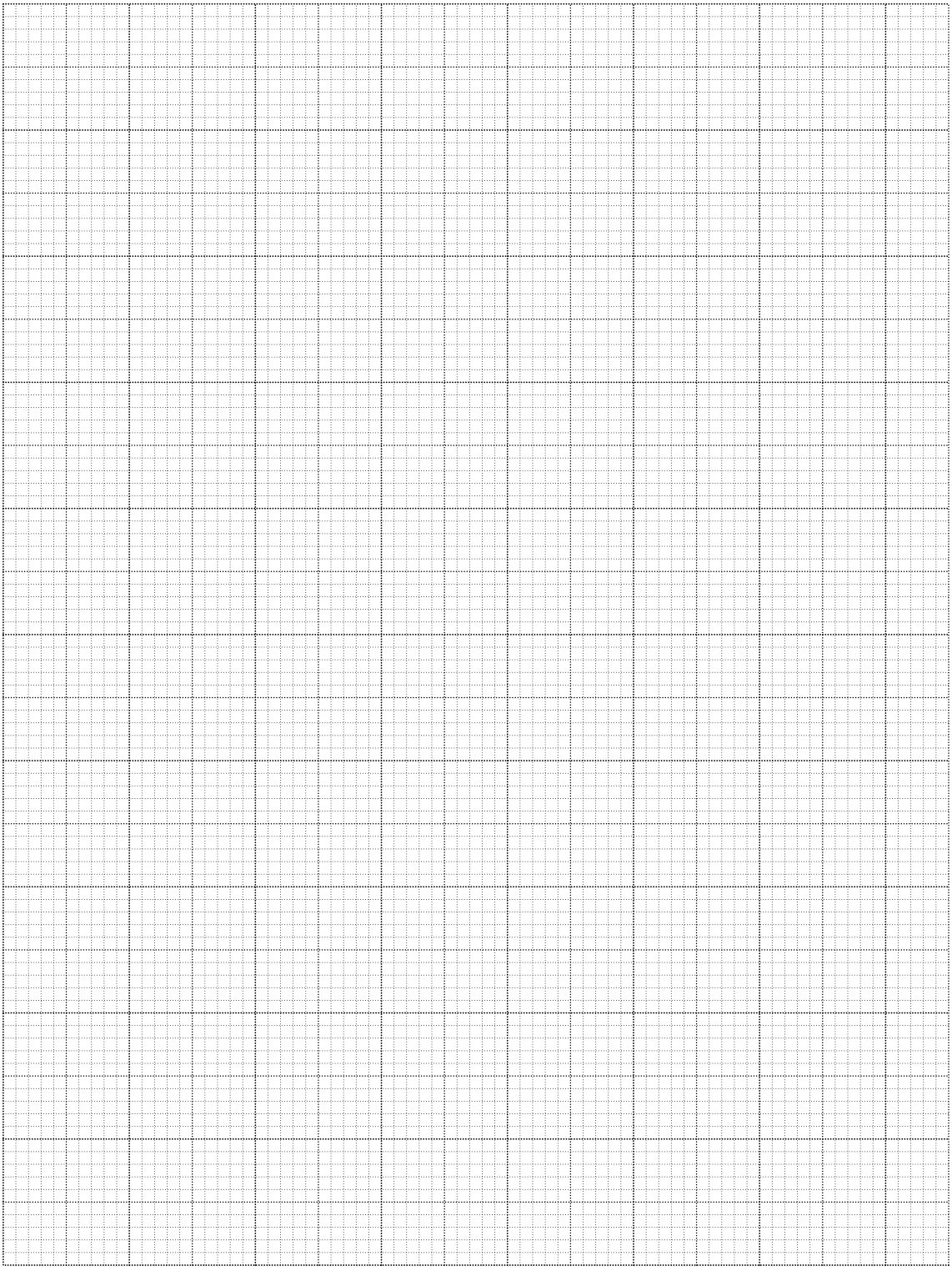
(iii) On the grid, draw a histogram to illustrate the data in the table. [4]



6 **(a)** Find the number of ways in which all 9 letters of the word AUSTRALIA can be arranged in each of the following cases.

(i) All the vowels (A, I, U are vowels) are together. [3]

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(ii) The letter T is in the central position and each end position is occupied by one of the other consonants (R, S, L). [3]

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(b) Donna has 2 necklaces, 8 rings and 4 bracelets, all different. She chooses 4 pieces of jewellery. How many possible selections can she make if she chooses at least 1 necklace and at least 1 bracelet? [4]

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7 In a certain country, 60% of mobile phones sold are made by Company *A*, 35% are made by Company *B* and 5% are made by other companies.

(i) Find the probability that, out of a random sample of 13 people who buy a mobile phone, fewer than 11 choose a mobile phone made by Company *A*. [3]

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(ii) Use a suitable approximation to find the probability that, out of a random sample of 130 people who buy a mobile phone, at least 50 choose a mobile phone made by Company *B*. [5]

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(iii) A random sample of n mobile phones sold is chosen. The probability that at least one of these phones is made by Company B is more than 0.98. Find the least possible value of n. [3]

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Additional Page

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

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3180209555

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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1 The masses in kilograms of 50 children having a medical check-up were recorded correct to the nearest kilogram. The results are shown in the table.

Mass (kg)	10 – 14	15 – 19	20 – 24	25 – 34	35 – 59
Frequency	6	12	14	10	8

(i) Find which class interval contains the lower quartile. [1]

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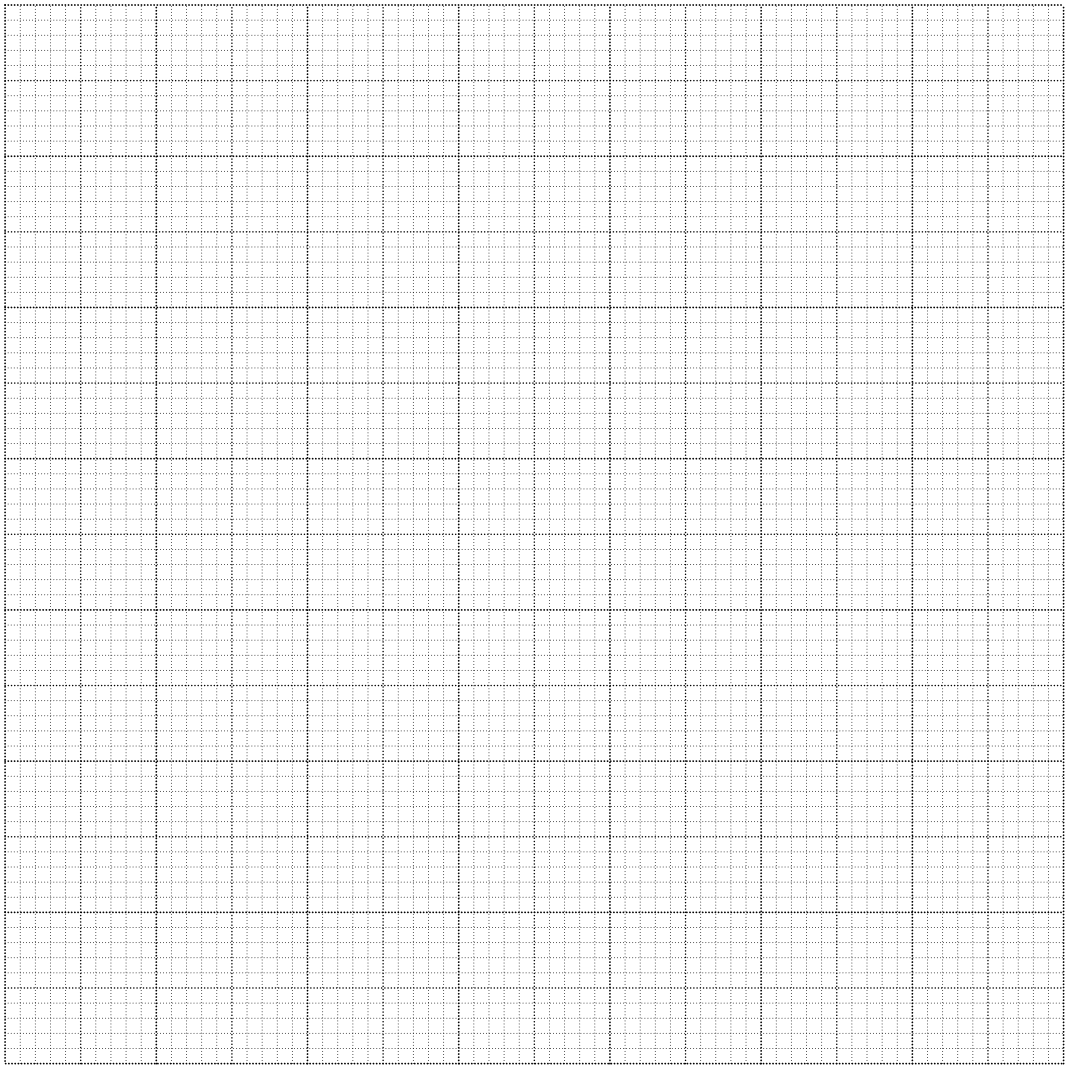
(ii) On the grid, draw a histogram to illustrate the data in the table. [4]



2 The random variable X has the distribution $N(-3, \sigma^2)$. The probability that a randomly chosen value of X is positive is 0.25.

(i) Find the value of σ. [3]

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(ii) Find the probability that, of 8 random values of X, fewer than 2 will be positive. [3]

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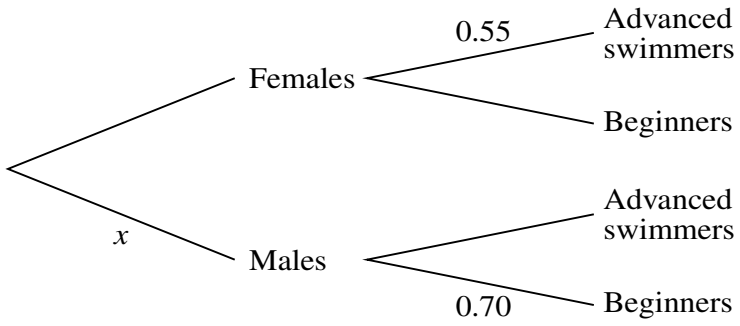
3 The members of a swimming club are classified either as 'Advanced swimmers' or 'Beginners'. The proportion of members who are male is x, and the proportion of males who are Beginners is 0.7. The proportion of females who are Advanced swimmers is 0.55. This information is shown in the tree diagram.



For a randomly chosen member, the probability of being an Advanced swimmer is the same as the probability of being a Beginner.

(i) Find x. [3]

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(ii) Given that a randomly chosen member is an Advanced swimmer, find the probability that the member is male. [3]

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4 Farfield Travel and Lacket Travel are two travel companies which arrange tours abroad. The numbers of holidays arranged in a certain week are recorded in the table below, together with the means and standard deviations of the prices.

	Number of holidays	Mean price ($)	Standard deviation ($)
Farfield Travel	30	1500	230
Lacket Travel	21	2400	160

(i) Calculate the mean price of all 51 holidays. [2]

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(ii) The prices of individual holidays with Farfield Travel are denoted by $\$x_F$ and the prices of individual holidays with Lacket Travel are denoted by $\$x_L$. By first finding Σx_F^2 and Σx_L^2, find the standard deviation of the prices of all 51 holidays. [5]

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5 A game is played with 3 coins, A, B and C. Coins A and B are biased so that the probability of obtaining a head is 0.4 for coin A and 0.75 for coin B. Coin C is not biased. The 3 coins are thrown once.

(i) Draw up the probability distribution table for the number of heads obtained. [5]

(ii) Hence calculate the mean and variance of the number of heads obtained. [3]

6 The diameters of apples in an orchard have a normal distribution with mean 5.7 cm and standard deviation 0.8 cm. Apples with diameters between 4.1 cm and 5 cm can be used as toffee apples.

(i) Find the probability that an apple selected at random can be used as a toffee apple. [3]

(ii) 250 apples are chosen at random. Use a suitable approximation to find the probability that fewer than 50 can be used as toffee apples. [5]

7 Find the number of ways the 9 letters of the word SEVENTEEN can be arranged in each of the following cases.

(i) One of the letter Es is in the centre with 4 letters on either side. [2]

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(ii) No E is next to another E. [3]

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5 letters are chosen from the 9 letters of the word SEVENTEEN.

(iii) Find the number of possible selections which contain exactly 2 Es and exactly 2 Ns. [1]

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(iv) Find the number of possible selections which contain at least 2 Es. [4]

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Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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1067175054

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
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You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This document consists of **15** printed pages and **1** blank page.

Cambridge Assessment International Education

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1 The times, t seconds, taken to swim 100 m were recorded for a group of 9 swimmers and were found to be as follows.

95 126 117 135 120 125 114 119 136

(i) Find the values of $\Sigma(t - 120)$ and $\Sigma(t - 120)^2$. [2]

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(ii) Using your values found in part **(i)**, calculate the variance of t. [2]

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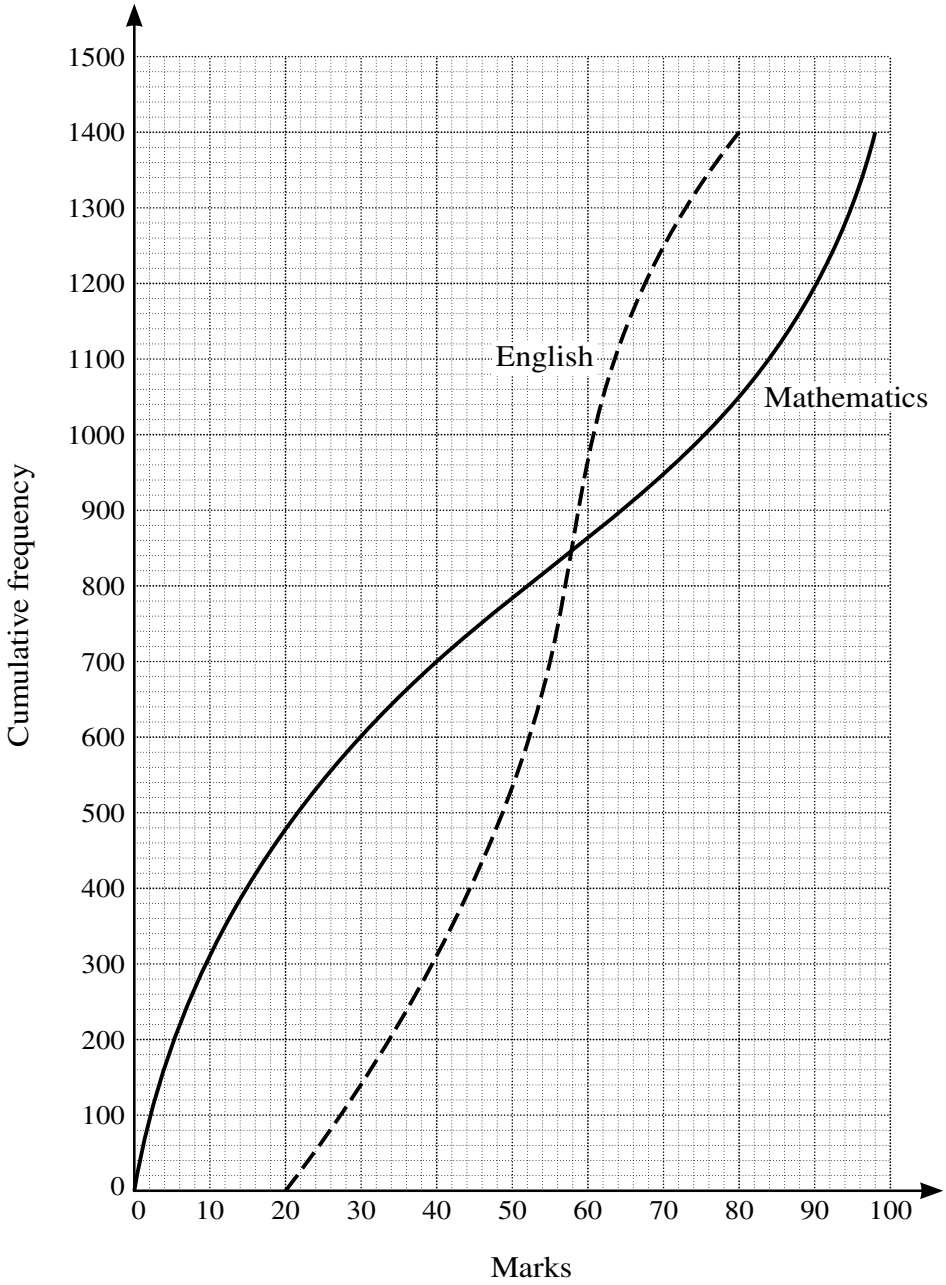
2 Jameel has 5 plums and 3 apricots in a box. Rosa has x plums and 6 apricots in a box. One fruit is chosen at random from Jameel's box and one fruit is chosen at random from Rosa's box. The probability that both fruits chosen are plums is $\frac{1}{4}$. Write down an equation in x and hence find x. [3]

3 A fair six-sided die is thrown twice and the scores are noted. Event X is defined as 'The total of the two scores is 4'. Event Y is defined as 'The first score is 2 or 5'. Are events X and Y independent? Justify your answer. [4]

4 The Mathematics and English A-level marks of 1400 pupils all taking the same examinations are shown in the cumulative frequency graphs below. Both examinations are marked out of 100.



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Use suitable data from these graphs to compare the central tendency and spread of the marks in Mathematics and English. [6]

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5 In a certain country the probability that a child owns a bicycle is 0.65.

(i) A random sample of 15 children from this country is chosen. Find the probability that more than 12 own a bicycle. [3]

(ii) A random sample of 250 children from this country is chosen. Use a suitable approximation to find the probability that fewer than 179 own a bicycle. [4]

6 At a funfair, Amy pays \$1 for two attempts to make a bell ring by shooting at it with a water pistol.

- If she makes the bell ring on her first attempt, she receives \$3 and stops playing. This means that overall she has gained \$2.
- If she makes the bell ring on her second attempt, she receives \$1.50 and stops playing. This means that overall she has gained \$0.50.
- If she does not make the bell ring in the two attempts, she has lost her original \$1.

The probability that Amy makes the bell ring on any attempt is 0.2, independently of other attempts.

(i) Show that the probability that Amy loses her original \$1 is 0.64. [2]

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(ii) Complete the probability distribution table for the amount that Amy gains. [4]

Amy's gain ($)			
Probability	0.64		

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(iii) Calculate Amy's expected gain. [1]

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7 The weight of adult female giraffes has a normal distribution with mean 830 kg and standard deviation 120 kg.

(i) There are 430 adult female giraffes in a particular game reserve. Find the number of these adult female giraffes which can be expected to weigh less than 700 kg. [4]

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(ii) Given that 90% of adult female giraffes weigh between $(830 - w)$ kg and $(830 + w)$ kg, find the value of w. [3]

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The weight of adult male giraffes has a normal distribution with mean 1190 kg and standard deviation σ kg.

(iii) Given that 83.4% of adult male giraffes weigh more than 950 kg, find the value of σ. [3]

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8 Freddie has 6 toy cars and 3 toy buses, all different. He chooses 4 toys to take on holiday with him.

(i) In how many different ways can Freddie choose 4 toys? [1]

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(ii) How many of these choices will include both his favourite car and his favourite bus? [2]

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Freddie arranges these 9 toys in a line.

(iii) Find the number of possible arrangements if the buses are all next to each other. [3]

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(iv) Find the number of possible arrangements if there is a car at each end of the line and no buses are next to each other. [3]

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Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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The total number of marks for this paper is 50.

This document consists of **12** printed pages.

1 Two ordinary fair dice are thrown and the numbers obtained are noted. Event S is 'The sum of the numbers is even'. Event T is 'The sum of the numbers is either less than 6 or a multiple of 4 or both'. Showing your working, determine whether the events S and T are independent. [4]

2 The volume of ink in a certain type of ink cartridge has a normal distribution with mean 30 ml and standard deviation 1.5 ml. People in an office use a total of 8 cartridges of this ink per month. Find the expected number of cartridges per month that contain less than 28.9 ml of this ink. [4]

3 The probability that Janice will buy an item online in any week is 0.35. Janice does not buy more than one item online in any week.

(i) Find the probability that, in a 10-week period, Janice buys at most 7 items online. [3]

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(ii) The probability that Janice buys at least one item online in a period of n weeks is greater than 0.99. Find the smallest possible value of n. [3]

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4 It is known that 20% of male giant pandas in a certain area weigh more than 121 kg and 71.9% weigh more than 102 kg. Weights of male giant pandas in this area have a normal distribution. Find the mean and standard deviation of the weights of male giant pandas in this area. [5]

5 Maryam has 7 sweets in a tin; 6 are toffees and 1 is a chocolate. She chooses one sweet at random and takes it out. Her friend adds 3 chocolates to the tin. Then Maryam takes another sweet at random out of the tin.

(i) Draw a fully labelled tree diagram to illustrate this situation. [3]

(ii) Draw up the probability distribution table for the number of toffees taken. [3]

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(iii) Find the mean number of toffees taken. [1]

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(iv) Find the probability that the first sweet taken is a chocolate, given that the second sweet taken is a toffee. [4]

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6 **(i)** Give one advantage and one disadvantage of using a box-and-whisker plot to represent a set of data. [2]

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(ii) The times in minutes taken to run a marathon were recorded for a group of 13 marathon runners and were found to be as follows.

180 275 235 242 311 194 246 229 238 768 332 227 228

State which of the mean, mode or median is most suitable as a measure of central tendency for these times. Explain why the other measures are less suitable. [3]

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(iii) Another group of 33 people ran the same marathon and their times in minutes were as follows.

190	203	215	246	249	253	255	254	258	260	261
263	267	269	274	276	280	288	283	287	294	300
307	318	327	331	336	345	351	353	360	368	375

(a) On the grid below, draw a box-and-whisker plot to illustrate the times for these 33 people. [4]

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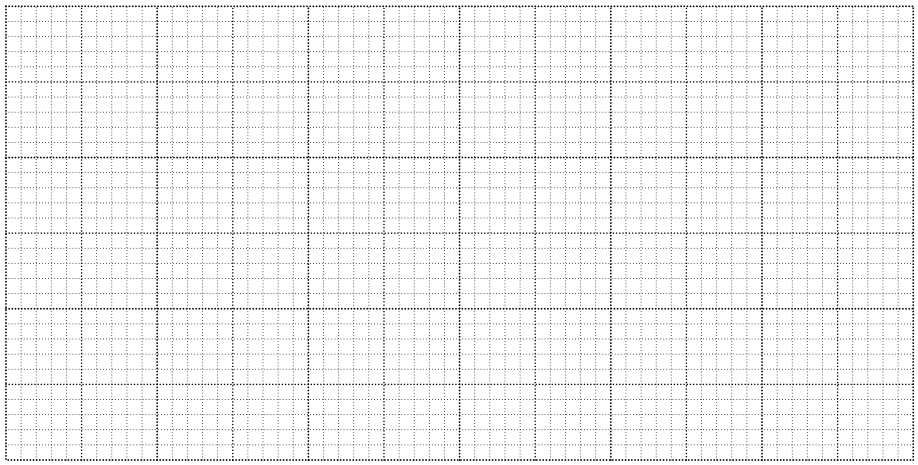

(b) Find the interquartile range of these times. [1]

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7 **(a)** A group of 6 teenagers go boating. There are three boats available. One boat has room for 3 people, one has room for 2 people and one has room for 1 person. Find the number of different ways the group of 6 teenagers can be divided between the three boats. [3]

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(b) Find the number of different 7-digit numbers which can be formed from the seven digits 2, 2, 3, 7, 7, 7, 8 in each of the following cases.

(i) The odd digits are together and the even digits are together. [3]

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(ii) The 2s are not together. [4]

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Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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5543033167

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **May/June 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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The total number of marks for this paper is 50.

This document consists of **12** printed pages.

1 The time taken, in minutes, by a ferry to cross a lake has a normal distribution with mean 85 and standard deviation 6.8.

(i) Find the probability that, on a randomly chosen occasion, the time taken by the ferry to cross the lake is between 79 and 91 minutes. [3]

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(ii) Over a long period it is found that 96% of ferry crossings take longer than a certain time t minutes. Find the value of t. [3]

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2 Megan sends messages to her friends in one of 3 different ways: text, email or social media. For each message, the probability that she uses text is 0.3 and the probability that she uses email is 0.2. She receives an immediate reply from a text message with probability 0.4, from an email with probability 0.15 and from social media with probability 0.6.

(i) Draw a fully labelled tree diagram to represent this information. [2]

(ii) Given that Megan does not receive an immediate reply to a message, find the probability that the message was an email. [4]

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3 Mr and Mrs Keene and their 5 children all go to watch a football match, together with their friends Mr and Mrs Uzuma and their 2 children. Find the number of ways in which all 11 people can line up at the entrance in each of the following cases.

(i) Mr Keene stands at one end of the line and Mr Uzuma stands at the other end. [2]

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(ii) The 5 Keene children all stand together and the Uzuma children both stand together. [3]

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4 **(i)** Find the number of ways a committee of 6 people can be chosen from 8 men and 4 women if there must be at least twice as many men as there are women on the committee. [3]

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(ii) Find the number of ways a committee of 6 people can be chosen from 8 men and 4 women if 2 particular men refuse to be on the committee together. [3]

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5 On average, 34% of the people who go to a particular theatre are men.

(i) A random sample of 14 people who go to the theatre is chosen. Find the probability that at most 2 people are men. [3]

(ii) Use an approximation to find the probability that, in a random sample of 600 people who go to the theatre, fewer than 190 are men. [5]

6 A fair five-sided spinner has sides numbered 1, 1, 1, 2, 3. A fair three-sided spinner has sides numbered 1, 2, 3. Both spinners are spun once and the score is the product of the numbers on the sides the spinners land on.

(i) Draw up the probability distribution table for the score. [4]

(ii) Find the mean and the variance of the score. [3]

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(iii) Find the probability that the score is greater than the mean score. [2]

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7 The times in minutes taken by 13 pupils at each of two schools in a cross-country race are recorded in the table below.

Thaters School	38	43	48	52	54	56	57	58	58	61	62	66	75
Whitefay Park School	45	47	53	56	56	61	64	66	69	73	75	78	83

(i) Draw a back-to-back stem-and-leaf diagram to illustrate these times with Thaters School on the left. [4]

(ii) Find the interquartile range of the times for pupils at Thaters School. [2]

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The times taken by pupils at Whitefay Park School are denoted by x minutes.

