Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

2211393414

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **May/June 2021**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
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INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
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This document has **16** pages.

1 Anya scans an image into her computer for a school project.

(a) The scanned image is a bitmapped image.

(i) Complete the following table to describe the two terms about graphics.

Term	Description
Pixel	....
File header	....

[2]

(ii) The image is scanned with an image resolution of 1024 × 512 pixels, and a colour depth of 8 bits per pixel.

Calculate an estimate for the file size, giving your answer in mebibytes. Show your working.

Working .....

.....

.....

.....

Answer ..... mebibytes

[3]

(b) The image is compressed using lossless compression.

Identify **one** method of lossless compression that can be used to compress the image **and** describe how the method will reduce the file size.

Lossless compression method .....

Description .....

.....

.....

.....

.....

[3]

(c) One of the colours used in the image has the hexadecimal colour code:

`#FC238A`

`FC` is the amount of red, `23` is the amount of green and `8A` is the amount of blue in the colour.

(i) Convert the hexadecimal code `FC` into denary.

..... [1]

(ii) The amount of green in binary is `00100011`. This has the denary number `15` added to it to create a second colour.

Add the denary number `15` to the binary number `00100011` and give your answer in binary.

Perform the addition in binary. Show your working.

Working .....

.....

.....

.....

.....

Answer (in binary) .....

[3]

(iii) Hexadecimal `23` in two's complement representation is `00100011`. The denary number `10` needs to be subtracted from this value.

Subtract the denary number `10` from the two's complement representation `00100011`.

Give your answer in binary. Show your working.

Working .....

.....

.....

.....

.....

Answer (in binary) .....

[3]

(d) Anya made sure that the image was not subject to any copyright before scanning it.

Describe what is meant by **copyright**.

.....

.....

.....

..... [2]

2 Bingwen's computer comes with an Operating System and utility software.

(a) Draw **one** line from each utility software to its correct description.

Utility software	Description
	Scans software for errors and repairs the problems
Disk formatter	Moves parts of files so that each file is contiguous in memory
Defragmentation	Creates a copy of data that is no longer required
Back-up	Sets up a disk so it is ready to store files
Disk repair	Scans for errors in a disk and corrects them
	Creates a copy of data in case the original is lost

[4]

(b) Identify **four** key management tasks that the Operating System will perform.

1 .....

2 .....

3 .....

4 .....

[4]

3 A processor has one general purpose register, the Accumulator (ACC), and several special purpose registers.

(a) Complete the following description of the role of the registers in the fetch-execute cycle by writing the missing registers.

The ..... holds the address of the next instruction to be loaded. This address is sent to the ..... .

The ..... holds the data fetched from this address.

This data is sent to the ..... and the Control Unit decodes the instruction's opcode.

The ..... is incremented.

[5]

(b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing: The address to be used is at the given address. Load the contents of this second address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
MOV	<register>	Move the contents of the accumulator to the given register (IX)
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are shown.

Address	Instruction
200	LDD 365
201	CMP 366
202	JPE 209
203	INC ACC
204	STO 365
205	MOV IX
206	LDX 365
207	OUT
208	JMP 200
209	END
...	
365	1
366	3
367	65
368	66
IX	0

ASCII code table (selected codes only)

ASCII code	Character
65	A
66	B
67	C
68	D

Complete the trace table for the program currently in main memory.

Instruction address	ACC	Memory address				IX	Output
		365	366	367	368		
		1	3	65	66	0	

[6]

(c) (i) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1

Write the contents of the Accumulator after the processor has executed the following instruction:

```
LSL #2
```


[1]

(ii) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1

Identify the mathematical operation that the following instruction will perform on the contents of the accumulator.

```
LSR #3
```

.....

..... [1]

4 Melinda and her friends set up a peer-to-peer network between their computers to share data.

(a) Describe the key features of a peer-to-peer network.

.....

.....

.....

..... [2]

(b) Describe **two** drawbacks to Melinda and her friends of using a peer-to-peer network.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(c) Melinda connects her laptop to the internet through her router.

(i) Tick (✓) **one** box in each row to identify whether the task is performed by the router or not.

Task	Performed by router	Not performed by router
Receives packets from devices		
Finds the IP address of a Uniform Resource Locator (URL)		
Directs each packet to all devices attached to it		
Stores the IP and/or MAC address of all devices attached to it		

[2]

(ii) Melinda mainly uses the internet to watch films and play computer games.

Tick (✓) **one** box to identify whether Melinda should connect to the router using a wired or wireless network **and** justify your choice.

Wired	
Wireless	

Justification .....

.....

.....

.....

.....

..... [3]

(d) Melinda sends emails from her webmail account (email account accessed through a website).

Explain whether Melinda is using the internet, or the World Wide Web (WWW), or both.

.....

.....

.....

.....

.....