(iii) Find the value of $\Sigma(x - 60)^2$. [2]

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(iv) It is given that $\Sigma(x - 60) = 46$. Use this result, together with your answer to part **(iii)**, to find the variance of x. [2]

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Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **February/March 2016**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

5448625221

READ THESE INSTRUCTIONS FIRST

An answer booklet and a graph paper booklet are provided inside this question paper. You should follow the instructions on the front cover of both booklets. If you need additional answer paper or graph paper ask the invigilator for a continuation booklet or graph paper booklet.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
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The total number of marks for this paper is 50.

This document consists of **3** printed pages, **1** blank page and **2** inserts.

1 For 10 values of x the mean is 86.2 and $\Sigma(x - a) = 362$. Find the value of

(i) Σx, [1]

(ii) the constant a. [2]

2 A flower shop has 5 yellow roses, 3 red roses and 2 white roses. Martin chooses 3 roses at random. Draw up the probability distribution table for the number of white roses Martin chooses. [4]

3 A fair eight-sided die has faces marked 1, 2, 3, 4, 5, 6, 7, 8. The score when the die is thrown is the number on the face the die lands on. The die is thrown twice.

- Event R is 'one of the scores is exactly 3 greater than the other score'.
- Event S is 'the product of the scores is more than 19'.

(i) Find the probability of R. [2]

(ii) Find the probability of S. [2]

(iii) Determine whether events R and S are independent. Justify your answer. [3]

4 A survey was made of the journey times of 63 people who cycle to work in a certain town. The results are summarised in the following cumulative frequency table.

Journey time (minutes)	$\leqslant 10$	$\leqslant 25$	$\leqslant 45$	$\leqslant 60$	$\leqslant 80$
Cumulative frequency	0	18	50	59	63

(i) State how many journey times were between 25 and 45 minutes. [1]

(ii) Draw a histogram on graph paper to represent the data. [4]

(iii) Calculate an estimate of the mean journey time. [2]

5 In a certain town, 35% of the people take a holiday abroad and 65% take a holiday in their own country. Of those going abroad 80% go to the seaside, 15% go camping and 5% take a city break. Of those taking a holiday in their own country, 20% go to the seaside and the rest are divided equally between camping and a city break.

(i) A person is chosen at random. Given that the person chosen goes camping, find the probability that the person goes abroad. [5]

(ii) A group of n people is chosen randomly. The probability of all the people in the group taking a holiday in their own country is less than 0.002. Find the smallest possible value of n. [3]

6 Hannah chooses 5 singers from 15 applicants to appear in a concert. She lists the 5 singers in the order in which they will perform.

(i) How many different lists can Hannah make? [2]

Of the 15 applicants, 10 are female and 5 are male.

(ii) Find the number of lists in which the first performer is male, the second is female, the third is male, the fourth is female and the fifth is male. [2]

Hannah's friend Ami would like the group of 5 performers to include more males than females. The order in which they perform is no longer relevant.

(iii) Find the number of different selections of 5 performers with more males than females. [3]

(iv) Two of the applicants are Mr and Mrs Blake. Find the number of different selections that include Mr and Mrs Blake and also fulfil Ami's requirement. [3]

7 The times taken by a garage to fit a tow bar onto a car have a normal distribution with mean m hours and standard deviation 0.35 hours. It is found that 95% of times taken are longer than 0.9 hours.

(i) Find the value of m. [3]

(ii) On one day 4 cars have a tow bar fitted. Find the probability that none of them takes more than 2 hours to fit. [5]

The times in hours taken by another garage to fit a tow bar onto a car have the distribution $N(\mu, \sigma^2)$ where $\mu = 3\sigma$.

(iii) Find the probability that it takes more than 0.6μ hours to fit a tow bar onto a randomly chosen car at this garage. [3]

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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **February/March 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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1 Twelve values of x are shown below.

1761.6	1758.5	1762.3	1761.4	1759.4	1759.1
1762.5	1761.9	1762.4	1761.9	1762.8	1761.0

Find the mean and standard deviation of $(x - 1760)$. Hence find the mean and standard deviation of x. [4]

2 A bag contains 10 pink balloons, 9 yellow balloons, 12 green balloons and 9 white balloons. 7 balloons are selected at random without replacement. Find the probability that exactly 3 of them are green. [3]

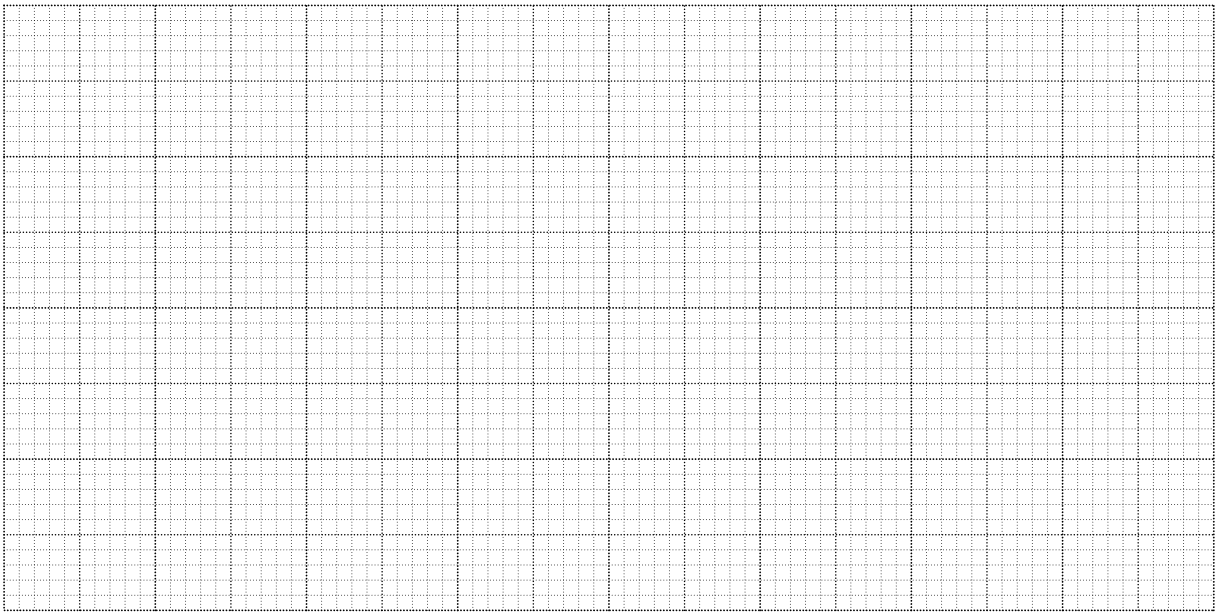
3 It is found that 10% of the population enjoy watching Historical Drama on television. Use an appropriate approximation to find the probability that, out of 160 people chosen randomly, more than 17 people enjoy watching Historical Drama on television. [5]

4 The weights in kilograms of packets of cereal were noted correct to 4 significant figures. The following stem-and-leaf diagram shows the data.

747	3	(1)
748	1 2 5 7 7 9	(6)
749	0 2 2 2 3 5 5 5 6 7 8 9	(12)
750	1 1 2 2 2 3 4 4 5 6 7 7 8 8 9	(15)
751	0 0 2 3 3 4 4 4 5 5 7 7 9	(13)
752	0 0 0 1 1 2 2 3 4 4 4	(11)
753	2	(1)

Key: 748 | 5 represents 0.7485 kg.

(i) On the grid, draw a box-and-whisker plot to represent the data. [5]



(ii) Name a distribution that might be a suitable model for the weights of this type of cereal packet. Justify your answer. [2]

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5 **(i)** A plate of cakes holds 12 different cakes. Find the number of ways these cakes can be shared between Alex and James if each receives an odd number of cakes. [3]

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(ii) Another plate holds 7 cup cakes, each with a different colour icing, and 4 brownies, each of a different size. Find the number of different ways these 11 cakes can be arranged in a row if no brownie is next to another brownie. [3]

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(iii) A plate of biscuits holds 4 identical chocolate biscuits, 6 identical shortbread biscuits and 2 identical gingerbread biscuits. These biscuits are all placed in a row. Find how many different arrangements are possible if the chocolate biscuits are all kept together. [3]

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6 Pack A consists of ten cards numbered 0, 0, 1, 1, 1, 1, 1, 3, 3, 3. Pack B consists of six cards numbered 0, 0, 2, 2, 2, 2. One card is chosen at random from each pack. The random variable X is defined as the sum of the two numbers on the cards.

(i) Show that $\mathrm{P}(X = 2) = \frac{2}{15}$. [2]

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(ii) Draw up the probability distribution table for X. [4]

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(iii) Given that $X = 3$, find the probability that the card chosen from pack A is a 1. [3]

7 **(a)** The lengths, in centimetres, of middle fingers of women in Raneland have a normal distribution with mean μ and standard deviation σ. It is found that 25% of these women have fingers longer than 8.8 cm and 17.5% have fingers shorter than 7.7 cm.

(i) Find the values of μ and σ. [5]

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The lengths, in centimetres, of middle fingers of women in Snoland have a normal distribution with mean 7.9 and standard deviation 0.44. A random sample of 5 women from Snoland is chosen.

(ii) Find the probability that exactly 3 of these women have middle fingers shorter than 8.2 cm. [5]

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(b) The random variable X has a normal distribution with mean equal to the standard deviation. Find the probability that a particular value of X is less than 1.5 times the mean. [3]

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Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **February/March 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This document consists of **12** printed pages.

1 On each day that Tamar goes to work, he wears either a blue suit with probability 0.6 or a grey suit with probability 0.4. If he wears a blue suit then the probability that he wears red socks is 0.2. If he wears a grey suit then the probability that he wears red socks is 0.32.

(i) Find the probability that Tamar wears red socks on any particular day that he is at work. [2]

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(ii) Given that Tamar is not wearing red socks at work, find the probability that he is wearing a grey suit. [3]

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2 For 40 values of the variable x, it is given that $\Sigma(x - c)^2 = 3099.2$, where c is a constant. The standard deviation of these values of x is 3.2.

(i) Find the value of $\Sigma(x - c)$. [3]

(ii) Given that $c = 50$, find the mean of these values of x. [1]

3 The times taken, in minutes, for trains to travel between Alphaton and Beeton are normally distributed with mean 140 and standard deviation 12.

(i) Find the probability that a randomly chosen train will take less than 132 minutes to travel between Alphaton and Beeton. [3]

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(ii) The probability that a randomly chosen train takes more than k minutes to travel between Alphaton and Beeton is 0.675. Find the value of k. [3]

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4 The random variable X takes the values -1, 1, 2, 3 only. The probability that X takes the value x is kx^2, where k is a constant.

(i) Draw up the probability distribution table for X, in terms of k, and find the value of k. [3]

(ii) Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. [3]

5 The weights, in kg, of the 11 members of the Dolphins swimming team and the 11 members of the Sharks swimming team are shown below.

Dolphins	62	75	69	82	63	80	65	65	73	82	72
Sharks	68	84	59	70	71	64	77	80	66	74	72

(i) Draw a back-to-back stem-and-leaf diagram to represent this information, with Dolphins on the left-hand side of the diagram and Sharks on the right-hand side. [4]

(ii) Find the median and interquartile range for the Dolphins. [3]

6 The results of a survey by a large supermarket show that 35% of its customers shop online.

(i) Six customers are chosen at random. Find the probability that more than three of them shop online. [3]

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(ii) For a random sample of n customers, the probability that at least one of them shops online is greater than 0.95. Find the least possible value of n. [3]

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(iii) For a random sample of 100 customers, use a suitable approximating distribution to find the probability that more than 39 shop online. [5]

7 Find the number of different arrangements that can be made of all 9 letters in the word CAMERAMAN in each of the following cases.

(i) There are no restrictions. [2]

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(ii) The As occupy the 1st, 5th and 9th positions. [1]

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(iii) There is exactly one letter between the Ms. [4]

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Three letters are selected from the 9 letters of the word CAMERAMAN.

(iv) Find the number of different selections if the three letters include exactly one M and exactly one A. [1]

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(v) Find the number of different selections if the three letters include at least one M. [3]

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Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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CAMBRIDGE INTERNATIONAL EXAMINATIONS

General Certificate of Education Advanced Subsidiary Level
General Certificate of Education Advanced Level
Advanced International Certificate of Education

MATHEMATICS 9709/6

STATISTICS 0390/6

PAPER 6 Probability & Statistics 1 **(S1)**

OCTOBER/NOVEMBER SESSION 2002

1 hour 15 minutes

Additional materials:
Answer paper
Graph paper
List of Formulae (MF9)

TIME 1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all** the questions.

Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 50.

Questions carrying smaller numbers of marks are printed earlier in the paper, and questions carrying larger numbers of marks later in the paper.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

This question paper consists of 3 printed pages and 1 blank page.

UNIVERSITY *of* CAMBRIDGE
Local Examinations Syndicate

[Turn over

2

1 The discrete random variable X has the following probability distribution.

x	1	3	5	7
$P(X = x)$	0.3	a	b	0.25

(i) Write down an equation satisfied by a and b. [1]

(ii) Given that $E(X) = 4$, find a and b. [3]

2 Ivan throws three fair dice.

(i) List all the possible scores on the three dice which give a total score of 5, and hence show that the probability of Ivan obtaining a total score of 5 is $\frac{1}{36}$. [3]

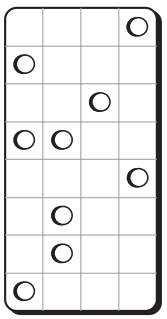
(ii) Find the probability of Ivan obtaining a total score of 7. [3]

3 The distance in metres that a ball can be thrown by pupils at a particular school follows a normal distribution with mean 35.0 m and standard deviation 11.6 m.

(i) Find the probability that a randomly chosen pupil can throw a ball between 30 and 40 m. [3]

(ii) The school gives a certificate to the 10% of pupils who throw further than a certain distance. Find the least distance that must be thrown to qualify for a certificate. [3]

4 In a certain hotel, the lock on the door to each room can be opened by inserting a key card. The key card can be inserted only one way round. The card has a pattern of holes punched in it. The card has 4 columns, and each column can have either 1 hole, 2 holes, 3 holes or 4 holes punched in it. Each column has 8 different positions for the holes. The diagram illustrates one particular key card with 3 holes punched in the first column, 3 in the second, 1 in the third and 2 in the fourth.



(i) Show that the number of different ways in which a column could have exactly 2 holes is 28. [1]

(ii) Find how many different patterns of holes can be punched in a column. [4]

(iii) How many different possible key cards are there? [2]

5 Rachel and Anna play each other at badminton. Each game results in either a win for Rachel or a win for Anna. The probability of Rachel winning the first game is 0.6. If Rachel wins a particular game, the probability of her winning the next game is 0.7, but if she loses, the probability of her winning the next game is 0.4. By using a tree diagram, or otherwise,

(i) find the conditional probability that Rachel wins the first game, given that she loses the second, [5]

(ii) find the probability that Rachel wins 2 games and loses 1 game out of the first three games they play. [4]

6 **(i)** A manufacturer of biscuits produces 3 times as many cream ones as chocolate ones. Biscuits are chosen randomly and packed into boxes of 10. Find the probability that a box contains equal numbers of cream biscuits and chocolate biscuits. [2]

(ii) A random sample of 8 boxes is taken. Find the probability that exactly 1 of them contains equal numbers of cream biscuits and chocolate biscuits. [2]

(iii) A large box of randomly chosen biscuits contains 120 biscuits. Using a suitable approximation, find the probability that it contains fewer than 35 chocolate biscuits. [5]

7 The weights in kilograms of two groups of 17-year-old males from country P and country Q are displayed in the following back-to-back stem-and-leaf diagram. In the third row of the diagram, ... 4 | 7 | 1 ... denotes weights of 74 kg for a male in country P and 71 kg for a male in country Q.

Country P		Country Q
	5	1 5
	6	2 3 4 8
9 8 7 6 4	7	1 3 4 5 6 7 7 8 8 9
8 8 6 6 5 3	8	2 3 6 7 7 8 8
9 7 7 6 5 5 5 4 2	9	0 2 2 4
5 4 4 3 1	10	4 5

(i) Find the median and quartile weights for country Q. [3]

(ii) You are given that the lower quartile, median and upper quartile for country P are 84, 94 and 98 kg respectively. On a single diagram on graph paper, draw two box-and-whisker plots of the data. [4]

(iii) Make two comments on the weights of the two groups. [2]

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CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Subsidiary Level and Advanced Level
Advanced International Certificate of Education

MATHEMATICS **9709/06**

STATISTICS **0390/06**

Paper 6 Probability & Statistics 1 **(S1)**

October/November 2003

1 hour 15 minutes

Additional materials: Answer Booklet/Paper
Graph paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
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The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

[Turn over

1 A computer can generate random numbers which are either 0 or 2. On a particular occasion, it generates a set of numbers which consists of 23 zeros and 17 twos. Find the mean and variance of this set of 40 numbers. [4]

2 The floor areas, $x\,\text{m}^2$, of 20 factories are as follows.

150	350	450	578	595	644	722	798	802	904
1000	1330	1533	1561	1778	1960	2167	2330	2433	3231

Represent these data by a histogram on graph paper, using intervals

$$0 \leqslant x < 500,\ 500 \leqslant x < 1000,\ 1000 \leqslant x < 2000,\ 2000 \leqslant x < 3000,\ 3000 \leqslant x < 4000.$$ [4]

3 In a normal distribution, 69% of the distribution is less than 28 and 90% is less than 35. Find the mean and standard deviation of the distribution. [6]

4 Single cards, chosen at random, are given away with bars of chocolate. Each card shows a picture of one of 20 different football players. Richard needs just one picture to complete his collection. He buys 5 bars of chocolate and looks at all the pictures. Find the probability that

(i) Richard does not complete his collection, [2]

(ii) he has the required picture exactly once, [2]

(iii) he completes his collection with the third picture he looks at. [2]

5 In a certain country 54% of the population is male. It is known that 5% of the males are colour-blind and 2% of the females are colour-blind. A person is chosen at random and found to be colour-blind. By drawing a tree diagram, or otherwise, find the probability that this person is male. [6]

6 **(a)** A collection of 18 books contains one Harry Potter book. Linda is going to choose 6 of these books to take on holiday.

(i) In how many ways can she choose 6 books? [1]

(ii) How many of these choices will include the Harry Potter book? [2]

(b) In how many ways can 5 boys and 3 girls stand in a straight line

(i) if there are no restrictions, [1]

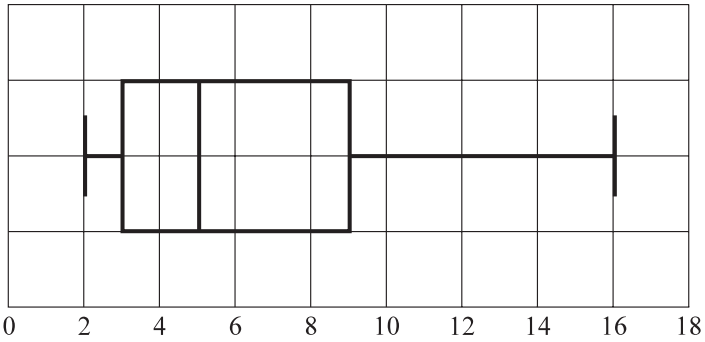
(ii) if the boys stand next to each other? [4]

7 The length of time a person undergoing a routine operation stays in hospital can be modelled by a normal distribution with mean 7.8 days and standard deviation 2.8 days.

(i) Calculate the proportion of people who spend between 7.8 days and 11.0 days in hospital. [4]

(ii) Calculate the probability that, of 3 people selected at random, exactly 2 spend longer than 11.0 days in hospital. [2]

(iii) A health worker plotted a box-and-whisker plot of the times that 100 patients, chosen randomly, stayed in hospital. The result is shown below.



State with a reason whether or not this agrees with the model used in parts **(i)** and **(ii)**. [2]

8 A discrete random variable X has the following probability distribution.

x	1	2	3	4
$P(X = x)$	$3c$	$4c$	$5c$	$6c$

(i) Find the value of the constant c. [2]

(ii) Find $E(X)$ and $\text{Var}(X)$. [4]

(iii) Find $P\big(X > E(X)\big)$. [2]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Subsidiary Level and Advanced Level
Advanced International Certificate of Education

MATHEMATICS **9709/06**

STATISTICS **0390/06**

Paper 6 Probability & Statistics 1 **(S1)**

October/November 2004

1 hour 15 minutes

Additional materials: Answer Booklet/Paper
Graph paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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This document consists of **3** printed pages and **1** blank page.

1 The word ARGENTINA includes the four consonants R, G, N, T and the three vowels A, E, I.

(i) Find the number of different arrangements using all nine letters. [2]

(ii) How many of these arrangements have a consonant at the beginning, then a vowel, then another consonant, and so on alternately? [3]

2 The lengths of cars travelling on a car ferry are noted. The data are summarised in the following table.

Length of car (x metres)	Frequency	Frequency density
$2.80 \leqslant x < 3.00$	17	85
$3.00 \leqslant x < 3.10$	24	240
$3.10 \leqslant x < 3.20$	19	190
$3.20 \leqslant x < 3.40$	8	a

(i) Find the value of a. [1]

(ii) Draw a histogram on graph paper to represent the data. [3]

(iii) Find the probability that a randomly chosen car on the ferry is less than 3.20 m in length. [2]

3 When Andrea needs a taxi, she rings one of three taxi companies, A, B or C. 50% of her calls are to taxi company A, 30% to B and 20% to C. A taxi from company A arrives late 4% of the time, a taxi from company B arrives late 6% of the time and a taxi from company C arrives late 17% of the time.

(i) Find the probability that, when Andrea rings for a taxi, it arrives late. [3]

(ii) Given that Andrea's taxi arrives late, find the conditional probability that she rang company B. [3]

4 The ages, x years, of 18 people attending an evening class are summarised by the following totals: $\Sigma x = 745, \Sigma x^2 = 33\,951$.

(i) Calculate the mean and standard deviation of the ages of this group of people. [3]

(ii) One person leaves the group and the mean age of the remaining 17 people is exactly 41 years. Find the age of the person who left and the standard deviation of the ages of the remaining 17 people. [4]

5 The length of Paulo's lunch break follows a normal distribution with mean μ minutes and standard deviation 5 minutes. On one day in four, on average, his lunch break lasts for more than 52 minutes.

(i) Find the value of μ. [3]

(ii) Find the probability that Paulo's lunch break lasts for between 40 and 46 minutes on every one of the next four days. [4]

6 A box contains five balls numbered 1, 2, 3, 4, 5. Three balls are drawn randomly at the same time from the box.

(i) By listing all possible outcomes (123, 124, etc.), find the probability that the sum of the three numbers drawn is an odd number. [2]

The random variable L denotes the largest of the three numbers drawn.

(ii) Find the probability that L is 4. [1]

(iii) Draw up a table to show the probability distribution of L. [3]

(iv) Calculate the expectation and variance of L. [3]

7 **(i)** State two conditions which must be satisfied for a situation to be modelled by a binomial distribution. [2]

In a certain village 28% of all cars are made by Ford.

(ii) 14 cars are chosen randomly in this village. Find the probability that fewer than 4 of these cars are made by Ford. [4]

(iii) A random sample of 50 cars in the village is taken. Estimate, using a normal approximation, the probability that more than 18 cars are made by Ford. [4]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Subsidiary Level and Advanced Level
Advanced International Certificate of Education

MATHEMATICS **9709/06**

STATISTICS **0390/06**

Paper 6 Probability & Statistics 1 **(S1)**

October/November 2005

1 hour 15 minutes

Additional materials: Answer Booklet/Paper
Graph paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
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You are reminded of the need for clear presentation in your answers.

This document consists of **3** printed pages and **1** blank page.

1 A study of the ages of car drivers in a certain country produced the results shown in the table.

Percentage of drivers in each age group

	Young	Middle-aged	Elderly
Males	40	35	25
Females	20	70	10

Illustrate these results diagrammatically. [4]

2 Boxes of sweets contain toffees and chocolates. Box *A* contains 6 toffees and 4 chocolates, box *B* contains 5 toffees and 3 chocolates, and box *C* contains 3 toffees and 7 chocolates. One of the boxes is chosen at random and two sweets are taken out, one after the other, and eaten.

(i) Find the probability that they are both toffees. [3]

(ii) Given that they are both toffees, find the probability that they both came from box *A*. [3]

3 A staff car park at a school has 13 parking spaces in a row. There are 9 cars to be parked.

(i) How many different arrangements are there for parking the 9 cars and leaving 4 empty spaces? [2]

(ii) How many different arrangements are there if the 4 empty spaces are next to each other? [3]

(iii) If the parking is random, find the probability that there will **not** be 4 empty spaces next to each other. [2]

4 A group of 10 married couples and 3 single men found that the mean age $\bar{x}_w$ of the 10 women was 41.2 years and the standard deviation of the women's ages was 15.1 years. For the 13 men, the mean age $\bar{x}_m$ was 46.3 years and the standard deviation was 12.7 years.

(i) Find the mean age of the whole group of 23 people. [2]

(ii) The individual women's ages are denoted by x_w and the individual men's ages by x_m. By first finding Σx_w^2 and Σx_m^2, find the standard deviation for the whole group. [5]

5 A box contains 300 discs of different colours. There are 100 pink discs, 100 blue discs and 100 orange discs. The discs of each colour are numbered from 0 to 99. Five discs are selected at random, one at a time, with replacement. Find

(i) the probability that no orange discs are selected, [1]

(ii) the probability that exactly 2 discs with numbers ending in a 6 are selected, [3]

(iii) the probability that exactly 2 orange discs with numbers ending in a 6 are selected, [2]

(iv) the mean and variance of the number of pink discs selected. [2]

6 In a competition, people pay \$1 to throw a ball at a target. If they hit the target on the first throw they receive \$5. If they hit it on the second or third throw they receive \$3, and if they hit it on the fourth or fifth throw they receive \$1. People stop throwing after the first hit, or after 5 throws if no hit is made. Mario has a constant probability of $\frac{1}{5}$ of hitting the target on any throw, independently of the results of other throws.

(i) Mario misses with his first and second throws and hits the target with his third throw. State how much profit he has made. [1]

(ii) Show that the probability that Mario's profit is \$0 is 0.184, correct to 3 significant figures. [2]

(iii) Draw up a probability distribution table for Mario's profit. [3]

(iv) Calculate his expected profit. [2]

7 In tests on a new type of light bulb it was found that the time they lasted followed a normal distribution with standard deviation 40.6 hours. 10% lasted longer than 5130 hours.

(i) Find the mean lifetime, giving your answer to the nearest hour. [3]

(ii) Find the probability that a light bulb fails to last for 5000 hours. [3]

(iii) A hospital buys 600 of these light bulbs. Using a suitable approximation, find the probability that fewer than 65 light bulbs will last longer than 5130 hours. [4]

276

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/06**

Paper 6 Probability & Statistics 1 **(S1)**

October/November 2006

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

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1 The weights of 30 children in a class, to the nearest kilogram, were as follows.

50	45	61	53	55	47	52	49	46	51
60	52	54	47	57	59	42	46	51	53
56	48	50	51	44	52	49	58	55	45

Construct a grouped frequency table for these data such that there are five equal class intervals with the first class having a lower boundary of 41.5 kg and the fifth class having an upper boundary of 61.5 kg. [4]

2 The discrete random variable X has the following probability distribution.

x	0	1	2	3	4
$P(X = x)$	0.26	q	$3q$	0.05	0.09

(i) Find the value of q. [2]

(ii) Find $E(X)$ and $Var(X)$. [3]

3 In a survey, people were asked how long they took to travel to and from work, on average. The median time was 3 hours 36 minutes, the upper quartile was 4 hours 42 minutes and the interquartile range was 3 hours 48 minutes. The longest time taken was 5 hours 12 minutes and the shortest time was 30 minutes.

(i) Find the lower quartile. [2]

(ii) Represent the information by a box-and-whisker plot, using a scale of 2 cm to represent 60 minutes. [4]

4 Two fair dice are thrown.

(i) Event A is 'the scores differ by 3 or more'. Find the probability of event A. [3]

(ii) Event B is 'the product of the scores is greater than 8'. Find the probability of event B. [2]

(iii) State with a reason whether events A and B are mutually exclusive. [2]

5 **(i)** Give an example of a variable in real life which could be modelled by a normal distribution. [1]

(ii) The random variable X is normally distributed with mean μ and variance 21.0. Given that $P(X > 10.0) = 0.7389$, find the value of μ. [3]

(iii) If 300 observations are taken at random from the distribution in part **(ii)**, estimate how many of these would be greater than 22.0. [4]

6 Six men and three women are standing in a supermarket queue.

(i) How many possible arrangements are there if there are no restrictions on order? [2]

(ii) How many possible arrangements are there if no two of the women are standing next to each other? [4]

(iii) Three of the people in the queue are chosen to take part in a customer survey. How many different choices are possible if at least one woman must be included? [3]

7 A manufacturer makes two sizes of elastic bands: large and small. 40% of the bands produced are large bands and 60% are small bands. Assuming that each pack of these elastic bands contains a random selection, calculate the probability that, in a pack containing 20 bands, there are

(i) equal numbers of large and small bands, [2]

(ii) more than 17 small bands. [3]

An office pack contains 150 elastic bands.

(iii) Using a suitable approximation, calculate the probability that the number of small bands in the office pack is between 88 and 97 inclusive. [6]

280

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281

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/06**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2007**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 A summary of 24 observations of x gave the following information:

$$\Sigma(x - a) = -73.2 \quad \text{and} \quad \Sigma(x - a)^2 = 2115.$$

The mean of these values of x is 8.95.

(i) Find the value of the constant a. [2]

(ii) Find the standard deviation of these values of x. [2]

2 The random variable X takes the values -2, 0 and 4 only. It is given that $P(X = -2) = 2p$, $P(X = 0) = p$ and $P(X = 4) = 3p$.

(i) Find p. [2]

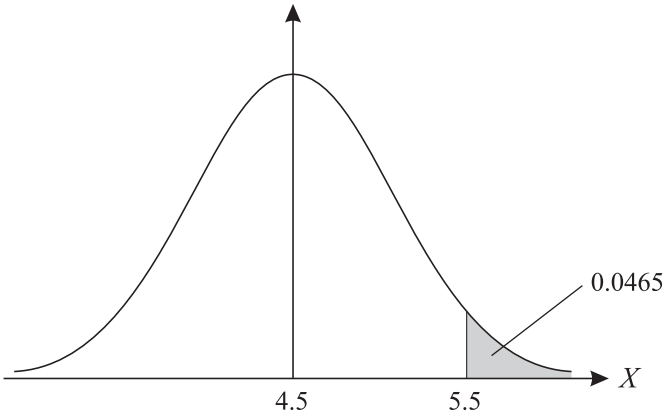
(ii) Find $E(X)$ and $Var(X)$. [4]

3 The six digits 4, 5, 6, 7, 7, 7 can be arranged to give many different 6-digit numbers.

(i) How many different 6-digit numbers can be made? [2]

(ii) How many of these 6-digit numbers start with an odd digit and end with an odd digit? [4]

4



The random variable X has a normal distribution with mean 4.5. It is given that $P(X > 5.5) = 0.0465$ (see diagram).

(i) Find the standard deviation of X. [3]

(ii) Find the probability that a random observation of X lies between 3.8 and 4.8. [4]

5 The arrival times of 204 trains were noted and the number of minutes, t, that each train was late was recorded. The results are summarised in the table.

Number of minutes late (t)	$-2 \leqslant t < 0$	$0 \leqslant t < 2$	$2 \leqslant t < 4$	$4 \leqslant t < 6$	$6 \leqslant t < 10$
Number of trains	43	51	69	22	19

(i) Explain what $-2 \leqslant t < 0$ means about the arrival times of trains. [1]

(ii) Draw a cumulative frequency graph, and from it estimate the median and the interquartile range of the number of minutes late of these trains. [7]

6 On any occasion when a particular gymnast performs a certain routine, the probability that she will perform it correctly is 0.65, independently of all other occasions.

(i) Find the probability that she will perform the routine correctly on exactly 5 occasions out of 7. [2]

(ii) On one day she performs the routine 50 times. Use a suitable approximation to estimate the probability that she will perform the routine correctly on fewer than 29 occasions. [5]

(iii) On another day she performs the routine n times. Find the smallest value of n for which the expected number of correct performances is at least 8. [2]

7 Box A contains 5 red paper clips and 1 white paper clip. Box B contains 7 red paper clips and 2 white paper clips. One paper clip is taken at random from box A and transferred to box B. One paper clip is then taken at random from box B.

(i) Find the probability of taking both a white paper clip from box A and a red paper clip from box B. [2]

(ii) Find the probability that the paper clip taken from box B is red. [2]

(iii) Find the probability that the paper clip taken from box A was red, given that the paper clip taken from box B is red. [2]

(iv) The random variable X denotes the number of times that a red paper clip is taken. Draw up a table to show the probability distribution of X. [4]

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285

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/06**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2008**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

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1 Rachel measured the lengths in millimetres of some of the leaves on a tree. Her results are recorded below.

32 35 45 37 38 44 33 39 36 45

Find the mean and standard deviation of the lengths of these leaves. [3]

2 On a production line making toys, the probability of any toy being faulty is 0.08. A random sample of 200 toys is checked. Use a suitable approximation to find the probability that there are at least 15 faulty toys. [5]

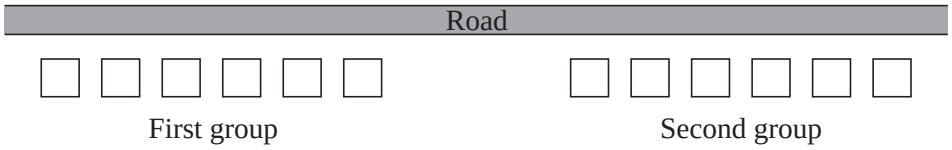
3 **(i)** The daily minimum temperature in degrees Celsius (°C) in January in Ottawa is a random variable with distribution N(−15.1, 62.0). Find the probability that a randomly chosen day in January in Ottawa has a minimum temperature above 0 °C. [3]

(ii) In another city the daily minimum temperature in °C in January is a random variable with distribution N(μ, 40.0). In this city the probability that a randomly chosen day in January has a minimum temperature above 0 °C is 0.8888. Find the value of μ. [3]

4 A builder is planning to build 12 houses along one side of a road. He will build 2 houses in style *A*, 2 houses in style *B*, 3 houses in style *C*, 4 houses in style *D* and 1 house in style *E*.

(i) Find the number of possible arrangements of these 12 houses. [2]

(ii)



The 12 houses will be in two groups of 6 (see diagram). Find the number of possible arrangements if all the houses in styles *A* and *D* are in the first group and all the houses in styles *B*, *C* and *E* are in the second group. [3]

(iii) Four of the 12 houses will be selected for a survey. Exactly one house must be in style *B* and exactly one house in style *C*. Find the number of ways in which these four houses can be selected. [2]

5 The pulse rates, in beats per minute, of a random sample of 15 small animals are shown in the following table.

115	120	158	132	125
104	142	160	145	104
162	117	109	124	134

(i) Draw a stem-and-leaf diagram to represent the data. [3]

(ii) Find the median and the quartiles. [2]

(iii) On graph paper, using a scale of 2 cm to represent 10 beats per minute, draw a box-and-whisker plot of the data. [3]

6 There are three sets of traffic lights on Karinne's journey to work. The independent probabilities that Karinne has to stop at the first, second and third set of lights are 0.4, 0.8 and 0.3 respectively.

(i) Draw a tree diagram to show this information. [2]

(ii) Find the probability that Karinne has to stop at each of the first two sets of lights but does not have to stop at the third set. [2]

(iii) Find the probability that Karinne has to stop at exactly two of the three sets of lights. [3]

(iv) Find the probability that Karinne has to stop at the first set of lights, given that she has to stop at exactly two sets of lights. [3]

7 A fair die has one face numbered 1, one face numbered 3, two faces numbered 5 and two faces numbered 6.

(i) Find the probability of obtaining at least 7 odd numbers in 8 throws of the die. [4]

The die is thrown twice. Let X be the sum of the two scores. The following table shows the possible values of X.

		Second throw					
		1	3	5	5	6	6
First throw	1	2	4	6	6	7	7
	3	4	6	8	8	9	9
	5	6	8	10	10	11	11
	5	6	8	10	10	11	11
	6	7	9	11	11	12	12
	6	7	9	11	11	12	12

(ii) Draw up a table showing the probability distribution of X. [3]

(iii) Calculate $\mathrm{E}(X)$. [2]

(iv) Find the probability that X is greater than $\mathrm{E}(X)$. [2]

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289

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2009**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

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1 The mean number of defective batteries in packs of 20 is 1.6. Use a binomial distribution to calculate the probability that a randomly chosen pack of 20 will have more than 2 defective batteries. [5]

2 The probability distribution of the random variable X is shown in the following table.

x	−2	−1	0	1	2	3
$P(X = x)$	0.08	p	0.12	0.16	q	0.22

The mean of X is 1.05.

(i) Write down two equations involving p and q and hence find the values of p and q. [4]

(ii) Find the variance of X. [2]

3 The times for a certain car journey have a normal distribution with mean 100 minutes and standard deviation 7 minutes. Journey times are classified as follows:

'short' (the shortest 33% of times),
'long' (the longest 33% of times),
'standard' (the remaining 34% of times).

(i) Find the probability that a randomly chosen car journey takes between 85 and 100 minutes. [3]

(ii) Find the least and greatest times for 'standard' journeys. [4]

4 A library has many identical shelves. All the shelves are full and the numbers of books on each shelf in a certain section are summarised by the following stem-and-leaf diagram.

3	3 6 9 9	(4)
4	6 7	(2)
5	0 1 2 2	(4)
6	0 0 1 1 2 3 4 4 4 4 4 5 5 6 6 6 7 8 8 9	(20)
7	1 1 3 3 3 5 6 6 7 8 9 9	(12)
8	0 2 4 5 5 6 8	(7)
9	0 0 1 2 4 4 4 4 5 5 6 7 7 8 8 9 9 9	(18)

Key: 3 | 6 represents 36 books

(i) Find the number of shelves in this section of the library. [1]

(ii) Draw a box-and-whisker plot to represent the data. [5]

In another section all the shelves are full and the numbers of books on each shelf are summarised by the following stem-and-leaf diagram.

2	1 2 2 2 3 3 4 5 6 6 6 7 9	(13)
3	0 1 1 2 3 4 4 5 6 6 7 7 7 8 8	(15)
4	2 2 3 5 7 7 8 9	(8)

Key: 3 | 6 represents 36 books

(iii) There are fewer books in this section than in the previous section. State one other difference between the books in this section and the books in the previous section. [1]

5 **(a)** Find how many numbers between 5000 and 6000 can be formed from the digits 1, 2, 3, 4, 5 and 6

(i) if no digits are repeated, [2]

(ii) if repeated digits are allowed. [2]

(b) Find the number of ways of choosing a school team of 5 pupils from 6 boys and 8 girls

(i) if there are more girls than boys in the team, [4]

(ii) if three of the boys are cousins and are either all in the team or all not in the team. [3]

6 A box contains 4 pears and 7 oranges. Three fruits are taken out at random and eaten. Find the probability that

(i) 2 pears and 1 orange are eaten, in any order, [3]

(ii) the third fruit eaten is an orange, [3]

(iii) the first fruit eaten was a pear, given that the third fruit eaten is an orange. [3]

There are 121 similar boxes in a warehouse. One fruit is taken at random from each box.

(iv) Using a suitable approximation, find the probability that fewer than 39 are pears. [5]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2009**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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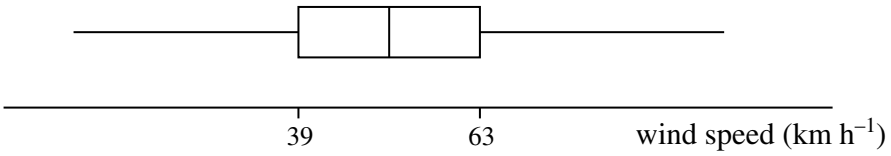
UNIVERSITY of CAMBRIDGE International Examinations

1



Measurements of wind speed on a certain island were taken over a period of one year. A box-and-whisker plot of the data obtained is displayed above, and the values of the quartiles are as shown. It is suggested that wind speed can be modelled approximately by a normal distribution with mean μ km h^{-1} and standard deviation σ km h^{-1}.

(i) Estimate the value of μ. [1]

(ii) Estimate the value of σ. [3]

2 Two unbiased tetrahedral dice each have four faces numbered 1, 2, 3 and 4. The two dice are thrown together and the sum of the numbers on the faces on which they land is noted. Find the expected number of occasions on which this sum is 7 or more when the dice are thrown together 200 times. [4]

3 Maria chooses toast for her breakfast with probability 0.85. If she does not choose toast then she has a bread roll. If she chooses toast then the probability that she will have jam on it is 0.8. If she has a bread roll then the probability that she will have jam on it is 0.4.

(i) Draw a fully labelled tree diagram to show this information. [2]

(ii) Given that Maria did **not** have jam for breakfast, find the probability that she had toast. [4]

4 **(a)** **(i)** Find how many different four-digit numbers can be made using only the digits 1, 3, 5 and 6 with no digit being repeated. [1]

(ii) Find how many different odd numbers greater than 500 can be made using some or all of the digits 1, 3, 5 and 6 with no digit being repeated. [4]

(b) Six cards numbered 1, 2, 3, 4, 5, 6 are arranged randomly in a line. Find the probability that the cards numbered 4 and 5 are **not** next to each other. [3]

5 In a particular discrete probability distribution the random variable X takes the value $\frac{120}{r}$ with probability $\frac{r}{45}$, where r takes all integer values from 1 to 9 inclusive.

(i) Show that $\mathrm{P}(X = 40) = \frac{1}{15}$. [2]

(ii) Construct the probability distribution table for X. [3]

(iii) Which is the modal value of X? [1]

(iv) Find the probability that X lies between 18 and 100. [2]

6 The following table gives the marks, out of 75, in a pure mathematics examination taken by 234 students.

Marks	1–20	21–30	31–40	41–50	51–60	61–75
Frequency	40	34	56	54	29	21

(i) Draw a histogram on graph paper to represent these results. [5]

(ii) Calculate estimates of the mean mark and the standard deviation. [4]

7 The weights, X grams, of bars of soap are normally distributed with mean 125 grams and standard deviation 4.2 grams.

(i) Find the probability that a randomly chosen bar of soap weighs more than 128 grams. [3]

(ii) Find the value of k such that $\mathrm{P}(k < X < 128) = 0.7465$. [4]

(iii) Five bars of soap are chosen at random. Find the probability that more than two of the bars each weigh more than 128 grams. [4]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2010**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
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1 Anita made observations of the maximum temperature, $t\,^{\circ}\mathrm{C}$, on 50 days. Her results are summarised by $\Sigma t = 910$ and $\Sigma(t - \bar{t})^2 = 876$, where $\bar{t}$ denotes the mean of the 50 observations. Calculate $\bar{t}$ and the standard deviation of the observations. [3]

2 On average, 2 apples out of 15 are classified as being underweight. Find the probability that in a random sample of 200 apples, the number of apples which are underweight is more than 21 and less than 35. [5]

3 The times taken by students to get up in the morning can be modelled by a normal distribution with mean 26.4 minutes and standard deviation 3.7 minutes.

(i) For a random sample of 350 students, find the number who would be expected to take longer than 20 minutes to get up in the morning. [3]

(ii) 'Very slow' students are students whose time to get up is more than 1.645 standard deviations above the mean. Find the probability that fewer than 3 students from a random sample of 8 students are 'very slow'. [4]

4 The weights in grams of a number of stones, measured correct to the nearest gram, are represented in the following table.

Weight (grams)	1 – 10	11 – 20	21 – 25	26 – 30	31 – 50	51 – 70
Frequency	$2x$	$4x$	$3x$	$5x$	$4x$	x

A histogram is drawn with a scale of 1 cm to 1 unit on the vertical axis, which represents frequency density. The 1 – 10 rectangle has height 3 cm.

(i) Calculate the value of x and the height of the 51 – 70 rectangle. [4]

(ii) Calculate an estimate of the mean weight of the stones. [3]

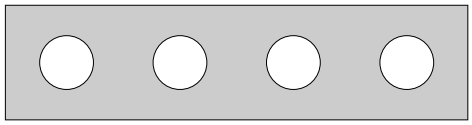
5 Three friends, Rick, Brenda and Ali, go to a football match but forget to say which entrance to the ground they will meet at. There are four entrances, A, B, C and D. Each friend chooses an entrance independently.

- The probability that Rick chooses entrance A is $\frac{1}{3}$. The probabilities that he chooses entrances B, C or D are all equal.
- Brenda is equally likely to choose any of the four entrances.
- The probability that Ali chooses entrance C is $\frac{2}{7}$ and the probability that he chooses entrance D is $\frac{3}{5}$. The probabilities that he chooses the other two entrances are equal.

(i) Find the probability that at least 2 friends will choose entrance B. [4]

(ii) Find the probability that the three friends will all choose the same entrance. [4]

6



Pegs are to be placed in the four holes shown, one in each hole. The pegs come in different colours and pegs of the same colour are identical. Calculate how many different arrangements of coloured pegs in the four holes can be made using

(i) 6 pegs, all of different colours, [1]

(ii) 4 pegs consisting of 2 blue pegs, 1 orange peg and 1 yellow peg. [1]

Beryl has 12 pegs consisting of 2 red, 2 blue, 2 green, 2 orange, 2 yellow and 2 black pegs. Calculate how many different arrangements of coloured pegs in the 4 holes Beryl can make using

(iii) 4 different colours, [1]

(iv) 3 different colours, [3]

(v) any of her 12 pegs. [3]

7 Sanket plays a game using a biased die which is twice as likely to land on an even number as on an odd number. The probabilities for the three even numbers are all equal and the probabilities for the three odd numbers are all equal.

(i) Find the probability of throwing an odd number with this die. [2]

Sanket throws the die once and calculates his score by the following method.

- If the number thrown is 3 or less he multiplies the number thrown by 3 and adds 1.
- If the number thrown is more than 3 he multiplies the number thrown by 2 and subtracts 4.

The random variable X is Sanket's score.

(ii) Show that $\mathrm{P}(X = 8) = \frac{2}{9}$. [2]

The table shows the probability distribution of X.

x	4	6	7	8	10
$\mathrm{P}(X = x)$	$\frac{3}{9}$	$\frac{1}{9}$	$\frac{2}{9}$	$\frac{2}{9}$	$\frac{1}{9}$

(iii) Given that $\mathrm{E}(X) = \frac{58}{9}$, find $\mathrm{Var}(X)$. [2]

Sanket throws the die twice.

(iv) Find the probability that the total of the scores on the two throws is 16. [2]

(v) Given that the total of the scores on the two throws is 16, find the probability that the score on the first throw was 6. [3]

300

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2010**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 The discrete random variable X takes the values 1, 4, 5, 7 and 9 only. The probability distribution of X is shown in the table.

x	1	4	5	7	9
$P(X = x)$	$4p$	$5p^2$	$1.5p$	$2.5p$	$1.5p$

Find p. [3]

2 Esme noted the test marks, x, of 16 people in a class. She found that $\Sigma x = 824$ and that the standard deviation of x was 6.5.

(i) Calculate $\Sigma(x - 50)$ and $\Sigma(x - 50)^2$. [3]

(ii) One person did the test later and her mark was 72. Calculate the new mean and standard deviation of the marks of all 17 people. [3]

3 A fair five-sided spinner has sides numbered 1, 2, 3, 4, 5. Raj spins the spinner and throws two fair dice. He calculates his score as follows.

- If the spinner lands on an **even-numbered** side, Raj **multiplies** the two numbers showing on the dice to get his score.
- If the spinner lands on an **odd-numbered** side, Raj **adds** the numbers showing on the dice to get his score.

Given that Raj's score is 12, find the probability that the spinner landed on an even-numbered side. [6]

4 The weights in kilograms of 11 bags of sugar and 7 bags of flour are as follows.

Sugar: 1.961 1.983 2.008 2.014 1.968 1.994 2.011 2.017 1.977 1.984 1.989

Flour: 1.945 1.962 1.949 1.977 1.964 1.941 1.953

(i) Represent this information on a back-to-back stem-and-leaf diagram with sugar on the left-hand side. [4]

(ii) Find the median and interquartile range of the weights of the bags of sugar. [3]

5 The distance the Zotoc car can travel on 20 litres of fuel is normally distributed with mean 320 km and standard deviation 21.6 km. The distance the Ganmor car can travel on 20 litres of fuel is normally distributed with mean 350 km and standard deviation 7.5 km. Both cars are filled with 20 litres of fuel and are driven towards a place 367 km away.

(i) For each car, find the probability that it runs out of fuel before it has travelled 367 km. [3]

(ii) The probability that a Zotoc car can travel at least $(320 + d)$ km on 20 litres of fuel is 0.409. Find the value of d. [4]

6 **(i)** State three conditions that must be satisfied for a situation to be modelled by a binomial distribution. [2]

On any day, there is a probability of 0.3 that Julie's train is late.

(ii) Nine days are chosen at random. Find the probability that Julie's train is late on more than 7 days or fewer than 2 days. [3]

(iii) 90 days are chosen at random. Find the probability that Julie's train is late on more than 35 days or fewer than 27 days. [5]

7 A committee of 6 people, which must contain at least 4 men and at least 1 woman, is to be chosen from 10 men and 9 women.

(i) Find the number of possible committees that can be chosen. [3]

(ii) Find the probability that one particular man, Albert, and one particular woman, Tracey, are both on the committee. [2]

(iii) Find the number of possible committees that include either Albert or Tracey but not both. [3]

(iv) The committee that is chosen consists of 4 men and 2 women. They queue up randomly in a line for refreshments. Find the probability that the women are not next to each other in the queue. [3]

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2010**

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1 Name the distribution and suggest suitable numerical parameters that you could use to model the weights in kilograms of female 18-year-old students. [2]

2 In a probability distribution the random variable X takes the value x with probability kx, where x takes values 1, 2, 3, 4, 5 only.

(i) Draw up a probability distribution table for X, in terms of k, and find the value of k. [3]

(ii) Find $\mathrm{E}(X)$. [2]

3 It was found that 68% of the passengers on a train used a cell phone during their train journey. Of those using a cell phone, 70% were under 30 years old, 25% were between 30 and 65 years old and the rest were over 65 years old. Of those not using a cell phone, 26% were under 30 years old and 64% were over 65 years old.

(i) Draw a tree diagram to represent this information, giving all probabilities as decimals. [2]

(ii) Given that one of the passengers is 45 years old, find the probability of this passenger using a cell phone during the journey. [3]

4 Delip measured the speeds, x km per hour, of 70 cars on a road where the speed limit is 60 km per hour. His results are summarised by $\Sigma(x - 60) = 245$.

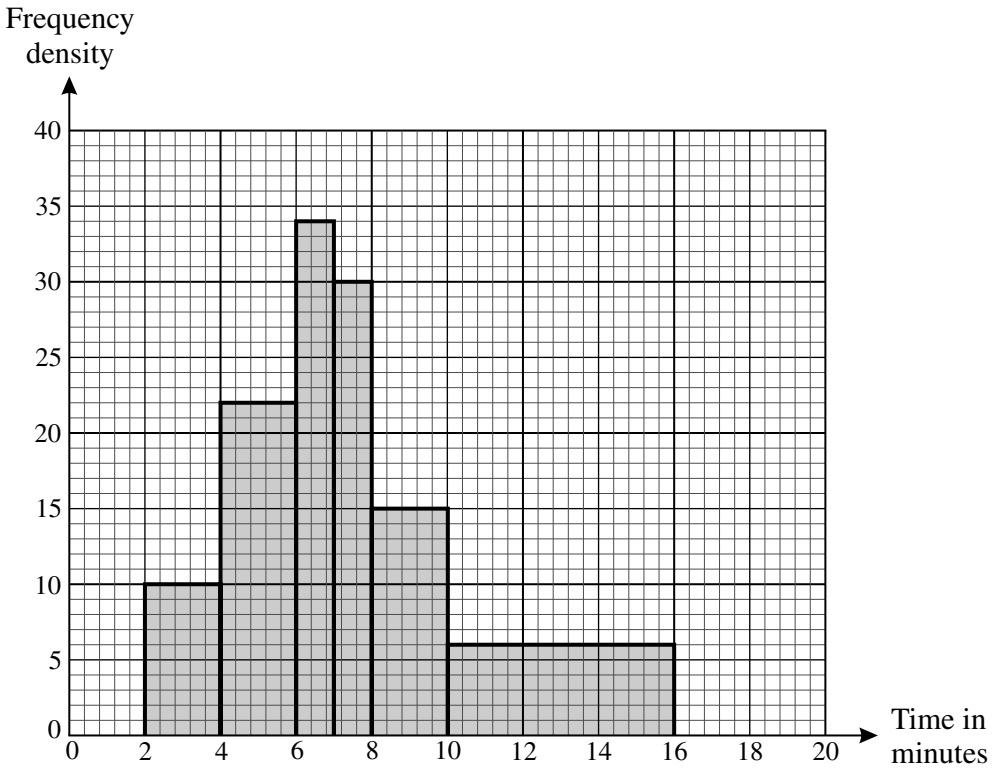
(i) Calculate the mean speed of these 70 cars. [2]

His friend Sachim used values of $(x - 50)$ to calculate the mean.

(ii) Find $\Sigma(x - 50)$. [2]

(iii) The standard deviation of the speeds is 10.6 km per hour. Calculate $\Sigma(x - 50)^2$. [2]

5 The following histogram illustrates the distribution of times, in minutes, that some students spent taking a shower.



(i) Copy and complete the following frequency table for the data. [3]

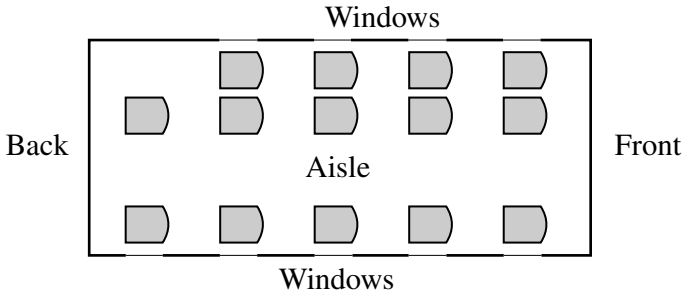
Time (t minutes)	$2 < t \leqslant 4$	$4 < t \leqslant 6$	$6 < t \leqslant 7$	$7 < t \leqslant 8$	$8 < t \leqslant 10$	$10 < t \leqslant 16$
Frequency						

(ii) Calculate an estimate of the mean time to take a shower. [2]

(iii) Two of these students are chosen at random. Find the probability that exactly one takes between 7 and 10 minutes to take a shower. [3]

[Questions 6 and 7 are printed on the next page.]

6



A small aeroplane has 14 seats for passengers. The seats are arranged in 4 rows of 3 seats and a back row of 2 seats (see diagram). 12 passengers board the aeroplane.

(i) How many possible seating arrangements are there for the 12 passengers? Give your answer correct to 3 significant figures. [2]

These 12 passengers consist of 2 married couples (Mr and Mrs Lin and Mr and Mrs Brown), 5 students and 3 business people.

(ii) The 3 business people sit in the front row. The 5 students each sit at a window seat. Mr and Mrs Lin sit in the same row on the same side of the aisle. Mr and Mrs Brown sit in another row on the same side of the aisle. How many possible seating arrangements are there? [4]

(iii) If, instead, the 12 passengers are seated randomly, find the probability that Mrs Lin sits directly behind a student and Mrs Brown sits in the front row. [4]

7 The times spent by people visiting a certain dentist are independent and normally distributed with a mean of 8.2 minutes. 79% of people who visit this dentist have visits lasting less than 10 minutes.

(i) Find the standard deviation of the times spent by people visiting this dentist. [3]

(ii) Find the probability that the time spent visiting this dentist by a randomly chosen person deviates from the mean by more than 1 minute. [3]

(iii) Find the probability that, of 6 randomly chosen people, more than 2 have visits lasting longer than 10 minutes. [3]

(iv) Find the probability that, of 35 randomly chosen people, fewer than 16 have visits lasting less than 8.2 minutes. [5]

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2011**

1 hour 15 minutes

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1 When a butternut squash seed is sown the probability that it will germinate is 0.86, independently of any other seeds. A market gardener sows 250 of these seeds. Use a suitable approximation to find the probability that more than 210 germinate. [5]

2 The values, x, in a particular set of data are summarised by

$$\Sigma(x - 25) = 133, \qquad \Sigma(x - 25)^2 = 3762.$$

The mean, $\bar{x}$, is 28.325.

(i) Find the standard deviation of x. [4]

(ii) Find Σx^2. [2]

3 A team of 4 is to be randomly chosen from 3 boys and 5 girls. The random variable X is the number of girls in the team.

(i) Draw up a probability distribution table for X. [4]

(ii) Given that $\mathrm{E}(X) = \frac{5}{2}$, calculate $\mathrm{Var}(X)$. [2]

4 The marks of the pupils in a certain class in a History examination are as follows.

28 33 55 38 42 39 27 48 51 37 57 49 33

The marks of the pupils in a Physics examination are summarised as follows.

Lower quartile: 28, Median: 39, Upper quartile: 67.
The lowest mark was 17 and the highest mark was 74.

(i) Draw box-and-whisker plots in a single diagram on graph paper to illustrate the marks for History and Physics. [5]

(ii) State one difference, which can be seen from the diagram, between the marks for History and Physics. [1]

5 The weights of letters posted by a certain business are normally distributed with mean 20 g. It is found that the weights of 94% of the letters are within 12 g of the mean.

(i) Find the standard deviation of the weights of the letters. [3]

(ii) Find the probability that a randomly chosen letter weighs more than 13 g. [3]

(iii) Find the probability that at least 2 of a random sample of 7 letters have weights which are more than 12 g above the mean. [3]

6 **(a)** Find the number of different ways in which the 12 letters of the word STRAWBERRIES can be arranged

(i) if there are no restrictions, [2]

(ii) if the 4 vowels A, E, E, I must all be together. [3]

(b) **(i)** 4 astronauts are chosen from a certain number of candidates. If order of choosing is not taken into account, the number of ways the astronauts can be chosen is 3876. How many ways are there if order of choosing is taken into account? [2]

(ii) 4 astronauts are chosen to go on a mission. Each of these astronauts can take 3 personal possessions with him. How many different ways can these 12 possessions be arranged in a row if each astronaut's possessions are kept together? [2]

7 Bag A contains 4 balls numbered 2, 4, 5, 8. Bag B contains 5 balls numbered 1, 3, 6, 8, 8. Bag C contains 7 balls numbered 2, 7, 8, 8, 8, 8, 9. One ball is selected at random from each bag.

(i) Find the probability that exactly two of the selected balls have the same number. [5]

(ii) Given that exactly two of the selected balls have the same number, find the probability that they are both numbered 2. [2]

(iii) Event X is 'exactly two of the selected balls have the same number'. Event Y is 'the ball selected from bag A has number 2'. Showing your working, determine whether events X and Y are independent or not. [2]

4

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313

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1 The following are the times, in minutes, taken by 11 runners to complete a 10 km run.

48.3 55.2 59.9 67.7 60.5 75.6 62.5 57.4 53.4 49.2 64.1

Find the mean and standard deviation of these times. [3]

2 Twelve coins are tossed and placed in a line. Each coin can show either a head or a tail.

(i) Find the number of different arrangements of heads and tails which can be obtained. [2]

(ii) Find the number of different arrangements which contain 7 heads and 5 tails. [1]

3 **(a)** Geoff wishes to plant 25 flowers in a flower-bed. He can choose from 15 different geraniums, 10 different roses and 8 different lilies. He wants to have at least 11 geraniums and also to have the same number of roses and lilies. Find the number of different selections of flowers he can make. [4]

(b) Find the number of different ways in which the 9 letters of the word GREENGAGE can be arranged if exactly two of the Gs are next to each other. [3]

4 The weights of 220 sausages are summarised in the following table.

Weight (grams)	<20	<30	<40	<45	<50	<60	<70
Cumulative frequency	0	20	50	100	160	210	220

(i) State which interval the median weight lies in. [1]

(ii) Find the smallest possible value and the largest possible value for the interquartile range. [2]

(iii) State how many sausages weighed between 50 g and 60 g. [1]

(iv) On graph paper, draw a histogram to represent the weights of the sausages. [4]

5 A triangular spinner has one red side, one blue side and one green side. The red side is weighted so that the spinner is four times more likely to land on the red side than on the blue side. The green side is weighted so that the spinner is three times more likely to land on the green side than on the blue side.

(i) Show that the probability that the spinner lands on the blue side is $\frac{1}{8}$. [1]

(ii) The spinner is spun 3 times. Find the probability that it lands on a different coloured side each time. [3]

(iii) The spinner is spun 136 times. Use a suitable approximation to find the probability that it lands on the blue side fewer than 20 times. [5]

6 There are a large number of students in Luttley College. 60% of the students are boys. Students can choose exactly one of Games, Drama or Music on Friday afternoons. It is found that 75% of the boys choose Games, 10% of the boys choose Drama and the remainder of the boys choose Music. Of the girls, 30% choose Games, 55% choose Drama and the remainder choose Music.

(i) 6 boys are chosen at random. Find the probability that fewer than 3 of them choose Music. [3]

(ii) 5 Drama students are chosen at random. Find the probability that at least 1 of them is a boy. [6]

7 **(i)** In a certain country, the daily minimum temperature, in °C, in winter has the distribution N(8, 24). Find the probability that a randomly chosen winter day in this country has a minimum temperature between 7 °C and 12 °C. [3]

The daily minimum temperature, in °C, in another country in winter has a normal distribution with mean μ and standard deviation 2μ.

(ii) Find the proportion of winter days on which the minimum temperature is below zero. [2]

(iii) 70 winter days are chosen at random. Find how many of these would be expected to have a minimum temperature which is more than three times the mean. [3]

(iv) The probability of the minimum temperature being above 6 °C on any winter day is 0.0735. Find the value of μ. [3]

4

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317

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1 The random variable X is normally distributed and is such that the mean μ is three times the standard deviation σ. It is given that $P(X < 25) = 0.648$.

(i) Find the values of μ and σ. [4]

(ii) Find the probability that, from 6 random values of X, exactly 4 are greater than 25. [2]

2 In a group of 30 teenagers, 13 of the 18 males watch 'Kops are Kids' on television and 3 of the 12 females watch 'Kops are Kids'.

(i) Find the probability that a person chosen at random from the group is either female or watches 'Kops are Kids' or both. [4]

(ii) Showing your working, determine whether the events 'the person chosen is male' and 'the person chosen watches Kops are Kids' are independent or not. [2]

3 A factory makes a large number of ropes with lengths either 3 m or 5 m. There are four times as many ropes of length 3 m as there are ropes of length 5 m.

(i) One rope is chosen at random. Find the expectation and variance of its length. [4]

(ii) Two ropes are chosen at random. Find the probability that they have different lengths. [2]

(iii) Three ropes are chosen at random. Find the probability that their total length is 11 m. [3]

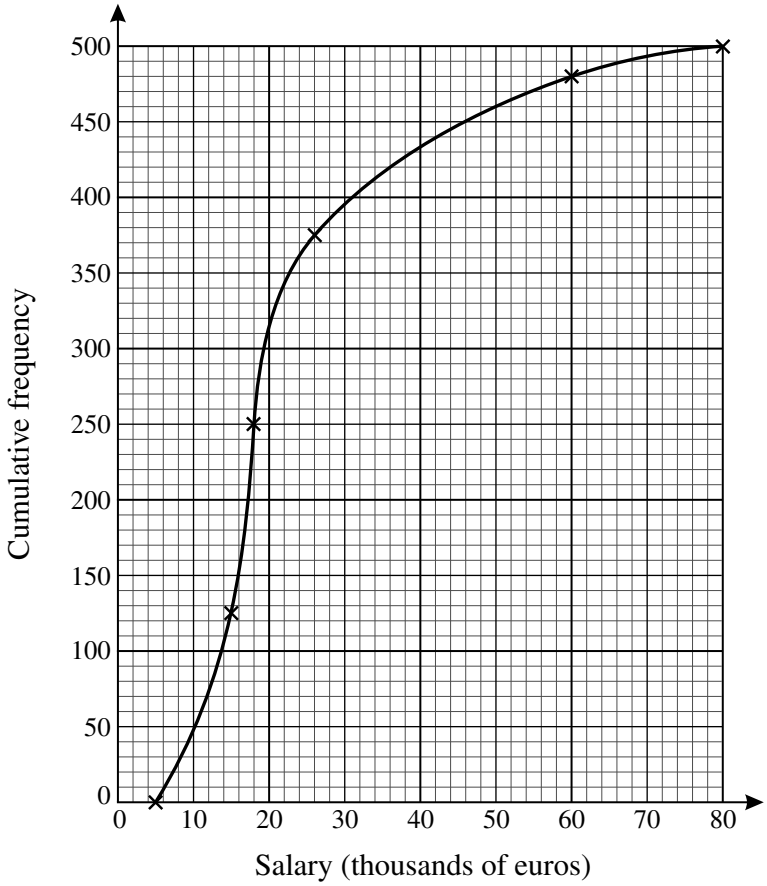
4 Mary saves her digital images on her computer in three separate folders named 'Family', 'Holiday' and 'Friends'. Her family folder contains 3 images, her holiday folder contains 4 images and her friends folder contains 8 images. All the images are different.

(i) Find in how many ways she can arrange these 15 images in a row across her computer screen if she keeps the images from each folder together. [3]

(ii) Find the number of different ways in which Mary can choose 6 of these images if there are 2 from each folder. [2]

(iii) Find the number of different ways in which Mary can choose 6 of these images if there are at least 3 images from the friends folder and at least 1 image from each of the other two folders. [4]

5



The cumulative frequency graph shows the annual salaries, in thousands of euros, of a random sample of 500 adults with jobs, in France. It has been plotted using grouped data. You may assume that the lowest salary is 5000 euros and the highest salary is 80 000 euros.

(i) On graph paper, draw a box-and-whisker plot to illustrate these salaries. [4]

(ii) Comment on the salaries of the people in this sample. [1]

(iii) An 'outlier' is defined as any data value which is more than 1.5 times the interquartile range above the upper quartile, or more than 1.5 times the interquartile range below the lower quartile.

(a) How high must a salary be in order to be classified as an outlier? [3]

(b) Show that none of the salaries is low enough to be classified as an outlier. [1]

6 Human blood groups are identified by two parts. The first part is A, B, AB or O and the second part (the Rhesus part) is + or −. In the UK, 35% of the population are group A+, 8% are B+, 3% are AB+, 37% are O+, 7% are A−, 2% are B−, 1% are AB− and 7% are O−.

(i) A random sample of 9 people in the UK who are Rhesus + is taken. Find the probability that fewer than 3 are group O+. [6]

(ii) A random sample of 150 people in the UK is taken. Find the probability that more than 60 people are group A+. [5]

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321

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General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2012**

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1 Ashok has 3 green pens and 7 red pens. His friend Rod takes 3 of these pens at random, without replacement. Draw up a probability distribution table for the number of green pens Rod takes. [4]

2 The amounts of money, x dollars, that 24 people had in their pockets are summarised by $\Sigma(x - 36) = -60$ and $\Sigma(x - 36)^2 = 227.76$. Find Σx and Σx^2. [5]

3 Lengths of rolls of parcel tape have a normal distribution with mean 75 m, and 15% of the rolls have lengths less than 73 m.

(i) Find the standard deviation of the lengths. [3]

Alison buys 8 rolls of parcel tape.

(ii) Find the probability that fewer than 3 of these rolls have lengths more than 77 m. [3]

4 Prices in dollars of 11 caravans in a showroom are as follows.

16 800 18 500 17 700 14 300 15 500 15 300 16 100 16 800 17 300 15 400 16 400

(i) Represent these prices by a stem-and-leaf diagram. [3]

(ii) Write down the lower quartile of the prices of the caravans in the showroom. [1]

(iii) 3 different caravans in the showroom are chosen at random and their prices are noted. Find the probability that 2 of these prices are more than the median and 1 is less than the lower quartile. [3]

5 A company set up a display consisting of 20 fireworks. For each firework, the probability that it fails to work is 0.05, independently of other fireworks.

(i) Find the probability that more than 1 firework fails to work. [3]

The 20 fireworks cost the company \$24 each. 450 people pay the company \$10 each to watch the display. If more than 1 firework fails to work they get their money back.

(ii) Calculate the expected profit for the company. [4]

6 Ana meets her friends once every day. For each day the probability that she is early is 0.05 and the probability that she is late is 0.75. Otherwise she is on time.

(i) Find the probability that she is on time on fewer than 20 of the next 96 days. [5]

(ii) If she is early there is a probability of 0.7 that she will eat a banana. If she is late she does not eat a banana. If she is on time there is a probability of 0.4 that she will eat a banana. Given that for one particular meeting with friends she does not eat a banana, find the probability that she is on time. [4]

7 **(a)** In a sweet shop 5 identical packets of toffees, 4 identical packets of fruit gums and 9 identical packets of chocolates are arranged in a line on a shelf. Find the number of different arrangements of the packets that are possible if the packets of chocolates are kept together. [2]

(b) Jessica buys 8 different packets of biscuits. She then chooses 4 of these packets.

(i) How many different choices are possible if the order in which Jessica chooses the 4 packets is taken into account? [2]

The 8 packets include 1 packet of chocolate biscuits and 1 packet of custard creams.

(ii) How many different choices are possible if the order in which Jessica chooses the 4 packets is taken into account and the packet of chocolate biscuits and the packet of custard creams are both chosen? [3]

(c) 9 different fruit pies are to be divided between 3 people so that each person gets an odd number of pies. Find the number of ways this can be done. [5]

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325

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2012**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

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1 Fabio drinks coffee each morning. He chooses Americano, Cappucino or Latte with probabilities 0.5, 0.3 and 0.2 respectively. If he chooses Americano he either drinks it immediately with probability 0.8, or leaves it to drink later. If he chooses Cappucino he either drinks it immediately with probability 0.6, or leaves it to drink later. If he chooses Latte he either drinks it immediately with probability 0.1, or leaves it to drink later.

(i) Find the probability that Fabio chooses Americano and leaves it to drink later. [1]

(ii) Fabio drinks his coffee immediately. Find the probability that he chose Latte. [4]

2 The random variable X is the daily profit, in thousands of dollars, made by a company. X is normally distributed with mean 6.4 and standard deviation 5.2.

(i) Find the probability that, on a randomly chosen day, the company makes a profit between \$10 000 and \$12 000. [3]

(ii) Find the probability that the company makes a loss on exactly 1 of the next 4 consecutive days. [4]

3 The table summarises the times that 112 people took to travel to work on a particular day.

Time to travel to work (t minutes)	$0 < t \leqslant 10$	$10 < t \leqslant 15$	$15 < t \leqslant 20$	$20 < t \leqslant 25$	$25 < t \leqslant 40$	$40 < t \leqslant 60$
Frequency	19	12	28	22	18	13

(i) State which time interval in the table contains the median and which time interval contains the upper quartile. [2]

(ii) On graph paper, draw a histogram to represent the data. [4]

(iii) Calculate an estimate of the mean time to travel to work. [2]

4 The mean of a certain normally distributed variable is four times the standard deviation. The probability that a randomly chosen value is greater than 5 is 0.15.

(i) Find the mean and standard deviation. [4]

(ii) 200 values of the variable are chosen at random. Find the probability that at least 160 of these values are less than 5. [5]

5 **(a)** A team of 3 boys and 3 girls is to be chosen from a group of 12 boys and 9 girls to enter a competition. Tom and Henry are two of the boys in the group. Find the number of ways in which the team can be chosen if Tom and Henry are either both in the team or both not in the team. [3]

(b) The back row of a cinema has 12 seats, all of which are empty. A group of 8 people, including Mary and Frances, sit in this row. Find the number of different ways they can sit in these 12 seats if

(i) there are no restrictions, [1]

(ii) Mary and Frances do not sit in seats which are next to each other, [3]

(iii) all 8 people sit together with no empty seats between them. [3]

6 A fair tetrahedral die has four triangular faces, numbered 1, 2, 3 and 4. The score when this die is thrown is the number on the face that the die lands on. This die is thrown three times. The random variable X is the sum of the three scores.

(i) Show that $P(X = 9) = \frac{10}{64}$. [3]

(ii) Copy and complete the probability distribution table for X. [3]

x	3	4	5	6	7	8	9	10	11	12
$P(X = x)$	$\frac{1}{64}$	$\frac{3}{64}$			$\frac{12}{64}$					

(iii) Event R is 'the sum of the three scores is 9'. Event S is 'the product of the three scores is 16'. Determine whether events R and S are independent, showing your working. [5]

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329

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
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Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2012**

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1 In a normal distribution with mean 9.3, the probability of a randomly chosen value being greater than 5.6 is 0.85. Find the standard deviation. [3]

2 The discrete random variable X has the following probability distribution.

x	−3	0	2	4
$P(X = x)$	p	q	r	0.4

Given that $E(X) = 2.3$ and $Var(X) = 3.01$, find the values of p, q and r. [6]

3 Ronnie obtained data about the gross domestic product (GDP) and the birth rate for 170 countries. He classified each GDP and each birth rate as either 'low', 'medium' or 'high'. The table shows the number of countries in each category.

		Birth rate		
		Low	Medium	High
GDP	Low	3	5	45
	Medium	20	42	12
	High	35	8	0

One of these countries is chosen at random.

(i) Find the probability that the country chosen has a medium GDP. [1]

(ii) Find the probability that the country chosen has a low birth rate, given that it does not have a medium GDP. [2]

(iii) State with a reason whether or not the events 'the country chosen has a high GDP' and 'the country chosen has a high birth rate' are exclusive. [2]

One country is chosen at random from those countries which have a medium GDP and then a different country is chosen at random from those which have a medium birth rate.

(iv) Find the probability that both countries chosen have a medium GDP and a medium birth rate. [3]

4 In a survey, the percentage of meat in a certain type of take-away meal was found. The results, to the nearest integer, for 193 take-away meals are summarised in the table.

Percentage of meat	1 – 5	6 – 10	11 – 20	21 – 30	31 – 50
Frequency	59	67	38	18	11

(i) Calculate estimates of the mean and standard deviation of the percentage of meat in these take-away meals. [4]

(ii) Draw, on graph paper, a histogram to illustrate the information in the table. [5]

5 The random variable X is such that $X \sim \mathrm{N}(82, 126)$.

(i) A value of X is chosen at random and rounded to the nearest whole number. Find the probability that this whole number is 84. [3]

(ii) Five independent observations of X are taken. Find the probability that at most one of them is greater than 87. [4]

(iii) Find the value of k such that $\mathrm{P}(87 < X < k) = 0.3$. [5]

6 **(a)** A chess team of 2 girls and 2 boys is to be chosen from the 7 girls and 6 boys in the chess club. Find the number of ways this can be done if 2 of the girls are twins and are either both in the team or both not in the team. [3]

(b) **(i)** The digits of the number 1 244 687 can be rearranged to give many different 7-digit numbers. How many of these 7-digit numbers are even? [4]

(ii) How many different numbers between 20 000 and 30 000 can be formed using 5 different digits from the digits 1, 2, 4, 6, 7, 8? [2]

(c) Helen has some black tiles, some white tiles and some grey tiles. She places a single row of 8 tiles above her washbasin. Each tile she places is equally likely to be black, white or grey. Find the probability that there are no tiles of the same colour next to each other. [3]

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333

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

MATHEMATICS **9709/61**

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1 It is given that $X \sim N(30, 49)$, $Y \sim N(30, 16)$ and $Z \sim N(50, 16)$. On a single diagram, with the horizontal axis going from 0 to 70, sketch three curves to represent the distributions of X, Y and Z. [3]

2 The people living in two towns, Mumbok and Bagville, are classified by age. The numbers in thousands living in each town are shown in the table below.

	Mumbok	Bagville
Under 18 years	15	35
18 to 60 years	55	95
Over 60 years	20	30

One of the towns is chosen. The probability of choosing Mumbok is 0.6 and the probability of choosing Bagville is 0.4. Then a person is chosen at random from that town. Given that the person chosen is between 18 and 60 years old, find the probability that the town chosen was Mumbok. [5]

3 Swati measured the lengths, x cm, of 18 stick insects and found that $\Sigma x^2 = 967$. Given that the mean length is $\frac{58}{9}$ cm, find the values of $\Sigma(x - 5)$ and $\Sigma(x - 5)^2$. [5]

4 The following are the house prices in thousands of dollars, arranged in ascending order, for 51 houses from a certain area.

253 270 310 354 386 428 433 468 472 477 485 520 520 524 526 531 535
536 538 541 543 546 548 549 551 554 572 583 590 605 614 638 649 652
666 670 682 684 690 710 725 726 731 734 745 760 800 854 863 957 986

(i) Draw a box-and-whisker plot to represent the data. [4]

An expensive house is defined as a house which has a price that is more than 1.5 times the interquartile range above the upper quartile.

(ii) For the above data, give the prices of the expensive houses. [2]

(iii) Give one disadvantage of using a box-and-whisker plot rather than a stem-and-leaf diagram to represent this set of data. [1]

5 Lengths of a certain type of carrot have a normal distribution with mean 14.2 cm and standard deviation 3.6 cm.

(i) 8% of carrots are shorter than c cm. Find the value of c. [3]

(ii) Rebekah picks 7 carrots at random. Find the probability that at least 2 of them have lengths between 15 and 16 cm. [6]

6 A shop has 7 different mountain bicycles, 5 different racing bicycles and 8 different ordinary bicycles on display. A cycling club selects 6 of these 20 bicycles to buy.

(i) How many different selections can be made if there must be no more than 3 mountain bicycles and no more than 2 of each of the other types of bicycle? [4]

The cycling club buys 3 mountain bicycles, 1 racing bicycle and 2 ordinary bicycles and parks them in a cycle rack, which has a row of 10 empty spaces.

(ii) How many different arrangements are there in the cycle rack if the mountain bicycles are all together with no spaces between them, the ordinary bicycles are both together with no spaces between them and the spaces are all together? [3]

(iii) How many different arrangements are there in the cycle rack if the ordinary bicycles are at each end of the bicycles and there are no spaces between any of the bicycles? [3]

7 James has a fair coin and a fair tetrahedral die with four faces numbered 1, 2, 3, 4. He tosses the coin once and the die twice. The random variable X is defined as follows.

- If the coin shows a **head** then X is the **sum** of the scores on the two throws of the die.
- If the coin shows a **tail** then X is the score on the **first throw** of the die only.

(i) Explain why $X = 1$ can only be obtained by throwing a tail, and show that $P(X = 1) = \frac{1}{8}$. [2]

(ii) Show that $P(X = 3) = \frac{3}{16}$. [4]

(iii) Copy and complete the probability distribution table for X. [3]

x	1	2	3	4	5	6	7	8
$P(X = x)$	$\frac{1}{8}$		$\frac{3}{16}$		$\frac{1}{8}$		$\frac{1}{16}$	$\frac{1}{32}$

Event Q is 'James throws a tail'. Event R is 'the value of X is 7'.

(iv) Determine whether events Q and R are exclusive. Justify your answer. [2]

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337

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2013**

1 hour 15 minutes

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1 It is given that $X \sim N(1.5, 3.2^2)$. Find the probability that a randomly chosen value of X is less than -2.4. [3]

2 On Saturday afternoons Mohit goes shopping with probability 0.25, or goes to the cinema with probability 0.35 or stays at home. If he goes shopping the probability that he spends more than \$50 is 0.7. If he goes to the cinema the probability that he spends more than \$50 is 0.8. If he stays at home he spends \$10 on a pizza.

(i) Find the probability that Mohit will go to the cinema and spend less than \$50. [1]

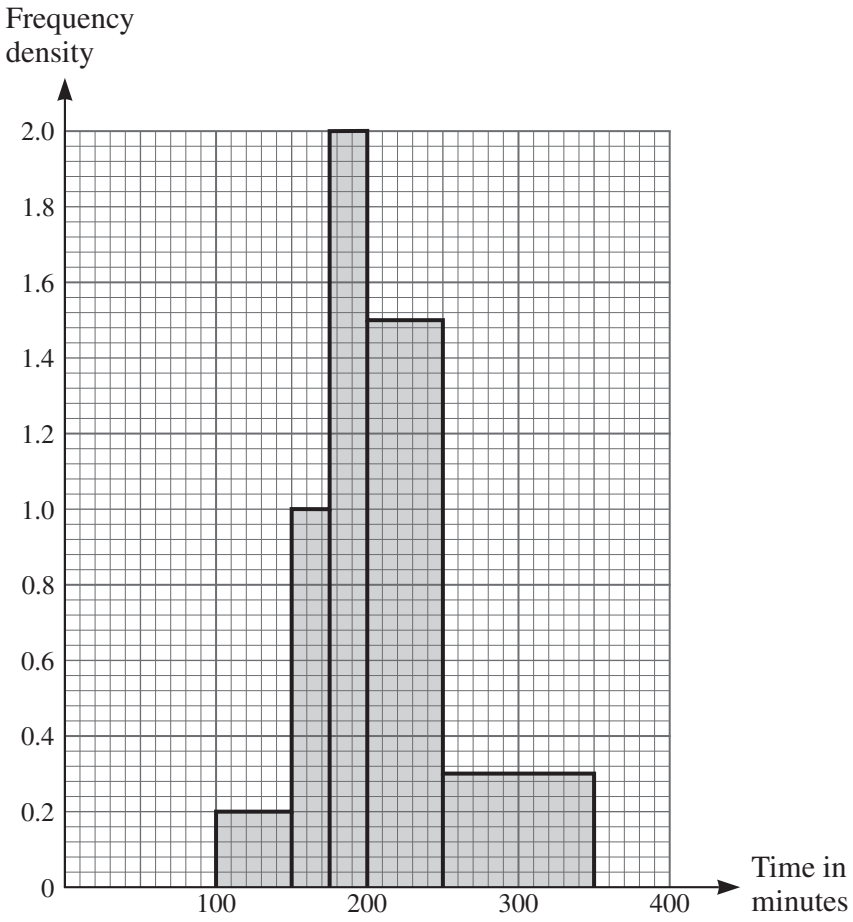
(ii) Given that he spends less than \$50, find the probability that he went to the cinema. [4]

3 The amount of fibre in a packet of a certain brand of cereal is normally distributed with mean 160 grams. 19% of packets of cereal contain more than 190 grams of fibre.

(i) Find the standard deviation of the amount of fibre in a packet. [3]

(ii) Kate buys 12 packets of cereal. Find the probability that at least 1 of the packets contains more than 190 grams of fibre. [2]

4 The following histogram summarises the times, in minutes, taken by 190 people to complete a race.



(i) Show that 75 people took between 200 and 250 minutes to complete the race. [1]

(ii) Calculate estimates of the mean and standard deviation of the times of the 190 people. [6]

(iii) Explain why your answers to part **(ii)** are estimates. [1]

5 On trains in the morning rush hour, each person is either a student with probability 0.36, or an office worker with probability 0.22, or a shop assistant with probability 0.29 or none of these.

(i) 8 people on a morning rush hour train are chosen at random. Find the probability that between 4 and 6 inclusive are office workers. [3]

(ii) 300 people on a morning rush hour train are chosen at random. Find the probability that between 31 and 49 inclusive are neither students nor office workers nor shop assistants. [6]

6 The 11 letters of the word REMEMBRANCE are arranged in a line.

(i) Find the number of different arrangements if there are no restrictions. [1]

(ii) Find the number of different arrangements which start and finish with the letter M. [2]

(iii) Find the number of different arrangements which do not have all 4 vowels (E, E, A, E) next to each other. [3]

4 letters from the letters of the word REMEMBRANCE are chosen.

(iv) Find the number of different selections which contain no Ms and no Rs and at least 2 Es. [3]

7 Rory has 10 cards. Four of the cards have a 3 printed on them and six of the cards have a 4 printed on them. He takes three cards at random, without replacement, and adds up the numbers on the cards.

(i) Show that P(the sum of the numbers on the three cards is 11) = $\frac{1}{2}$. [3]

(ii) Draw up a probability distribution table for the sum of the numbers on the three cards. [4]

Event R is 'the sum of the numbers on the three cards is 11'. Event S is 'the number on the first card taken is a 3'.

(iii) Determine whether events R and S are independent. Justify your answer. [3]

(iv) Determine whether events R and S are exclusive. Justify your answer. [1]

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341

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
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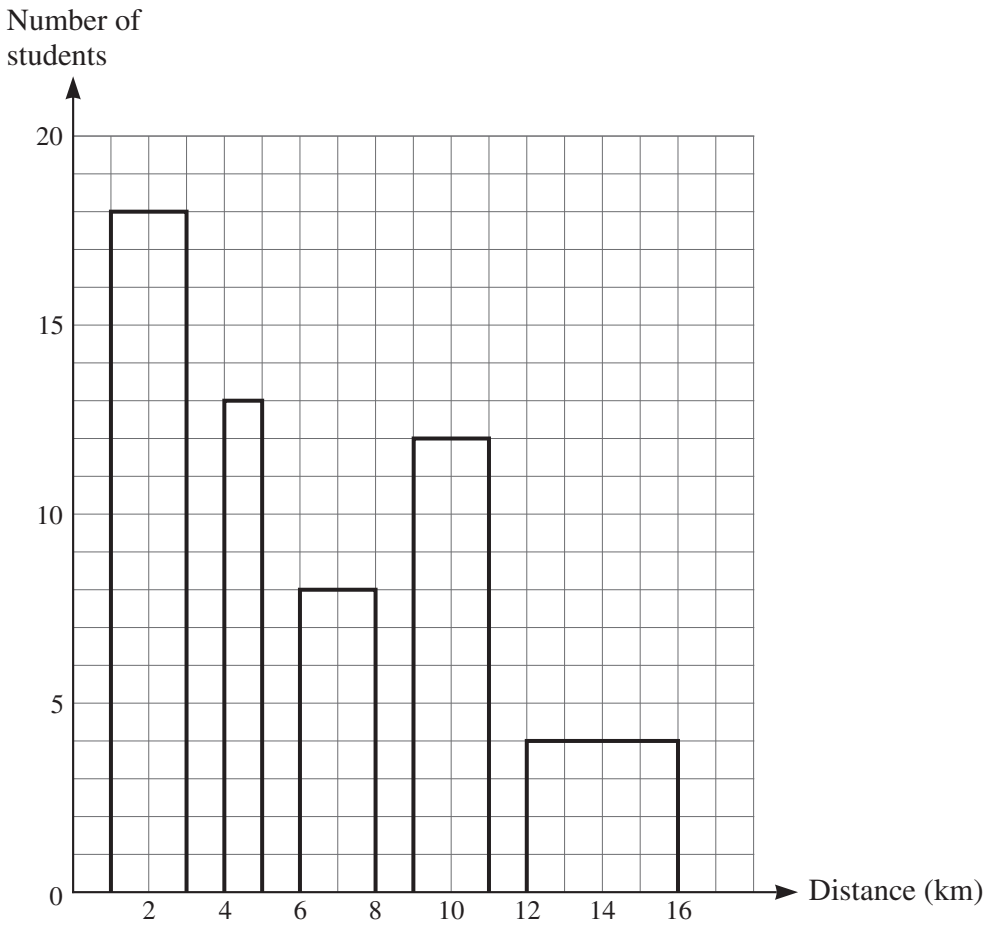
1 The distance of a student's home from college, correct to the nearest kilometre, was recorded for each of 55 students. The distances are summarised in the following table.

Distance from college (km)	1 – 3	4 – 5	6 – 8	9 – 11	12 – 16
Number of students	18	13	8	12	4

Dominic is asked to draw a histogram to illustrate the data. Dominic's diagram is shown below.



Give two reasons why this is not a correct histogram. [2]

2 A factory produces flower pots. The base diameters have a normal distribution with mean 14 cm and standard deviation 0.52 cm. Find the probability that the base diameters of exactly 8 out of 10 randomly chosen flower pots are between 13.6 cm and 14.8 cm. [5]

3 In a large consignment of mangoes, 15% of mangoes are classified as small, 70% as medium and 15% as large.

(i) Yue-chen picks 14 mangoes at random. Find the probability that fewer than 12 of them are medium or large. [3]

(ii) Yue-chen picks n mangoes at random. The probability that none of these n mangoes is small is at least 0.1. Find the largest possible value of n. [3]

4 Barry weighs 20 oranges and 25 lemons. For the oranges, the mean weight is 220 g and the standard deviation is 32 g. For the lemons, the mean weight is 118 g and the standard deviation is 12 g.

(i) Find the mean weight of the 45 fruits. [2]

(ii) The individual weights of the oranges in grams are denoted by x_o, and the individual weights of the lemons in grams are denoted by x_l. By first finding Σx_o^2 and Σx_l^2, find the variance of the weights of the 45 fruits. [5]

5 **(a)** The random variable X is normally distributed with mean 82 and standard deviation 7.4. Find the value of q such that $P(82 - q < X < 82 + q) = 0.44$. [3]

(b) The random variable Y is normally distributed with mean μ and standard deviation σ. It is given that $5\mu = 2\sigma^2$ and that $P(Y < \frac{1}{2}\mu) = 0.281$. Find the values of μ and σ. [4]

6 **(i)** Find the number of different ways that the 9 letters of the word AGGREGATE can be arranged in a line if the first letter is R. [2]

(ii) Find the number of different ways that the 9 letters of the word AGGREGATE can be arranged in a line if the 3 letters G are together, both letters A are together and both letters E are together. [2]

(iii) The letters G, R and T are consonants and the letters A and E are vowels. Find the number of different ways that the 9 letters of the word AGGREGATE can be arranged in a line if consonants and vowels occur alternately. [3]

(iv) Find the number of different selections of 4 letters of the word AGGREGATE which contain exactly 2 Gs or exactly 3 Gs. [3]

7 Dayo chooses two digits at random, without replacement, from the 9-digit number 113 333 555.

(i) Find the probability that the two digits chosen are equal. [3]

(ii) Find the probability that one digit is a 5 and one digit is not a 5. [3]

(iii) Find the probability that the first digit Dayo chose was a 5, given that the second digit he chose is not a 5. [4]

(iv) The random variable X is the number of 5s that Dayo chooses. Draw up a table to show the probability distribution of X. [3]

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345

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

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CAMBRIDGE International Examinations

1 Find the mean and variance of the following data. [3]

5 −2 12 7 −3 2 −6 4 0 8

2 The number of phone calls, X, received per day by Sarah has the following probability distribution.

x	0	1	2	3	4	$\geqslant 5$
$P(X = x)$	0.24	0.35	$2k$	k	0.05	0

(i) Find the value of k. [2]

(ii) Find the mode of X. [1]

(iii) Find the probability that the number of phone calls received by Sarah on any particular day is more than the mean number of phone calls received per day. [3]

3 Jodie tosses a biased coin and throws two fair tetrahedral dice. The probability that the coin shows a head is $\frac{1}{3}$. Each of the dice has four faces, numbered 1, 2, 3 and 4. Jodie's score is calculated from the numbers on the faces that the dice land on, as follows:

- if the coin shows a head, the two numbers from the dice are added together;
- if the coin shows a tail, the two numbers from the dice are multiplied together.

Find the probability that the coin shows a head given that Jodie's score is 8. [5]

4 The following back-to-back stem-and-leaf diagram shows the times to load an application on 61 smartphones of type A and 43 smartphones of type B.

	Type A		Type B	
(7)	9 7 6 6 4 3 3	2	1 3 5 8	(4)
(7)	5 5 4 4 2 2 2	3	0 4 4 5 6 6 6 6 7 8 8 9	(12)
(13)	9 9 8 8 8 7 6 6 4 3 2 2 0	4	0 1 1 2 3 6 8 8 8 9 9	(10)
(9)	6 5 5 4 3 2 1 1 0	5	2 5 6 6 9	(5)
(4)	9 7 3 0	6	1 3 8 9	(4)
(6)	8 7 4 4 1 0	7	5 7	(2)
(10)	7 6 6 6 5 3 3 2 1 0	8	1 2 4 4	(4)
(5)	8 6 5 5 5	9	0 6	(2)

Key: 3 \| 2 \| 1 means 0.23 seconds for type A and 0.21 seconds for type B.

(i) Find the median and quartiles for smartphones of type A. [3]

You are given that the median, lower quartile and upper quartile for smartphones of type B are 0.46 seconds, 0.36 seconds and 0.63 seconds respectively.

(ii) Represent the data by drawing a pair of box-and-whisker plots in a single diagram on graph paper. [3]

(iii) Compare the loading times for these two types of smartphone. [1]

5 Screws are sold in packets of 15. Faulty screws occur randomly. A large number of packets are tested for faulty screws and the mean number of faulty screws per packet is found to be 1.2.

(i) Show that the variance of the number of faulty screws in a packet is 1.104. [2]

(ii) Find the probability that a packet contains at most 2 faulty screws. [3]

Damien buys 8 packets of screws at random.

(iii) Find the probability that there are exactly 7 packets in which there is at least 1 faulty screw. [4]

6 A farmer finds that the weights of sheep on his farm have a normal distribution with mean 66.4 kg and standard deviation 5.6 kg.

(i) 250 sheep are chosen at random. Estimate the number of sheep which have a weight of between 70 kg and 72.5 kg. [5]

(ii) The proportion of sheep weighing less than 59.2 kg is equal to the proportion weighing more than y kg. Find the value of y. [2]

Another farmer finds that the weights of sheep on his farm have a normal distribution with mean μ kg and standard deviation 4.92 kg. 25% of these sheep weigh more than 67.5 kg.

(iii) Find the value of μ. [3]

7 A committee of 6 people is to be chosen from 5 men and 8 women. In how many ways can this be done

(i) if there are more women than men on the committee, [4]

(ii) if the committee consists of 3 men and 3 women but two particular men refuse to be on the committee together? [3]

One particular committee consists of 5 women and 1 man.

(iii) In how many different ways can the committee members be arranged in a line if the man is not at either end? [3]

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Cambridge International AS & A Level

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Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2014**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
Graph Paper
List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

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CAMBRIDGE International Examinations

1 The 50 members of a club include both the club president and the club treasurer. All 50 members want to go on a coach tour, but the coach only has room for 45 people. In how many ways can 45 members be chosen if both the club president and the club treasurer must be included? [3]

2 Find the number of different ways that 6 boys and 4 girls can stand in a line if

(i) all 6 boys stand next to each other, [3]

(ii) no girl stands next to another girl. [3]

3 **(i)** Four fair six-sided dice, each with faces marked 1, 2, 3, 4, 5, 6, are thrown. Find the probability that the numbers shown on the four dice add up to 5. [3]

(ii) Four fair six-sided dice, each with faces marked 1, 2, 3, 4, 5, 6, are thrown on 7 occasions. Find the probability that the numbers shown on the four dice add up to 5 on exactly 1 or 2 of the 7 occasions. [4]

4 Sharik attempts a multiple choice revision question on-line. There are 3 suggested answers, one of which is correct. When Sharik chooses an answer the computer indicates whether the answer is right or wrong. Sharik first chooses one of the three suggested answers at random. If this answer is wrong he has a second try, choosing an answer at random from the remaining 2. If this answer is also wrong Sharik then chooses the remaining answer, which must be correct.

(i) Draw a fully labelled tree diagram to illustrate the various choices that Sharik can make until the computer indicates that he has answered the question correctly. [4]

(ii) The random variable X is the number of attempts that Sharik makes up to and including the one that the computer indicates is correct. Draw up the probability distribution table for X and find $\mathrm{E}(X)$. [4]

5 **(a)** The time, X hours, for which people sleep in one night has a normal distribution with mean 7.15 hours and standard deviation 0.88 hours.

(i) Find the probability that a randomly chosen person sleeps for less than 8 hours in a night. [2]

(ii) Find the value of q such that $\mathrm{P}(X < q) = 0.75$. [3]

(b) The random variable Y has the distribution $\mathrm{N}(\mu, \sigma^2)$, where $2\sigma = 3\mu$ and $\mu \neq 0$. Find $\mathrm{P}(Y > 4\mu)$. [3]

6 On a certain day in spring, the heights of 200 daffodils are measured, correct to the nearest centimetre. The frequency distribution is given below.

Height (cm)	4 – 10	11 – 15	16 – 20	21 – 25	26 – 30
Frequency	22	32	78	40	28

(i) Draw a cumulative frequency graph to illustrate the data. [4]

(ii) 28% of these daffodils are of height h cm or more. Estimate h. [2]

(iii) You are given that the estimate of the mean height of these daffodils, calculated from the table, is 18.39 cm. Calculate an estimate of the standard deviation of the heights of these daffodils. [3]

7 In Marumbo, three quarters of the adults own a cell phone.

(i) A random sample of 8 adults from Marumbo is taken. Find the probability that the number of adults who own a cell phone is between 4 and 6 inclusive. [3]

(ii) A random sample of 160 adults from Marumbo is taken. Use an approximation to find the probability that more than 114 of them own a cell phone. [5]

(iii) Justify the use of your approximation in part **(ii)**. [1]

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353

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2014**

1 hour 15 minutes

Additional Materials: Answer Booklet/Paper
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CAMBRIDGE International Examinations

1 Packets of tea are labelled as containing 250 g. The actual weight of tea in a packet has a normal distribution with mean 260 g and standard deviation σ g. Any packet with a weight less than 250 g is classed as 'underweight'. Given that 1% of packets of tea are underweight, find the value of σ. [3]

2 A traffic camera measured the speeds, x kilometres per hour, of 8 cars travelling along a certain street, with the following results.

62.7 59.6 64.2 61.5 68.3 66.9 62.0 62.3

(i) Find $\Sigma(x - 62)$. [1]

(ii) Find $\Sigma(x - 62)^2$. [1]

(iii) Find the mean and variance of the speeds of the 8 cars. [3]

3 The number of books read by members of a book club each year has the binomial distribution B(12, 0.7).

(i) State the greatest number of books that could be read by a member of the book club in a particular year and find the probability that a member reads this number of books. [2]

(ii) Find the probability that a member reads fewer than 10 books in a particular year. [3]

4 A random sample of 25 people recorded the number of glasses of water they drank in a particular week. The results are shown below.

23	19	32	14	25
22	26	36	45	42
47	28	17	38	15
46	18	26	22	41
19	21	28	24	30

(i) Draw a stem-and-leaf diagram to represent the data. [3]

(ii) On graph paper draw a box-and-whisker plot to represent the data. [5]

5 Gem stones from a certain mine have weights, X grams, which are normally distributed with mean 1.9 g and standard deviation 0.55 g. These gem stones are sorted into three categories for sale depending on their weights, as follows.

Small: under 1.2 g Medium: between 1.2 g and 2.5 g Large: over 2.5 g

(i) Find the proportion of gem stones in each of these three categories. [5]

(ii) Find the value of k such that $P(k < X < 2.5) = 0.8$. [4]

6 **(a)** Seven fair dice each with faces marked 1, 2, 3, 4, 5, 6 are thrown and placed in a line. Find the number of possible arrangements where the sum of the numbers at each end of the line add up to 4. [3]

(b) Find the number of ways in which 9 different computer games can be shared out between Wainah, Jingyi and Hebe so that each person receives an odd number of computer games. [6]

7 A box contains 2 green apples and 2 red apples. Apples are taken from the box, one at a time, without replacement. When both red apples have been taken, the process stops. The random variable X is the number of apples which have been taken when the process stops.

(i) Show that $\mathrm{P}(X = 3) = \frac{1}{3}$. [3]

(ii) Draw up the probability distribution table for X. [3]

Another box contains 2 yellow peppers and 5 orange peppers. Three peppers are taken at random from the box without replacement.

(iii) Given that at least 2 of the peppers taken from the box are orange, find the probability that all 3 peppers are orange. [5]

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357

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2015**

1 hour 15 minutes

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CAMBRIDGE International Examinations

1 In a certain town, 76% of cars are fitted with satellite navigation equipment. A random sample of 11 cars from this town is chosen. Find the probability that fewer than 10 of these cars are fitted with this equipment. [4]

2 The random variable X has the distribution $N(\mu, \sigma^2)$. It is given that $P(X < 54.1) = 0.5$ and $P(X > 50.9) = 0.8665$. Find the values of μ and σ. [4]

3 Robert has a part-time job delivering newspapers. On a number of days he noted the time, correct to the nearest minute, that it took him to do his job. Robert used his results to draw up the following table; two of the values in the table are denoted by a and b.

Time (t minutes)	60 – 62	63 – 64	65 – 67	68 – 71
Frequency (number of days)	3	9	6	b
Frequency density	1	a	2	1.5

(i) Find the values of a and b. [3]

(ii) On graph paper, draw a histogram to represent Robert's times. [3]

4 **(a)** Amy measured her pulse rate while resting, x beats per minute, at the same time each day on 30 days. The results are summarised below.

$$\Sigma(x - 80) = -147 \qquad \Sigma(x - 80)^2 = 952$$

Find the mean and standard deviation of Amy's pulse rate. [4]

(b) Amy's friend Marok measured her pulse rate every day after running for half an hour. Marok's pulse rate, in beats per minute, was found to have a mean of 148.6 and a standard deviation of 18.5. Assuming that pulse rates have a normal distribution, find what proportion of Marok's pulse rates, after running for half an hour, were above 160 beats per minute. [3]

5 **(a)** Find the number of ways in which all nine letters of the word TENNESSEE can be arranged

(i) if all the letters E are together, [3]

(ii) if the T is at one end and there is an S at the other end. [3]

(b) Four letters are selected from the nine letters of the word VENEZUELA. Find the number of possible selections which contain exactly one E. [3]

6 Nadia is very forgetful. Every time she logs in to her online bank she only has a 40% chance of remembering her password correctly. She is allowed 3 unsuccessful attempts on any one day and then the bank will not let her try again until the next day.

(i) Draw a fully labelled tree diagram to illustrate this situation. [3]

(ii) Let X be the number of unsuccessful attempts Nadia makes on any day that she tries to log in to her bank. Copy and complete the following table to show the probability distribution of X. [4]

x	0	1	2	3
$P(X = x)$		0.24		

(iii) Calculate the expected number of unsuccessful attempts made by Nadia on any day that she tries to log in. [2]

7 The faces of a biased die are numbered 1, 2, 3, 4, 5 and 6. The probabilities of throwing odd numbers are all the same. The probabilities of throwing even numbers are all the same. The probability of throwing an odd number is twice the probability of throwing an even number.

(i) Find the probability of throwing a 3. [3]

(ii) The die is thrown three times. Find the probability of throwing two 5s and one 4. [3]

(iii) The die is thrown 100 times. Use an approximation to find the probability that an even number is thrown at most 37 times. [5]

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361

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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2015**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

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CAMBRIDGE International Examinations

1 For n values of the variable x, it is given that $\Sigma(x - 100) = 216$ and $\Sigma x = 2416$. Find the value of n. [3]

2 A committee of 6 people is to be chosen at random from 7 men and 9 women. Find the probability that there are no men on the committee. [3]

3 One plastic robot is given away free inside each packet of a certain brand of biscuits. There are four colours of plastic robot (red, yellow, blue and green) and each colour is equally likely to occur. Nick buys some packets of these biscuits. Find the probability that

(i) he gets a green robot on opening his first packet, [1]

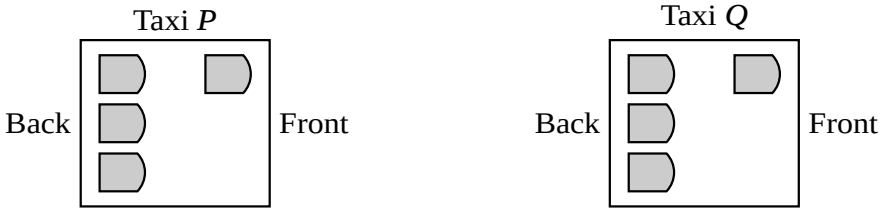
(ii) he gets his first green robot on opening his fifth packet. [2]

Nick's friend Amos is also collecting robots.

(iii) Find the probability that the first four packets Amos opens all contain different coloured robots. [3]

4 A group of 8 friends travels to the airport in two taxis, P and Q. Each taxi can take 4 passengers.

(i) The 8 friends divide themselves into two groups of 4, one group for taxi P and one group for taxi Q, with Jon and Sarah travelling in the same taxi. Find the number of different ways in which this can be done. [3]



Each taxi can take 1 passenger in the front and 3 passengers in the back (see diagram). Mark sits in the front of taxi P and Jon and Sarah sit in the back of taxi P next to each other.

(ii) Find the number of different seating arrangements that are now possible for the 8 friends. [4]

5 The weights, in kilograms, of the 15 rugby players in each of two teams, A and B, are shown below.

Team A	97	98	104	84	100	109	115	99	122	82	116	96	84	107	91
Team B	75	79	94	101	96	77	111	108	83	84	86	115	82	113	95

(i) Represent the data by drawing a back-to-back stem-and-leaf diagram with team A on the left-hand side of the diagram and team B on the right-hand side. [4]

(ii) Find the interquartile range of the weights of the players in team A. [2]

(iii) A new player joins team B as a substitute. The mean weight of the 16 players in team B is now 93.9 kg. Find the weight of the new player. [3]

6 A fair spinner A has edges numbered 1, 2, 3, 3. A fair spinner B has edges numbered −3, −2, −1, 1. Each spinner is spun. The number on the edge that the spinner comes to rest on is noted. Let X be the sum of the numbers for the two spinners.

(i) Copy and complete the table showing the possible values of X. [1]

		Spinner A			
		1	2	3	3
Spinner B	−3	−2			
	−2			1	
	−1				
	1				

(ii) Draw up a table showing the probability distribution of X. [3]

(iii) Find Var(X). [3]

(iv) Find the probability that X is even, given that X is positive. [2]

7 **(a)** A petrol station finds that its daily sales, in litres, are normally distributed with mean 4520 and standard deviation 560.

(i) Find on how many days of the year (365 days) the daily sales can be expected to exceed 3900 litres. [4]

The daily sales at another petrol station are X litres, where X is normally distributed with mean m and standard deviation 560. It is given that $P(X > 8000) = 0.122$.

(ii) Find the value of m. [3]

(iii) Find the probability that daily sales at this petrol station exceed 8000 litres on fewer than 2 of 6 randomly chosen days. [3]

(b) The random variable Y is normally distributed with mean μ and standard deviation σ. Given that $\sigma = \frac{2}{3}\mu$, find the probability that a random value of Y is less than 2μ. [3]

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365

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2015**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

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1 The time taken, t hours, to deliver letters on a particular route each day is measured on 250 working days. The mean time taken is 2.8 hours. Given that $\Sigma(t - 2.5)^2 = 96.1$, find the standard deviation of the times taken. [3]

2 In country X, 25% of people have fair hair. In country Y, 60% of people have fair hair. There are 20 million people in country X and 8 million people in country Y. A person is chosen at random from these 28 million people.

(i) Find the probability that the person chosen is from country X. [1]

(ii) Find the probability that the person chosen has fair hair. [2]

(iii) Find the probability that the person chosen is from country X, given that the person has fair hair. [2]

3 Ellie throws two fair tetrahedral dice, each with faces numbered 1, 2, 3 and 4. She notes the numbers on the faces that the dice land on. Event S is 'the sum of the two numbers is 4'. Event T is 'the product of the two numbers is an odd number'.

(i) Determine whether events S and T are independent, showing your working. [5]

(ii) Are events S and T exclusive? Justify your answer. [1]

4 The time taken for cucumber seeds to germinate under certain conditions has a normal distribution with mean 125 hours and standard deviation σ hours.

(i) It is found that 13% of seeds take longer than 136 hours to germinate. Find the value of σ. [3]

(ii) 170 seeds are sown. Find the expected number of seeds which take between 131 and 141 hours to germinate. [4]

5 **(a)** Find the number of different ways that the 13 letters of the word ACCOMMODATION can be arranged in a line if all the vowels (A, I, O) are next to each other. [3]

(b) There are 7 Chinese, 6 European and 4 American students at an international conference. Four of the students are to be chosen to take part in a television broadcast. Find the number of different ways the students can be chosen if at least one Chinese and at least one European student are included. [5]

6 The heights to the nearest metre of 134 office buildings in a certain city are summarised in the table below.

Height (m)	21 – 40	41 – 45	46 – 50	51 – 60	61 – 80
Frequency	18	15	21	52	28

(i) Draw a histogram on graph paper to illustrate the data. [4]

(ii) Calculate estimates of the mean and standard deviation of these heights. [5]

7 A factory makes water pistols, 8% of which do not work properly.

(i) A random sample of 19 water pistols is taken. Find the probability that at most 2 do not work properly. [3]

(ii) In a random sample of n water pistols, the probability that at least one does not work properly is greater than 0.9. Find the smallest possible value of n. [3]

(iii) A random sample of 1800 water pistols is taken. Use an approximation to find the probability that there are at least 152 that do not work properly. [5]

(iv) Justify the use of your approximation in part **(iii)**. [1]

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Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2016**

1 hour 15 minutes

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1 The random variable X is such that $X \sim \mathrm{N}(20, 49)$. Given that $\mathrm{P}(X > k) = 0.25$, find the value of k. [3]

2 Two fair six-sided dice with faces numbered 1, 2, 3, 4, 5, 6 are thrown and the two scores are noted. The difference between the two scores is defined as follows.

- If the scores are equal the difference is zero.
- If the scores are not equal the difference is the larger score minus the smaller score.

Find the expectation of the difference between the two scores. [5]

3 Visitors to a Wildlife Park in Africa have independent probabilities of 0.9 of seeing giraffes, 0.95 of seeing elephants, 0.85 of seeing zebras and 0.1 of seeing lions.

(i) Find the probability that a visitor to the Wildlife Park sees all these animals. [1]

(ii) Find the probability that, out of 12 randomly chosen visitors, fewer than 3 see lions. [3]

(iii) 50 people independently visit the Wildlife Park. Find the mean and variance of the number of these people who see zebras. [2]

4 Packets of rice are filled by a machine and have weights which are normally distributed with mean 1.04 kg and standard deviation 0.017 kg.

(i) Find the probability that a randomly chosen packet weighs less than 1 kg. [3]

(ii) How many packets of rice, on average, would the machine fill from 1000 kg of rice? [1]

The factory manager wants to produce more packets of rice. He changes the settings on the machine so that the standard deviation is the same but the mean is reduced to μ kg. With this mean the probability that a packet weighs less than 1 kg is 0.0388.

(iii) Find the value of μ. [3]

(iv) How many packets of rice, on average, would the machine now fill from 1000 kg of rice? [1]

5 **(a)** Find the number of different ways of arranging all nine letters of the word PINEAPPLE if no vowel (A, E, I) is next to another vowel. [4]

(b) A certain country has a cricket squad of 16 people, consisting of 7 batsmen, 5 bowlers, 2 all-rounders and 2 wicket-keepers. The manager chooses a team of 11 players consisting of 5 batsmen, 4 bowlers, 1 all-rounder and 1 wicket-keeper.

(i) Find the number of different teams the manager can choose. [2]

(ii) Find the number of different teams the manager can choose if one particular batsman refuses to be in the team when one particular bowler is in the team. [3]

6 Deeti has 3 red pens and 1 blue pen in her left pocket and 3 red pens and 1 blue pen in her right pocket. 'Operation T' consists of Deeti taking one pen at random from her left pocket and placing it in her right pocket, then taking one pen at random from her right pocket and placing it in her left pocket.

(i) Find the probability that, when Deeti carries out operation T, she takes a blue pen from her left pocket and then a blue pen from her right pocket. [2]

The random variable X is the number of blue pens in Deeti's left pocket after carrying out operation T.

(ii) Find $P(X = 1)$. [3]

(iii) Given that the pen taken from Deeti's right pocket is blue, find the probability that the pen taken from Deeti's left pocket is blue. [4]

7 The masses, in grams, of components made in factory A and components made in factory B are shown below.

Factory A	0.049	0.050	0.053	0.054	0.057	0.058	0.058
	0.059	0.061	0.061	0.061	0.063	0.065	
Factory B	0.031	0.056	0.049	0.044	0.038	0.048	0.051
	0.064	0.035	0.042	0.047	0.054	0.058	

(i) Draw a back-to-back stem-and-leaf diagram to represent the masses of components made in the two factories. [5]

(ii) Find the median and the interquartile range for the masses of components made in factory B. [3]

(iii) Make two comparisons between the masses of components made in factory A and the masses of those made in factory B. [2]

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373

Cambridge International AS & A Level

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MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2016**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

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This document consists of **3** printed pages, **1** blank page and **2** inserts.

CAMBRIDGE International Examinations

1 When Anya goes to school, the probability that she walks is 0.3 and the probability that she cycles is 0.65; if she does not walk or cycle she takes the bus. When Anya walks the probability that she is late is 0.15. When she cycles the probability that she is late is 0.1 and when she takes the bus the probability that she is late is 0.6. Given that Anya is late, find the probability that she cycles. [5]

2 Noor has 3 T-shirts, 4 blouses and 5 jumpers. She chooses 3 items at random. The random variable X is the number of T-shirts chosen.

(i) Show that the probability that Noor chooses exactly one T-shirt is $\frac{27}{55}$. [3]

(ii) Draw up the probability distribution table for X. [4]

3 On any day at noon, the probabilities that Kersley is asleep or studying are 0.2 and 0.6 respectively.

(i) Find the probability that, in any 7-day period, Kersley is either asleep or studying at noon on at least 6 days. [3]

(ii) Use an approximation to find the probability that, in any period of 100 days, Kersley is asleep at noon on at most 30 days. [5]

4 The time taken to cook an egg by people living in a certain town has a normal distribution with mean 4.2 minutes and standard deviation 0.6 minutes.

(i) Find the probability that a person chosen at random takes between 3.5 and 4.5 minutes to cook an egg. [3]

12% of people take more than t minutes to cook an egg.

(ii) Find the value of t. [3]

(iii) A random sample of n people is taken. Find the smallest possible value of n if the probability that none of these people takes more than t minutes to cook an egg is less than 0.003. [3]

5 The number of people a football stadium can hold is called the 'capacity'. The capacities of 130 football stadiums in the UK, to the nearest thousand, are summarised in the table.

Capacity	3000–7000	8000–12 000	13 000–22 000	23 000–42 000	43 000–82 000
Number of stadiums	40	30	18	34	8

(i) On graph paper, draw a histogram to represent this information. Use a scale of 2 cm for a capacity of 10 000 on the horizontal axis. [5]

(ii) Calculate an estimate of the mean capacity of these 130 stadiums. [2]

(iii) Find which class in the table contains the median and which contains the lower quartile. [2]

6 Find the number of ways all 10 letters of the word COPENHAGEN can be arranged so that

(i) the vowels (A, E, O) are together and the consonants (C, G, H, N, P) are together, [3]

(ii) the Es are not next to each other. [4]

Four letters are selected from the 10 letters of the word COPENHAGEN.

(iii) Find the number of different selections if the four letters must contain the same number of Es and Ns with at least one of each. [5]

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377

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2016**

1 hour 15 minutes

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

An answer booklet and a graph paper booklet are provided inside this question paper. You should follow the instructions on the front cover of both booklets. If you need additional answer paper or graph paper ask the invigilator for a continuation booklet or graph paper booklet.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
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The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

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CAMBRIDGE International Examinations

1 A committee of 5 people is to be chosen from 4 men and 6 women. William is one of the 4 men and Mary is one of the 6 women. Find the number of different committees that can be chosen if William and Mary refuse to be on the committee together. [3]

2 A fair triangular spinner has three sides numbered 1, 2, 3. When the spinner is spun, the score is the number of the side on which it lands. The spinner is spun four times.

(i) Find the probability that at least two of the scores are 3. [3]

(ii) Find the probability that the sum of the four scores is 5. [3]

3 Numbers are formed using some or all of the digits 4, 5, 6, 7 with no digit being used more than once.

(i) Show that, using exactly 3 of the digits, there are 12 different odd numbers that can be formed. [3]

(ii) Find how many odd numbers altogether can be formed. [3]

4 For a group of 250 cars the numbers, classified by colour and country of manufacture, are shown in the table.

	Germany	Japan	Korea
Silver	40	26	34
White	32	22	26
Red	28	12	30

One car is selected at random from this group. Find the probability that the selected car is

(i) a red or silver car manufactured in Korea, [1]

(ii) not manufactured in Japan. [1]

X is the event that the selected car is white. Y is the event that the selected car is manufactured in Germany.

(iii) By using appropriate probabilities, determine whether events X and Y are independent. [5]

5 The tables summarise the heights, h cm, of 60 girls and 60 boys.

Height of girls (cm)	$140 < h \leqslant 150$	$150 < h \leqslant 160$	$160 < h \leqslant 170$	$170 < h \leqslant 180$	$180 < h \leqslant 190$
Frequency	12	21	17	10	0

Height of boys (cm)	$140 < h \leqslant 150$	$150 < h \leqslant 160$	$160 < h \leqslant 170$	$170 < h \leqslant 180$	$180 < h \leqslant 190$
Frequency	0	20	23	12	5

(i) On graph paper, using the same set of axes, draw two cumulative frequency graphs to illustrate the data. [4]

(ii) On a school trip the students have to enter a cave which is 165 cm high. Use your graph to estimate the percentage of the girls who will be unable to stand upright. [3]

(iii) The students are asked to compare the heights of the girls and the boys. State one advantage of using a pair of box-and-whisker plots instead of the cumulative frequency graphs to do this. [1]

6 The weights of bananas in a fruit shop have a normal distribution with mean 150 grams and standard deviation 50 grams. Three sizes of banana are sold.

Small: under 95 grams
Medium: between 95 grams and 205 grams
Large: over 205 grams

(i) Find the proportion of bananas that are small. [3]

(ii) Find the weight exceeded by 10% of bananas. [3]

The prices of bananas are 10 cents for a small banana, 20 cents for a medium banana and 25 cents for a large banana.

(iii) (a) Show that the probability that a randomly chosen banana costs 20 cents is 0.7286. [1]

(b) Calculate the expected total cost of 100 randomly chosen bananas. [3]

7 Each day Annabel eats rice, potato or pasta. Independently of each other, the probability that she eats rice is 0.75, the probability that she eats potato is 0.15 and the probability that she eats pasta is 0.1.

(i) Find the probability that, in any week of 7 days, Annabel eats pasta on exactly 2 days. [2]

(ii) Find the probability that, in a period of 5 days, Annabel eats rice on 2 days, potato on 1 day and pasta on 2 days. [3]

(iii) Find the probability that Annabel eats potato on more than 44 days in a year of 365 days. [5]

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381

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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8695462711

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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CAMBRIDGE International Examinations

1 The discrete random variable X has the following probability distribution.

x	1	2	3	6
$P(X = x)$	0.15	p	0.4	q

Given that $E(X) = 3.05$, find the values of p and q. [4]

2 The time taken by a car to accelerate from 0 to 30 metres per second was measured correct to the nearest second. The results from 48 cars are summarised in the following table.

Time (seconds)	3 – 5	6 – 8	9 – 11	12 – 16	17 – 25
Frequency	10	15	17	4	2

(i) On the grid, draw a cumulative frequency graph to represent this information. [3]

(ii) 35 of these cars accelerated from 0 to 30 metres per second in a time more than t seconds. Estimate the value of t. [2]

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3 An experiment consists of throwing a biased die 30 times and noting the number of 4s obtained. This experiment was repeated many times and the average number of 4s obtained in 30 throws was found to be 6.21.

(i) Estimate the probability of throwing a 4. [1]

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(ii) find the variance of the number of 4s obtained in 30 throws, [1]

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(iii) find the probability that in 15 throws the number of 4s obtained is 2 or more. [3]

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4 The ages of a group of 12 people at an Art class have mean 48.7 years and standard deviation 7.65 years. The ages of a group of 7 people at another Art class have mean 38.1 years and standard deviation 4.2 years.

(i) Find the mean age of all 19 people. [2]

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(ii) The individual ages in years of people in the first Art class are denoted by x and those in the second Art class by y. By first finding Σx^2 and Σy^2, find the standard deviation of the ages of all 19 people. [4]

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5 Over a period of time Julian finds that on long-distance flights he flies economy class on 82% of flights. On the rest of the flights he flies first class. When he flies economy class, the probability that he gets a good night's sleep is x. When he flies first class, the probability that he gets a good night's sleep is 0.9.

(i) Draw a fully labelled tree diagram to illustrate this situation. [2]

The probability that Julian gets a good night's sleep on a randomly chosen flight is 0.285.

(ii) Find the value of x. [2]

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(iii) Given that on a particular flight Julian does not get a good night's sleep, find the probability that he is flying economy class. [3]

6 **(a)** A village hall has seats for 40 people, consisting of 8 rows with 5 seats in each row. Mary, Ahmad, Wayne, Elsie and John are the first to arrive in the village hall and no seats are taken before they arrive.

(i) How many possible arrangements are there of seating Mary, Ahmad, Wayne, Elsie and John assuming there are no restrictions? [2]

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(ii) How many possible arrangements are there of seating Mary, Ahmad, Wayne, Elsie and John if Mary and Ahmad sit together in the front row and the other three sit together in one of the other rows? [4]

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(b) In how many ways can a team of 4 people be chosen from 10 people if 2 of the people, Ross and Lionel, refuse to be in the team together? [4]

7 The weight, in grams, of pineapples is denoted by the random variable X which has a normal distribution with mean 500 and standard deviation 91.5. Pineapples weighing over 570 grams are classified as 'large'. Those weighing under 390 grams are classified as 'small' and the rest are classified as 'medium'.

(i) Find the proportions of large, small and medium pineapples. [5]

(ii) Find the weight exceeded by the heaviest 5% of pineapples. [3]

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(iii) Find the value of k such that $P(k < X < 610) = 0.3$. [5]

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393

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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6935260309

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

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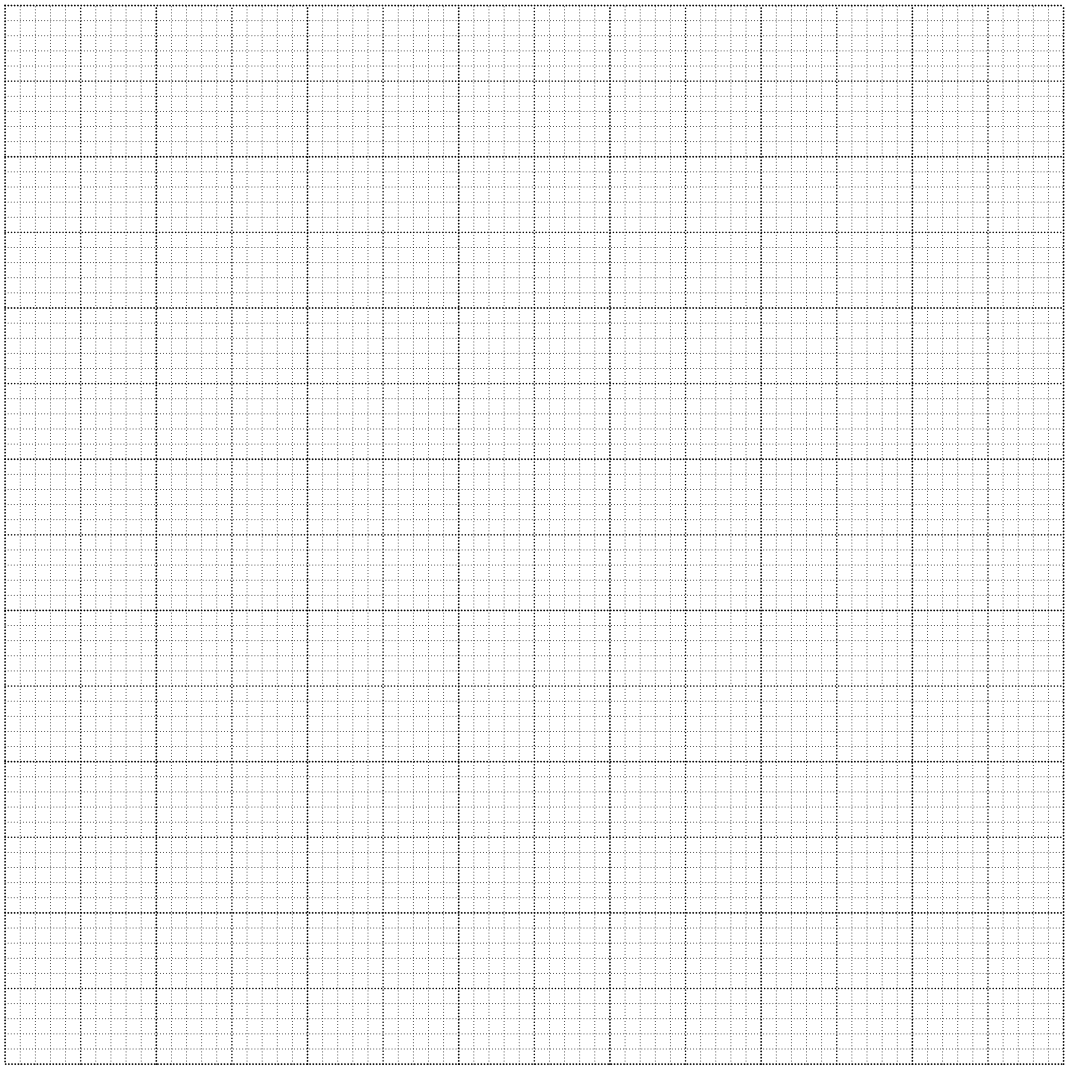
CAMBRIDGE International Examinations

1 Andy counts the number of emails, x, he receives each day and notes that, over a period of n days, $\Sigma(x - 10) = 27$ and the mean number of emails is 11.5. Find the value of n. [3]

2 The circumferences, c cm, of some trees in a wood were measured. The results are summarised in the table.

Circumference (c cm)	$40 < c \leqslant 50$	$50 < c \leqslant 80$	$80 < c \leqslant 100$	$100 < c \leqslant 120$
Frequency	14	48	70	8

(i) On the grid, draw a cumulative frequency graph to represent the information. [3]



(ii) Estimate the percentage of trees which have a circumference larger than 75 cm. [2]

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3 A box contains 6 identical-sized discs, of which 4 are blue and 2 are red. Discs are taken at random from the box in turn and not replaced. Let X be the number of discs taken, up to and including the first blue one.

(i) Show that $P(X = 3) = \frac{1}{15}$. [2]

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(ii) Draw up the probability distribution table for X. [3]

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4 A fair tetrahedral die has faces numbered 1, 2, 3, 4. A coin is biased so that the probability of showing a head when thrown is $\frac{1}{3}$. The die is thrown once and the number n that it lands on is noted. The biased coin is then thrown n times. So, for example, if the die lands on 3, the coin is thrown 3 times.

(i) Find the probability that the die lands on 4 and the number of times the coin shows heads is 2. [3]

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(ii) Find the probability that the die lands on 3 and the number of times the coin shows heads is 3. [1]

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(iii) Find the probability that the number the die lands on is the same as the number of times the coin shows heads. [3]

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5 Blank CDs are packed in boxes of 30. The probability that a blank CD is faulty is 0.04. A box is rejected if more than 2 of the blank CDs are faulty.

(i) Find the probability that a box is rejected. [3]

(ii) 280 boxes are chosen randomly. Use an approximation to find the probability that at least 30 of these boxes are rejected. [5]

6 **(a)** Find the number of different 3-digit numbers greater than 300 that can be made from the digits 1, 2, 3, 4, 6, 8 if

(i) no digit can be repeated, [3]

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(ii) a digit can be repeated and the number made is even. [3]

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(b) A team of 5 is chosen from 6 boys and 4 girls. Find the number of ways the team can be chosen if

(i) there are no restrictions, [1]

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(ii) the team contains more boys than girls. [3]

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7 In Jimpuri the weights, in kilograms, of boys aged 16 years have a normal distribution with mean 61.4 and standard deviation 12.3.

(i) Find the probability that a randomly chosen boy aged 16 years in Jimpuri weighs more than 65 kilograms. [3]

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(ii) For boys aged 16 years in Jimpuri, 25% have a weight between 65 kilograms and k kilograms, where k is greater than 65. Find k. [4]

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In Brigville the weights, in kilograms, of boys aged 16 years have a normal distribution. 99% of the boys weigh less than 97.2 kilograms and 33% of the boys weigh less than 55.2 kilograms.

(iii) Find the mean and standard deviation of the weights of boys aged 16 years in Brigville. [5]

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405

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

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7131501592

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2017**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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CAMBRIDGE International Examinations

1 A statistics student asks people to complete a survey. The probability that a randomly chosen person agrees to complete the survey is 0.2. Find the probability that at least one of the first three people asked agrees to complete the survey. [2]

2 Tien measured the arm lengths, x cm, of 20 people in his class. He found that $\Sigma x = 1218$ and the standard deviation of x was 4.2. Calculate $\Sigma(x - 45)$ and $\Sigma(x - 45)^2$. [3]

3 At the end of a revision course in mathematics, students have to pass a test to gain a certificate. The probability of any student passing the test at the first attempt is 0.85. Those students who fail are allowed to retake the test once, and the probability of any student passing the retake test is 0.65.

(i) Draw a fully labelled tree diagram to show all the outcomes. [2]

(ii) Given that a student gains the certificate, find the probability that this student fails the test on the first attempt. [4]

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4 A fair die with faces numbered 1, 2, 2, 2, 3, 6 is thrown. The score, X, is found by squaring the number on the face the die shows and then subtracting 4.

(i) Draw up a table to show the probability distribution of X. [3]

(ii) Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. [3]

5 The number of Olympic medals won in the 2012 Olympic Games by the top 27 countries is shown below.

104	88	82	65	44	38	35	34	28
28	18	18	17	17	14	13	13	12
12	10	10	10	9	6	5	2	2

(i) Draw a stem-and-leaf diagram to illustrate the data. [4]

(ii) Find the median and quartiles and draw a box-and-whisker plot on the grid. [5]

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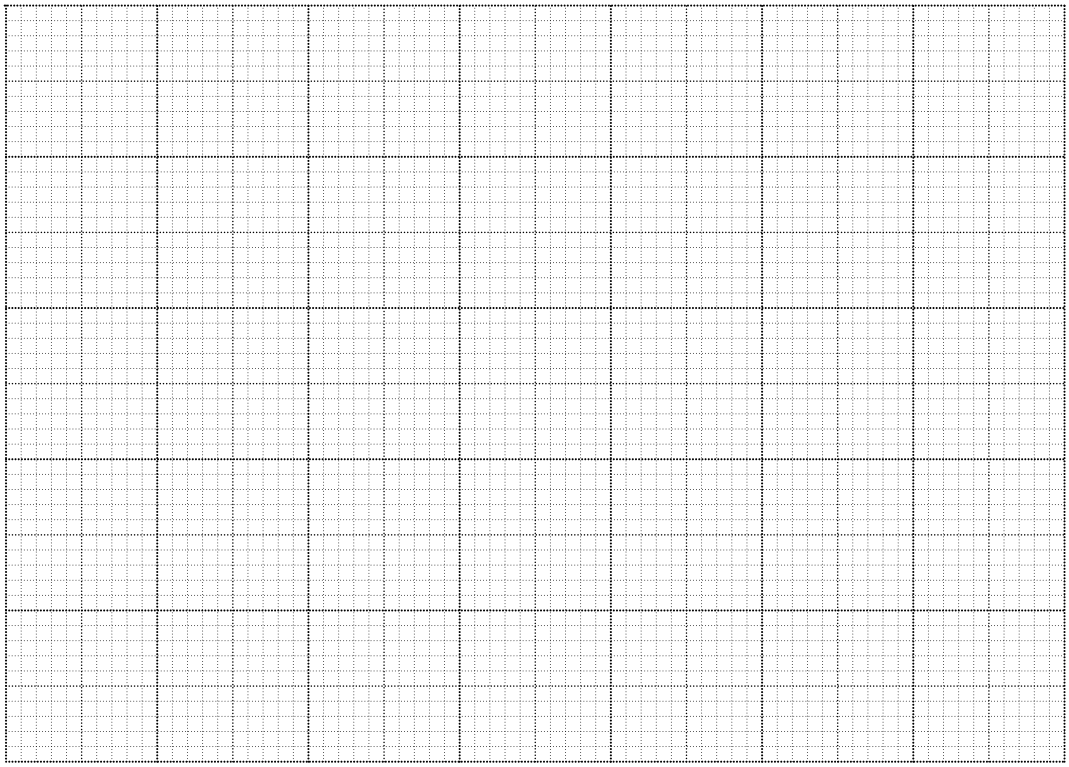

6 A car park has spaces for 18 cars, arranged in a line. On one day there are 5 cars, of different makes, parked in randomly chosen positions and 13 empty spaces.

(i) Find the number of possible arrangements of the 5 cars in the car park. [2]

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(ii) Find the probability that the 5 cars are not all next to each other. [5]

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On another day, 12 cars of different makes are parked in the car park. 5 of these cars are red, 4 are white and 3 are black. Elizabeth selects 3 of these cars.

(iii) Find the number of selections Elizabeth can make that include cars of at least 2 different colours. [5]

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7 Josie aims to catch a bus which departs at a fixed time every day. Josie arrives at the bus stop T minutes before the bus departs, where $T \sim \mathrm{N}(5.3, 2.1^2)$.

(i) Find the probability that Josie has to wait longer than 6 minutes at the bus stop. [3]

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On 5% of days Josie has to wait longer than x minutes at the bus stop.

(ii) Find the value of x. [3]

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(iii) Find the probability that Josie waits longer than x minutes on fewer than 3 days in 10 days. [3]

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(iv) Find the probability that Josie misses the bus. [3]

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

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MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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1 9 people are to be divided into a group of 4, a group of 3 and a group of 2. In how many different ways can this be done? [3]

2 A random variable X has the probability distribution shown in the following table, where p is a constant.

x	−1	0	1	2	4
$P(X = x)$	p	p	$2p$	$2p$	0.1

(i) Find the value of p. [1]

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(ii) Given that $E(X) = 1.15$, find $Var(X)$. [2]

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3 In an orchestra, there are 11 violinists, 5 cellists and 4 double bass players. A small group of 6 musicians is to be selected from these 20.

(i) How many different selections of 6 musicians can be made if there must be at least 4 violinists, at least 1 cellist and no more than 1 double bass player? [4]

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The small group that is selected contains 4 violinists, 1 cellist and 1 double bass player. They sit in a line to perform a concert.

(ii) How many different arrangements are there of these 6 musicians if the violinists must sit together? [3]

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4 **(a)** It is given that $X \sim N(31.4, 3.6)$. Find the probability that a randomly chosen value of X is less than 29.4. [3]

(b) The lengths of fish of a particular species are modelled by a normal distribution. A scientist measures the lengths of 400 randomly chosen fish of this species. He finds that 42 fish are less than 12 cm long and 58 are more than 19 cm long. Find estimates for the mean and standard deviation of the lengths of fish of this species. [5]

5 At the Nonland Business College, all students sit an accountancy examination at the end of their first year of study. On average, 80% of the students pass this examination.

(i) A random sample of 9 students who will take this examination is chosen. Find the probability that at most 6 of these students will pass the examination. [3]

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(ii) A random sample of 200 students who will take this examination is chosen. Use a suitable approximate distribution to find the probability that more than 166 of them will pass the examination. [5]

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(iii) Justify the use of your approximate distribution in part **(ii)**. [1]

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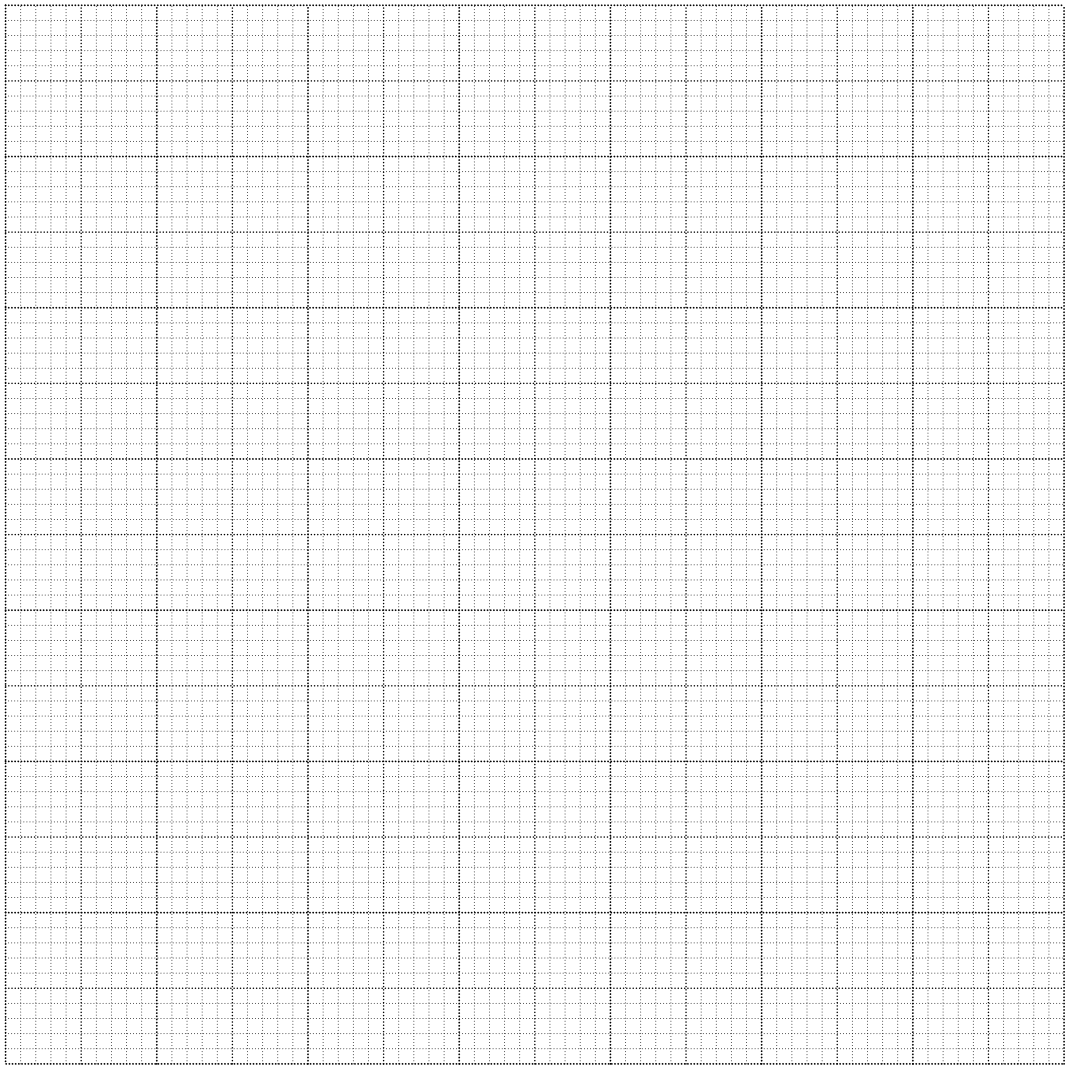
6 The daily rainfall, x mm, in a certain village is recorded on 250 consecutive days. The results are summarised in the following cumulative frequency table.

Rainfall, x mm	$x \leqslant 20$	$x \leqslant 30$	$x \leqslant 40$	$x \leqslant 50$	$x \leqslant 70$	$x \leqslant 100$
Cumulative frequency	52	94	142	172	222	250

(i) On the grid, draw a cumulative frequency graph to illustrate the data. [2]



(ii) On 100 of the days, the rainfall was k mm or more. Use your graph to estimate the value of k. [2]

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(iii) Calculate estimates of the mean and standard deviation of the daily rainfall in this village. [6]

7 In a group of students, the numbers of boys and girls studying Art, Music and Drama are given in the following table. Each of these 160 students is studying exactly one of these subjects.

	Art	Music	Drama
Boys	24	40	32
Girls	15	12	37

(i) Find the probability that a randomly chosen student is studying Music. [1]

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(ii) Determine whether the events 'a randomly chosen student is a boy' and 'a randomly chosen student is studying Music' are independent, justifying your answer. [2]

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(iii) Find the probability that a randomly chosen student is not studying Drama, given that the student is a girl. [2]

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(iv) Three students are chosen at random. Find the probability that exactly 1 is studying Music and exactly 2 are boys. [5]

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If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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433

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

9389620414

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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You are reminded of the need for clear presentation in your answers.

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The total number of marks for this paper is 50.

This document consists of **14** printed pages and **2** blank pages.

CAMBRIDGE International Examinations

1 **(i)** How many different arrangements are there of the 11 letters in the word MISSISSIPPI? [2]

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(ii) Two letters are chosen at random from the 11 letters in the word MISSISSIPPI. Find the probability that these two letters are the same. [3]

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2 The following back-to-back stem-and-leaf diagram shows the reaction times in seconds in an experiment involving two groups of people, *A* and *B*.

A			*B*	
(4)	4 2 0 0	20	5 6 7	(3)
(5)	9 8 5 0 0	21	1 2 2 3 7 7	(6)
(8)	9 8 7 5 3 2 2 2	22	1 3 5 6 6 8 9	(7)
(6)	8 7 6 5 2 1	23	4 5 7 8 8 9 9 9	(8)
(3)	8 6 3	24	2 4 5 6 7 8 8	(7)
(1)	0	25	0 2 7 8	(4)

Key: 5 | 22 | 6 means a reaction time of 0.225 seconds for *A* and 0.226 seconds for *B*

(i) Find the median and the interquartile range for group *A*. [3]

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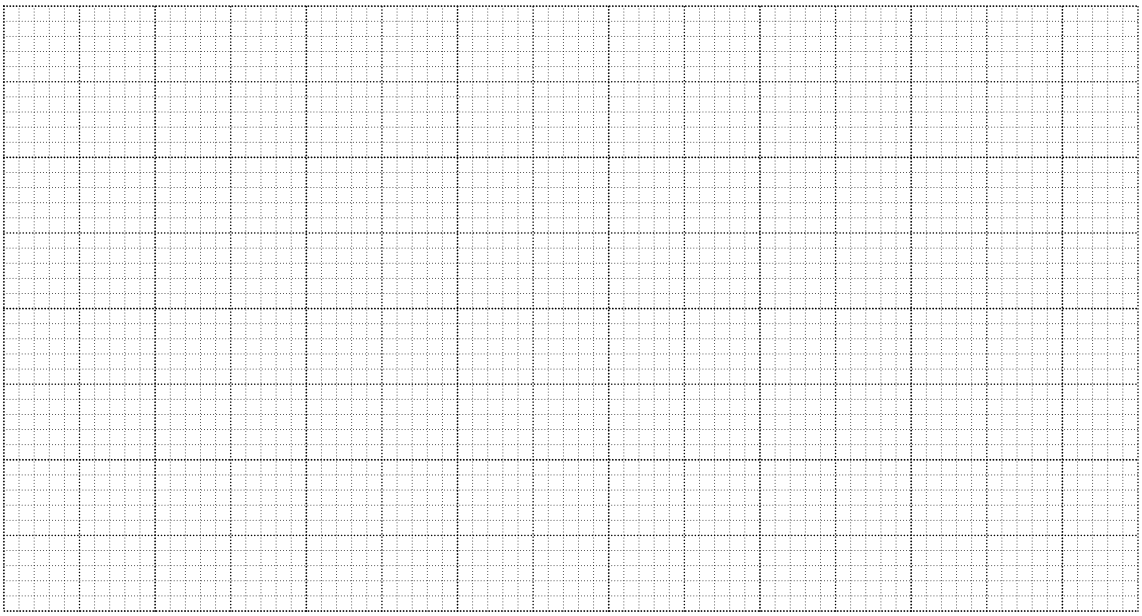
The median value for group *B* is 0.235 seconds, the lower quartile is 0.217 seconds and the upper quartile is 0.245 seconds.

(ii) Draw box-and-whisker plots for groups *A* and *B* on the grid. [3]



3 Jake attempts the crossword puzzle in his daily newspaper every day. The probability that he will complete the puzzle on any given day is 0.75, independently of all other days.

(i) Find the probability that he will complete the puzzle at least three times over a period of five days. [3]

Kenny also attempts the puzzle every day. The probability that he will complete the puzzle on a Monday is 0.8. The probability that he will complete it on a Tuesday is 0.9 if he completed it on the previous day and 0.6 if he did not complete it on the previous day.

(ii) Find the probability that Kenny will complete the puzzle on at least one of the two days Monday and Tuesday in a randomly chosen week. [3]

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4 **(i)** Find the number of different ways that 5 boys and 6 girls can stand in a row if all the boys stand together and all the girls stand together. [3]

(ii) Find the number of different ways that 5 boys and 6 girls can stand in a row if no boy stands next to another boy. [3]

5 The Quivers Archery club has 12 Junior members and 20 Senior members. For the Junior members, the mean age is 15.5 years and the standard deviation of the ages is 1.2 years. The ages of the Senior members are summarised by $\Sigma y = 910$ and $\Sigma y^2 = 42\,850$, where y is the age of a Senior member in years.

(i) Find the mean age of all 32 members of the club. [2]

(ii) Find the standard deviation of the ages of all 32 members of the club. [4]

6 A fair red spinner has 4 sides, numbered 1, 2, 3, 4. A fair blue spinner has 3 sides, numbered 1, 2, 3. When a spinner is spun, the score is the number on the side on which it lands. The spinners are spun at the same time. The random variable X denotes the score on the red spinner minus the score on the blue spinner.

(i) Draw up the probability distribution table for X. [3]

(ii) Find Var(X). [3]

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(iii) Find the probability that X is equal to 1, given that X is non-zero. [3]

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7 **(a)** The time, X hours, for which students use a games machine in any given day has a normal distribution with mean 3.24 hours and standard deviation 0.96 hours.

(i) On how many days of the year (365 days) would you expect a randomly chosen student to use a games machine for less than 4 hours? [3]

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(ii) Find the value of k such that $P(X > k) = 0.2$. [3]

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(iii) Find the probability that the number of hours for which a randomly chosen student uses a games machine in a day is within 1.5 standard deviations of the mean. [3]

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(b) The variable Y is normally distributed with mean μ and standard deviation σ, where $4\sigma = 3\mu$ and $\mu \neq 0$. Find the probability that a randomly chosen value of Y is positive. [3]

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449

Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4084773853

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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CAMBRIDGE International Examinations

450

1 A group consists of 5 men and 2 women. Find the number of different ways that the group can stand in a line if the women are not next to each other. [3]

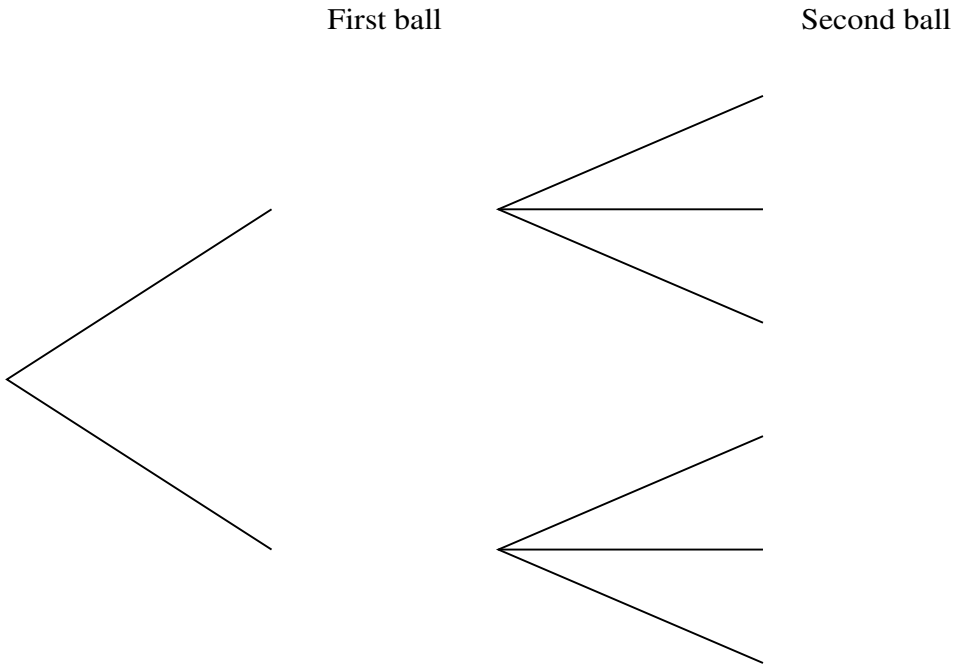
2 A fair 6-sided die has the numbers −1, −1, 0, 0, 1, 2 on its faces. A fair 3-sided spinner has edges numbered −1, 0, 1. The die is thrown and the spinner is spun. The number on the uppermost face of the die and the number on the edge on which the spinner comes to rest are noted. The sum of these two numbers is denoted by X.

(i) Draw up a table showing the probability distribution of X. [3]

(ii) Find Var(X). [3]

3 A box contains 3 red balls and 5 blue balls. One ball is taken at random from the box and not replaced. A yellow ball is then put into the box. A second ball is now taken at random from the box.

(i) Complete the tree diagram to show all the outcomes and the probability for each branch. [2]



(ii) Find the probability that the two balls taken are the same colour. [2]

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(iii) Find the probability that the first ball taken is red, given that the second ball taken is blue. [3]

4 Out of a class of 8 boys and 4 girls, a group of 7 people is chosen at random.

(i) Find the probability that the group of 7 includes one particular boy. [3]

(ii) Find the probability that the group of 7 includes at least 2 girls. [4]

5 The weights of apples sold by a store can be modelled by a normal distribution with mean 120 grams and standard deviation 24 grams. Apples weighing less than 90 grams are graded as 'small'; apples weighing more than 140 grams are graded as 'large'; the remainder are graded as 'medium'.

(i) Show that the probability that an apple chosen at random is graded as medium is 0.692, correct to 3 significant figures. [4]

(ii) Four apples are chosen at random. Find the probability that at least two are graded as medium. [4]

6 The lifetimes, in hours, of a particular type of light bulb are normally distributed with mean 2000 hours and standard deviation σ hours. The probability that a randomly chosen light bulb of this type has a lifetime of more than 1800 hours is 0.96.

(i) Find the value of σ. [3]

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New technology has resulted in a new type of light bulb. It is found that on average one in five of these new light bulbs has a lifetime of more than 2500 hours.

(ii) For a random selection of 300 of these new light bulbs, use a suitable approximate distribution to find the probability that fewer than 70 have a lifetime of more than 2500 hours. [4]

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(iii) Justify the use of your approximate distribution in part **(ii)**. [1]

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7 The heights, in cm, of the 11 members of the Anvils athletics team and the 11 members of the Brecons swimming team are shown below.

Anvils	173	158	180	196	175	165	170	169	181	184	172
Brecons	166	170	171	172	172	178	181	182	183	183	192

(i) Draw a back-to-back stem-and-leaf diagram to represent this information, with Anvils on the left-hand side of the diagram and Brecons on the right-hand side. [4]

(ii) Find the median and the interquartile range for the heights of the Anvils. [3]

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The heights of the 11 members of the Anvils are denoted by x cm. It is given that $\Sigma x = 1923$ and $\Sigma x^2 = 337\,221$. The Anvils are joined by 3 new members whose heights are 166 cm, 172 cm and 182 cm.

(iii) Find the standard deviation of the heights of all 14 members of the Anvils. [4]

Additional Page

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Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS **9709/61**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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1 When Shona goes to college she either catches the bus with probability 0.8 or she cycles with probability 0.2. If she catches the bus, the probability that she is late is 0.4. If she cycles, the probability that she is late is x. The probability that Shona is not late for college on a randomly chosen day is 0.63. Find the value of x. [3]

2 Annan has designed a new logo for a sportswear company. A survey of a large number of customers found that 42% of customers rated the logo as good.

(i) A random sample of 10 customers is chosen. Find the probability that fewer than 8 of them rate the logo as good. [3]

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(ii) On another occasion, a random sample of n customers of the company is chosen. Find the smallest value of n for which the probability that at least one person rates the logo as good is greater than 0.995. [3]

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3 The mean and standard deviation of 20 values of x are 60 and 4 respectively.

(i) Find the values of Σx and Σx^2. [3]

Another 10 values of x are such that their sum is 550 and the sum of their squares is 40 500.

(ii) Find the mean and standard deviation of all these 30 values of x. [4]

4 In a probability distribution the random variable X takes the values -1, 0, 1, 2, 4. The probability distribution table for X is as follows.

x	-1	0	1	2	4
$\mathrm{P}(X = x)$	$\frac{1}{4}$	p	p	$\frac{3}{8}$	$4p$

(i) Find the value of p. [2]

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(ii) Find $\mathrm{E}(X)$ and $\mathrm{Var}(X)$. [3]

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(iii) Given that X is greater than zero, find the probability that X is equal to 2. [2]

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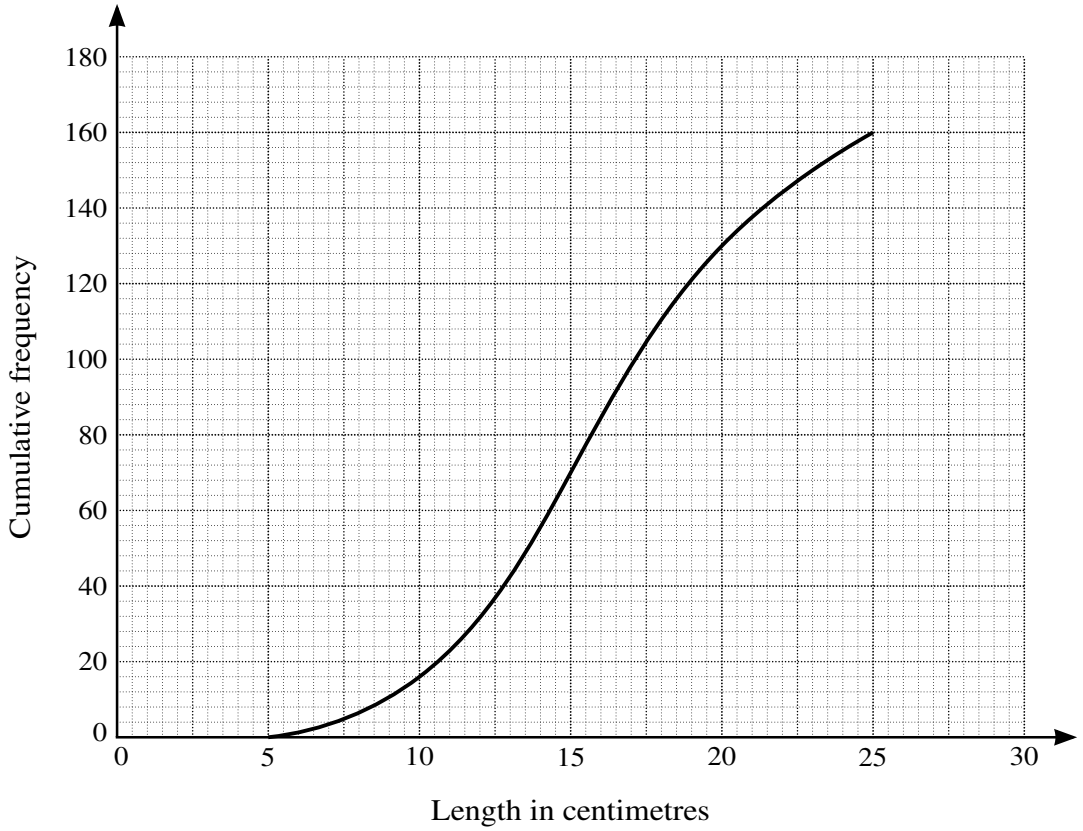
5 Ransha measured the lengths, in centimetres, of 160 palm leaves. His results are illustrated in the cumulative frequency graph below.



(i) Estimate how many leaves have a length between 14 and 24 centimetres. [1]

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(ii) 10% of the leaves have a length of L centimetres or more. Estimate the value of L. [2]

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(iii) Estimate the median and the interquartile range of the lengths. [3]

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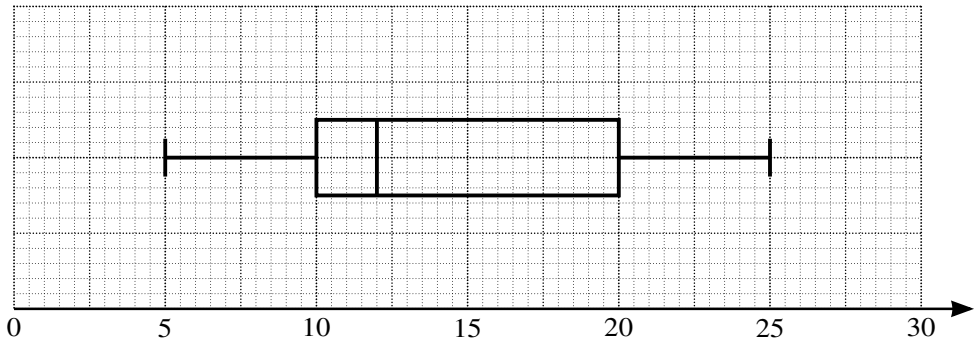
Sharim measured the lengths, in centimetres, of 160 palm leaves of a different type. He drew a box-and-whisker plot for the data, as shown on the grid below.



Length in centimetres

(iv) Compare the central tendency and the spread of the two sets of data. [2]

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6 **(i)** Find the number of different ways in which all 12 letters of the word STEEPLECHASE can be arranged so that all four Es are together. [1]

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(ii) Find the number of different ways in which all 12 letters of the word STEEPLECHASE can be arranged so that the Ss are not next to each other. [4]

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Four letters are selected from the 12 letters of the word STEEPLECHASE.

(iii) Find the number of different selections if the four letters include exactly one S. [4]

7 The shortest time recorded by an athlete in a 400 m race is called their personal best (PB). The PBs of the athletes in a large athletics club are normally distributed with mean 49.2 seconds and standard deviation 2.8 seconds.

(i) Find the probability that a randomly chosen athlete from this club has a PB between 46 and 53 seconds. [4]

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(ii) It is found that 92% of athletes from this club have PBs of more than t seconds. Find the value of t. [3]

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Three athletes from the club are chosen at random.

(iii) Find the probability that exactly 2 have PBs of less than 46 seconds. [3]

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Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

2342649388

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

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Cambridge Assessment International Education

1 Twelve tourists were asked to estimate the height, in metres, of a new building. Their estimates were as follows.

50 45 62 30 40 55 110 38 52 60 55 40

(i) Find the median and the interquartile range for the data. [3]

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(ii) Give a disadvantage of using the mean as a measure of the central tendency in this case. [1]

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2 Benju cycles to work each morning and he has two possible routes. He chooses the hilly route with probability 0.4 and the busy route with probability 0.6. If he chooses the hilly route, the probability that he will be late for work is x and if he chooses the busy route the probability that he will be late for work is $2x$. The probability that Benju is late for work on any day is 0.36.

(i) Show that $x = 0.225$. [2]

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(ii) Given that Benju is not late for work, find the probability that he chooses the hilly route. [3]

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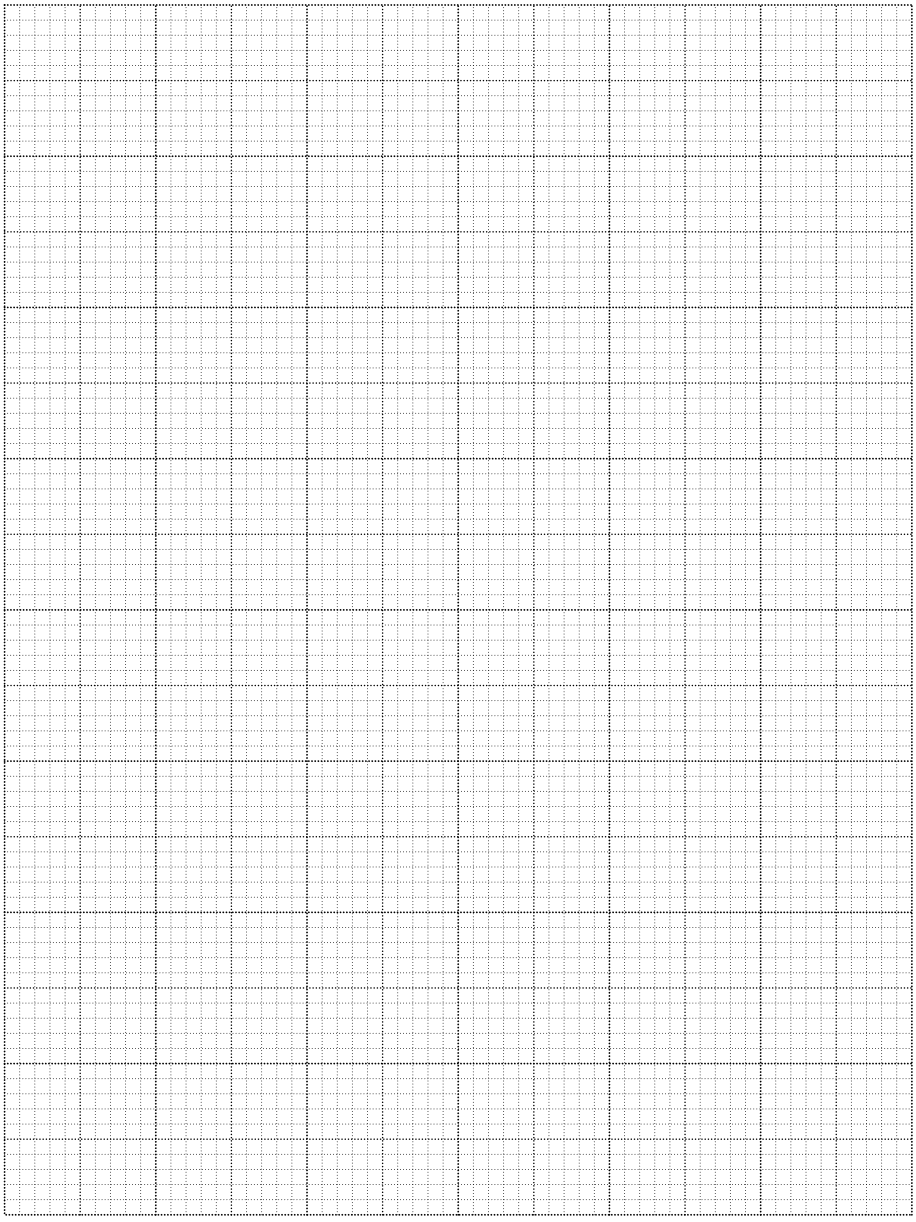
3 The speeds, in km h^{-1}, of 90 cars as they passed a certain marker on a road were recorded, correct to the nearest km h^{-1}. The results are summarised in the following table.

Speed (km h^{-1})	10 – 29	30 – 39	40 – 49	50 – 59	60 – 89
Frequency	10	24	30	14	12

(i) On the grid, draw a histogram to illustrate the data in the table. [4]



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(ii) Calculate an estimate for the mean speed of these 90 cars as they pass the marker. [2]

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4 In Quarendon, 66% of households are satisfied with the speed of their wifi connection.

(i) Find the probability that, out of 10 households chosen at random in Quarendon, at least 8 are satisfied with the speed of their wifi connection. [3]

(ii) A random sample of 150 households in Quarendon is chosen. Use a suitable approximation to find the probability that more than 84 are satisfied with the speed of their wifi connection. [5]

5 A fair red spinner has four sides, numbered 1, 2, 3, 3. A fair blue spinner has three sides, numbered −1, 0, 2. When a spinner is spun, the score is the number on the side on which it lands. The spinners are spun at the same time. The random variable X denotes the score on the red spinner minus the score on the blue spinner.

(i) Draw up the probability distribution table for X. [4]

(ii) Find Var(X). [3]

6 The heights, in metres, of fir trees in a large forest have a normal distribution with mean 40 and standard deviation 8.

(i) Find the probability that a fir tree chosen at random in this forest has a height less than 45 metres. [2]

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(ii) Find the probability that a fir tree chosen at random in this forest has a height within 5 metres of the mean. [2]

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In another forest, the heights of another type of fir tree are modelled by a normal distribution. A scientist measures the heights of 500 randomly chosen trees of this type. He finds that 48 trees are less than 10 m high and 76 trees are more than 24 m high.

(iii) Find the mean and standard deviation of the heights of trees of this type. [5]

7 **(i)** Find the number of different ways in which the 9 letters of the word TOADSTOOL can be arranged so that all three Os are together and both Ts are together. [1]

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(ii) Find the number of different ways in which the 9 letters of the word TOADSTOOL can be arranged so that the Ts are not together. [4]

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(iii) Find the probability that a randomly chosen arrangement of the 9 letters of the word TOADSTOOL has a T at the beginning and a T at the end. [2]

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(iv) Five letters are selected from the 9 letters of the word TOADSTOOL. Find the number of different selections if the five letters include at least 2 Os and at least 1 T. [4]

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If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

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5443970495

MATHEMATICS **9709/63**

Paper 6 Probability & Statistics 1 **(S1)** **October/November 2019**

1 hour 15 minutes

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This document consists of **13** printed pages and **3** blank pages.

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1 There are 300 students at a music college. All students play exactly one of the guitar, the piano or the flute. The numbers of male and female students that play each of the instruments are given in the following table.

	Guitar	Piano	Flute
Female students	62	35	43
Male students	78	40	42

(i) Find the probability that a randomly chosen student at the college is a male who does not play the piano. [1]

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(ii) Determine whether the events 'a randomly chosen student is male' and 'a randomly chosen student does not play the piano' are independent, justifying your answer. [2]

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2 **(i)** How many different arrangements are there of the 9 letters in the word CORRIDORS? [2]

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(ii) How many different arrangements are there of the 9 letters in the word CORRIDORS in which the first letter is D and the last letter is R or O? [3]

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3 A sports team of 7 people is to be chosen from 6 attackers, 5 defenders and 4 midfielders. The team must include at least 3 attackers, at least 2 defenders and at least 1 midfielder.

(i) In how many different ways can the team of 7 people be chosen? [4]

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The team of 7 that is chosen travels to a match in two cars. A group of 4 travel in one car and a group of 3 travel in the other car.

(ii) In how many different ways can the team of 7 be divided into a group of 4 and a group of 3? [2]

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4 The heights of students at the Mainland college are normally distributed with mean 148 cm and standard deviation 8 cm.

(i) The probability that a Mainland student chosen at random has a height less than h cm is 0.67. Find the value of h. [3]

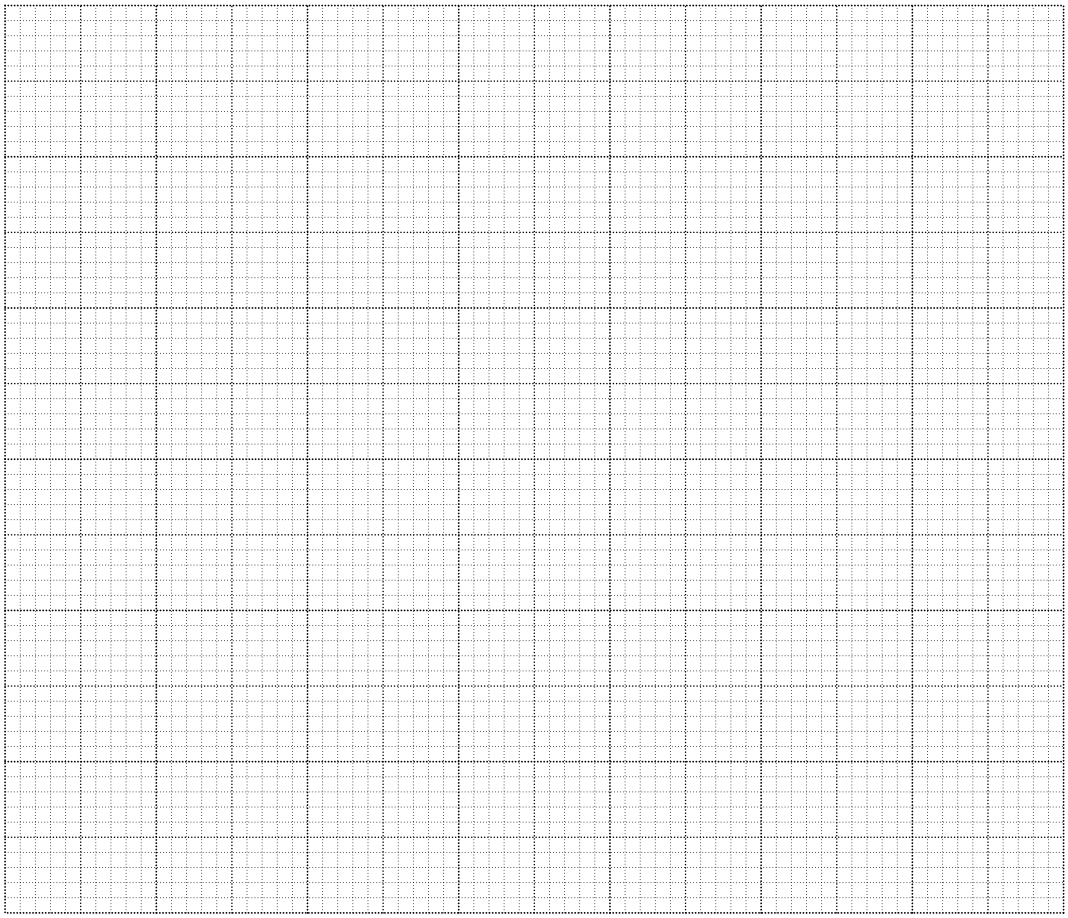
120 Mainland students are chosen at random.

(ii) Find the number of these students that would be expected to have a height within half a standard deviation of the mean. [4]

5 Last Saturday, 200 drivers entering a car park were asked the time, in minutes, that it had taken them to travel from home to the car park. The results are summarised in the following cumulative frequency table.

Time (t minutes)	$t \leqslant 10$	$t \leqslant 20$	$t \leqslant 30$	$t \leqslant 50$	$t \leqslant 70$	$t \leqslant 90$
Cumulative frequency	16	50	106	146	176	200

(i) On the grid, draw a cumulative frequency graph to illustrate the data. [2]



(ii) Use your graph to estimate the median of the data. [1]

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(iii) For 80 of the drivers, the time taken was at least T minutes. Use your graph to estimate the value of T. [2]

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(iv) Calculate an estimate of the mean time taken by all 200 drivers to travel to the car park. [4]

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6 A box contains 3 red balls and 5 white balls. One ball is chosen at random from the box and is not returned to the box. A second ball is now chosen at random from the box.

(i) Find the probability that both balls chosen are red. [1]

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(ii) Show that the probability that the balls chosen are of different colours is $\frac{15}{28}$. [2]

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(iii) Given that the second ball chosen is red, find the probability that the first ball chosen is red. [2]

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The random variable X denotes the number of red balls chosen.

(iv) Draw up the probability distribution table for X. [2]

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(v) Find Var(X). [3]

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7 A competition is taking place between two choirs, the Notes and the Classics. There is a large audience for the competition.

- 30% of the audience are Notes supporters.
- 45% of the audience are Classics supporters.
- The rest of the audience are not supporters of either of these choirs.
- No one in the audience supports both of these choirs.

(i) A random sample of 6 people is chosen from the audience.

(a) Find the probability that no more than 2 of the 6 people are Notes supporters. [3]

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(b) Find the probability that none of the 6 people support either of these choirs. [2]

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(ii) A random sample of 240 people is chosen from the audience. Use a suitable approximation to find the probability that fewer than 50 do not support either of the choirs. [5]

Additional Page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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Cambridge Assessment International Education

Cambridge International AS & A Level

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MATHEMATICS **9709/05**

Paper 5 Probability & Statistics 1 **For examination from 2020**

SPECIMEN PAPER **1 hour 15 minutes**

You must answer on the question paper.

You will need: List of formulae (MF19)

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **14** pages. Blank pages are indicated.

1 The following back to back stem-and leaf diagram shows the annual salaries of a group of 9 females and 9 males.

Females		Males
(4)	5200	0 | 3 (1)
(9)	988764000	1 | 0 07 (3)
(8)	87533100	2 | 004566 (6)
(6)	642100	3 | 0 02335677 (9)
(6)	754000	4 | 0112556889 (10)
(4)	9500	5 | 3457789 (7)
(2)	50	6 | 046 (3)

Key 2 \| 0 | 3 means $20 000 for 9 females and $30 000 for 9 males.

(a) Find the median and the quartiles of the females' salaries. [2]

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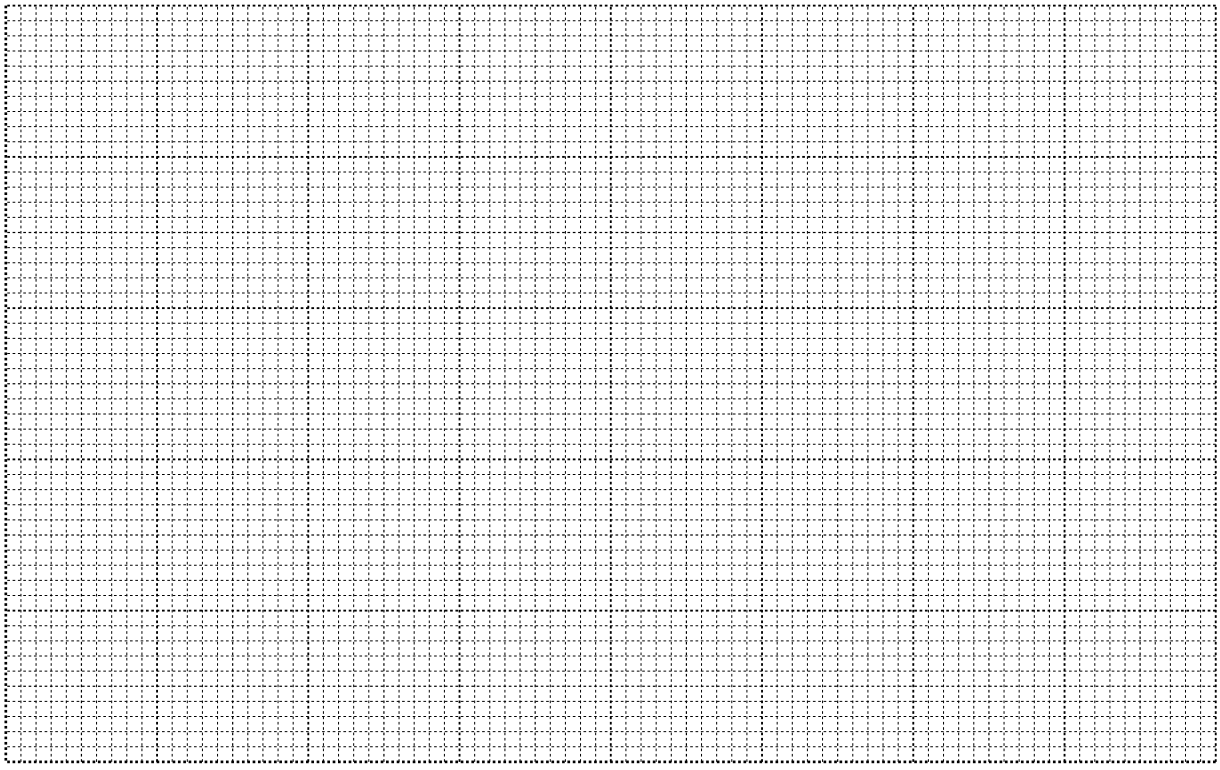
You are given that the median salary of the males is $40 000, the lower quartile is $28 000 and the upper quartile is $53 000.

(b) Draw a pair of box and whisker plots in a single diagram on the grid below to represent the data. [3]



2 A summary of the speeds, x kilometres per hour, of 2[illegible] cars passing a certain point gave the following information:

$$\Sigma(x - [illegible]) = [illegible] \quad \text{and} \quad \Sigma(x - [illegible])^2 = [illegible]$$

Find the variance of the speeds and hence find the value of Σx^2. [4]

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3 A book club sends 6 paperback and 2 hardback books to Mrs Hunt. She chooses 4 of these books at random to take with her on holiday. The random variable X represents the number of paperback books she chooses.

(a) Show that the probability that she chooses exactly 2 paperback books is $\frac{3}{14}$. [2]

(b) Draw up the probability distribution table for X. [3]

(c) You are given that $E(X) = 3$.

Find $Var(X)$. [2]

4 A petrol station finds that its daily sales, in litres, are normally distributed with mean [illegible] and standard deviation [illegible].

(a) Find on how many days of the year ([illegible] days) the daily sales can be expected to exceed [illegible] litres. [4]

The daily sales at another petrol station are X litres, where X is normally distributed with mean m and standard deviation [illegible]. It is given that $P(X > $ [illegible]$) = $ [illegible].

(b) Find the value of m. [3]

(c) Find the probability that daily sales at this petrol station exceed 6000 litres on fewer than 26 of each of these 365 days. [3]

5 A fair six sided die, with faces marked 1, 2, 3, 4, 5, 6 is thrown 10 times.

(a) Use an appropriate formula to find the probability that a 3 is obtained fewer than 8 times. [4]

(b) Justify your use of the approximation in part **(a)**. [1]

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On another occasion the same die is thrown repeatedly until a 3 is obtained.

(c) Find the probability that obtaining a 3 requires fewer than 7 throws. [2]

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6 A group of 8 friends travels to the airport in two taxis, *P* and *Q*. Each taxi can take 4 passengers.

(a) The 8 friends divide themselves into two groups of 4, one group for taxi *P* and one group for taxi *Q*, without Tom and Sarah travelling in the same taxi.

Find the number of different ways in which this can be done. [3]

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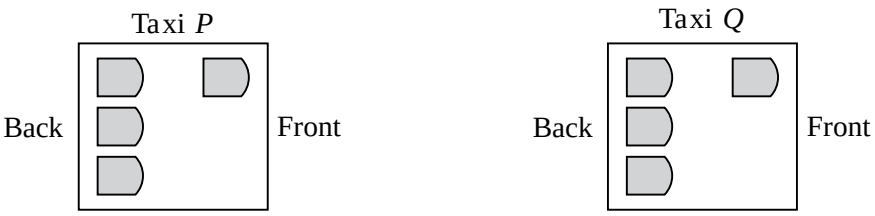

Each taxi can take 1 passenger in the front and 3 passengers in the back (see diagram). Mark sits in the front of taxi *P* and Jim and Sarah sit in the back of taxi *P* next to each other.

(b) Find the number of different seating arrangements that are now possible for the 5 friends. [4]

7 Bag *A* cn ain 4 b lls m b red 2, 4, 5, 8. Bag *B* cn ain 5 b lls m b red 1, 3, 6, 8, 8. Bag *C* cn ain 7 b lls m b red [illegible]. n b ll is selected a t rad m fr m each b g.

- Ev n *X* is 'ex ctly tw 6 th selected b lls h v th same n m b r'.
- Ev n *Y* is 'th b ll selected f rm bag *A* h s n m b r 4'.

(a) Fid P (*X*). [5]

(b) Find $P(X \cap Y)$ and hence determine whether or not events X and Y are independent. [3]

(c) Find the probability that two balls are numbered 2, given that exactly two of the selected balls have the same number. [2]

Additional page

If you use the following lined page to complete the answer(s) to any question(s), the question number(s) must be clearly shown.

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Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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MATHEMATICS **9709/06**

Paper 6 Probability & Statistics 1 **(S1)** **For Examination from 2017**

SPECIMEN PAPER **1 hour 15 minutes**

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This document consists of **11** printed pages and **1** blank page.

1 In a certain town, 76% of cars are fitted with satellite navigation equipment. A random sample of 11 cars from this town is chosen. Find the probability that fewer than 10 of these cars are fitted with this equipment. [4]

2 The random variable X has the distribution $N(\mu, \sigma^2)$. It is given that $P(X < 54.1) = 0.5$ and $P(X > 50.9) = 0.8665$. Find the values of μ and σ. [4]

3 Robert has a part-time job delivering newspapers. On a number of days he noted the time, correct to the nearest minute, that it took him to do his job. Robert used his results to draw up the following table; two of the values in the table are denoted by a and b.

Time (t minutes)	60 – 62	63 – 64	65 – 67	68 – 71
Frequency (number of days)	3	9	6	b
Frequency density	1	a	2	1.5

(i) Find the values of a and b. [3]

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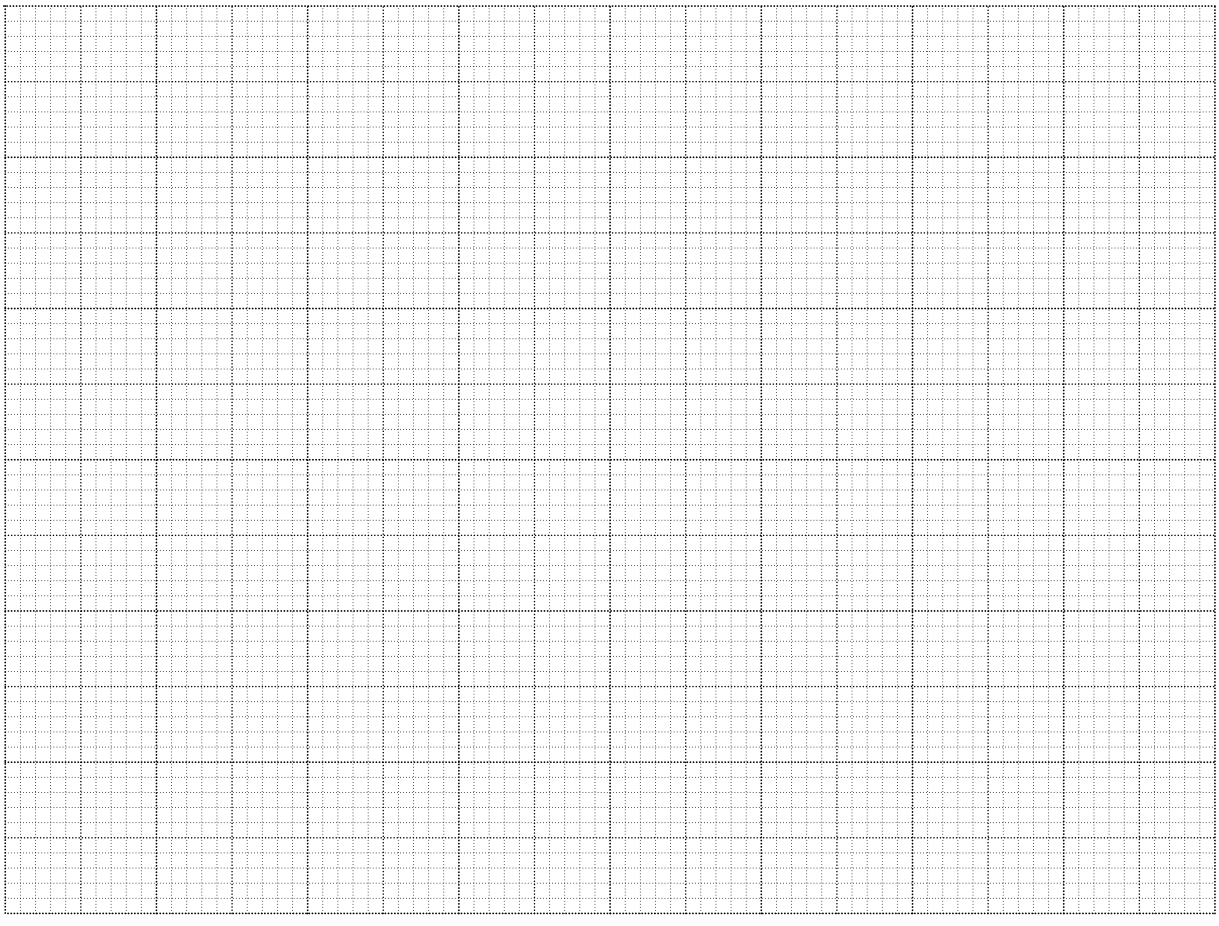
(ii) Draw a histogram to represent Robert's times. [3]



4 **(a)** Amy measured her pulse rate while resting, x beats per minute, at the same time each day on 30 days. The results are summarised below.

$$\Sigma(x - 80) = -147 \qquad \Sigma(x - 80)^2 = 952$$

Find the mean and standard deviation of Amy's pulse rate. [4]

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(b) Amy's friend Marok measured her pulse rate every day after running for half an hour. Marok's pulse rate, in beats per minute, was found to have a mean of 148.6 and a standard deviation of 18.5. Assuming that pulse rates have a normal distribution, find what proportion of Marok's pulse rates, after running for half an hour, were above 160 beats per minute. [3]

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5 **(a)** Find the number of ways in which all nine letters of the word TENNESSEE can be arranged

(i) if all the letters E are together, [3]

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(ii) if the T is at one end and there is an S at the other end. [3]

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(b) Four letters are selected from the nine letters of the word VENEZUELA. Find the number of possible selections which contain exactly one E. [3]

6 Nadia is very forgetful. Every time she logs in to her online bank she only has a 40% chance of remembering her password correctly. She is allowed 3 unsuccessful attempts on any one day and then the bank will not let her try again until the next day.

(i) Draw a fully labelled tree diagram to illustrate this situation. [3]

(ii) Let X be the number of unsuccessful attempts Nadia makes on any day that she tries to log in to her bank. Complete the following table to show the probability distribution of X. [4]

x	0	1	2	3
$P(X = x)$		0.24		

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(iii) Calculate the expected number of unsuccessful attempts made by Nadia on any day that she tries to log in. [2]

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7 The faces of a biased die are numbered 1, 2, 3, 4, 5 and 6. The probabilities of throwing odd numbers are all the same. The probabilities of throwing even numbers are all the same. The probability of throwing an odd number is twice the probability of throwing an even number.

(i) Find the probability of throwing a 3. [3]

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(ii) The die is thrown three times. Find the probability of throwing two 5s and one 4. [3]

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(iii) The die is thrown 100 times. Use an approximation to find the probability that an even number is thrown at most 37 times. [5]

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