..... [3]

5 Kiara has a washing machine and a refrigerator.

(a) She has an embedded system in her washing machine.

Describe what is meant by an **embedded system**, using the washing machine as an example.

.....

.....

.....

..... [2]

(b) The washing machine's embedded system makes use of both Random Access Memory (RAM) and Read Only Memory (ROM).

State the purpose of RAM and ROM within the washing machine's embedded system.

RAM .....

.....

ROM .....

.....
[2]

(c) The temperature in her refrigerator must be kept between 4 and 6 degrees Celsius.

The microprocessor in the refrigerator turns on the cooling if the temperature is too high, and turns off the cooling if the temperature is too low.

Explain why the system in the refrigerator is a control and not a monitoring system.

.....

.....

.....

.....

.....

..... [2]

6 Each of the following algorithms performs data validation.

State the type of validation check that each of the algorithms performs.

(a)

```
INPUT x
IF x < 0 OR x > 10 THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

(b)

```
INPUT x
IF x = "" THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

(c)

```
INPUT x
IF NOT(x = "Red" OR x = "Yellow" OR x = "Blue") THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

7 Bobby and Kim are discussing databases.

(a) Bobby tells Kim that a file-based approach is usually better than a relational database.

Explain why Bobby is incorrect.

.....

.....

.....

.....

.....

..... [3]

(b) Bobby has a shop that sells products to customers. His database will store data about his customers, their payment details, orders and the products he sells. Customers will have login details to access their accounts. The database will update customers' payment and login details without keeping any historical records.

(i) Give **one** example of each of the following relationships from Bobby's database.

one-to-one

.....

.....

one-to-many

.....

.....

many-to-many

.....

.....

[3]

(ii) Tick (✓) **one** box to identify the relationship that cannot be directly implemented in a normalised relational database.

Relationship	**Tick** (✓)
one-to-one	
one-to-many	
many-to-many	

[1]

(iii) Bobby wants to name his database `SHOPORDERS`.

Write a Data Definition Language (DDL) statement to define a new database with the name `SHOPORDERS`.

.....

..... [1]

(c) A database has a data dictionary.

Give **three** items that are stored in a data dictionary.

1 .....

2 .....

3 .....

[3]

8 Tick (✓) **one** box in each row to identify the logic gate that each statement describes.

Statement	AND	NAND	NOR	XOR	OR
The output is 1 only when both inputs are 1					
The output is 1 only when both inputs are different					
The output is 1 only when both inputs are 0					

[3]

Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3014994841

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **May/June 2021**

1 hour 30 minutes

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1 Raj owns houses that other people rent from him. He has a database that stores details about the people who rent houses, and the houses they rent. The database, HOUSE_RENTALS, has the following structure:

CUSTOMER(CustomerID, FirstName, LastName, DateOfBirth, Email)

HOUSE(HouseID, HouseNumber, Road, Town, Bedrooms, Bathrooms)

RENTAL(RentalID, CustomerID, HouseID, MonthlyCost, DepositPaid)

(a) Give the definition of the following database terms, using an example from the database HOUSE_RENTALS for each definition.

Term	Definition and example
Field	....
Entity	....
Foreign key	....

[6]

(b) Tick (✓) **one** box to identify whether the database HOUSE_RENTALS is in Third Normal Form (3NF) or not in 3NF.
Justify your choice using one or more examples from the database HOUSE_RENTALS.

In 3NF	
Not in 3NF	

Justification .....

.....

.....

..... [2]

(c) Example data from the table `RENTAL` are given:

RentalID	CustomerID	HouseID	MonthlyCost	DepositPaid
1	22	15B5L	1000.00	Yes
2	13	3F	687.00	No
3	1	12AB	550.00	Yes
4	3	37	444.50	Yes

(i) Complete the following Data Definition Language (DDL) statement to define the table `RENTAL`.

```
CREATE ..... ..... (
      RentalID INTEGER NOT NULL,
      CustomerID INTEGER NOT NULL,
      HouseID ..... (5) NOT NULL,
      MonthlyCost ..... NOT NULL,
      DepositPaid BOOLEAN NOT NULL,
      ..... (RentalID)
);
```

[4]

(ii) Write a Data Manipulation Language (DML) script to return the first name and last name of all customers who have **not** paid their deposit.

.....

.....

.....

.....

.....

..... [4]

2 Aisha manages a team of software developers.

(a) Explain the reasons why it is important that Aisha acts ethically in relation to her team members.

.....

.....

.....

..... [2]

(b) The team are developing a computer game where the user plays a board game (such as chess) against the computer.

Describe how the computer would use Artificial Intelligence (AI) to play the board game.

.....

.....

.....

.....

.....

..... [3]

(c) The final game will be released under a licence.

Tick (✓) **one or more** boxes in each row to identify the licence(s) each statement describes.

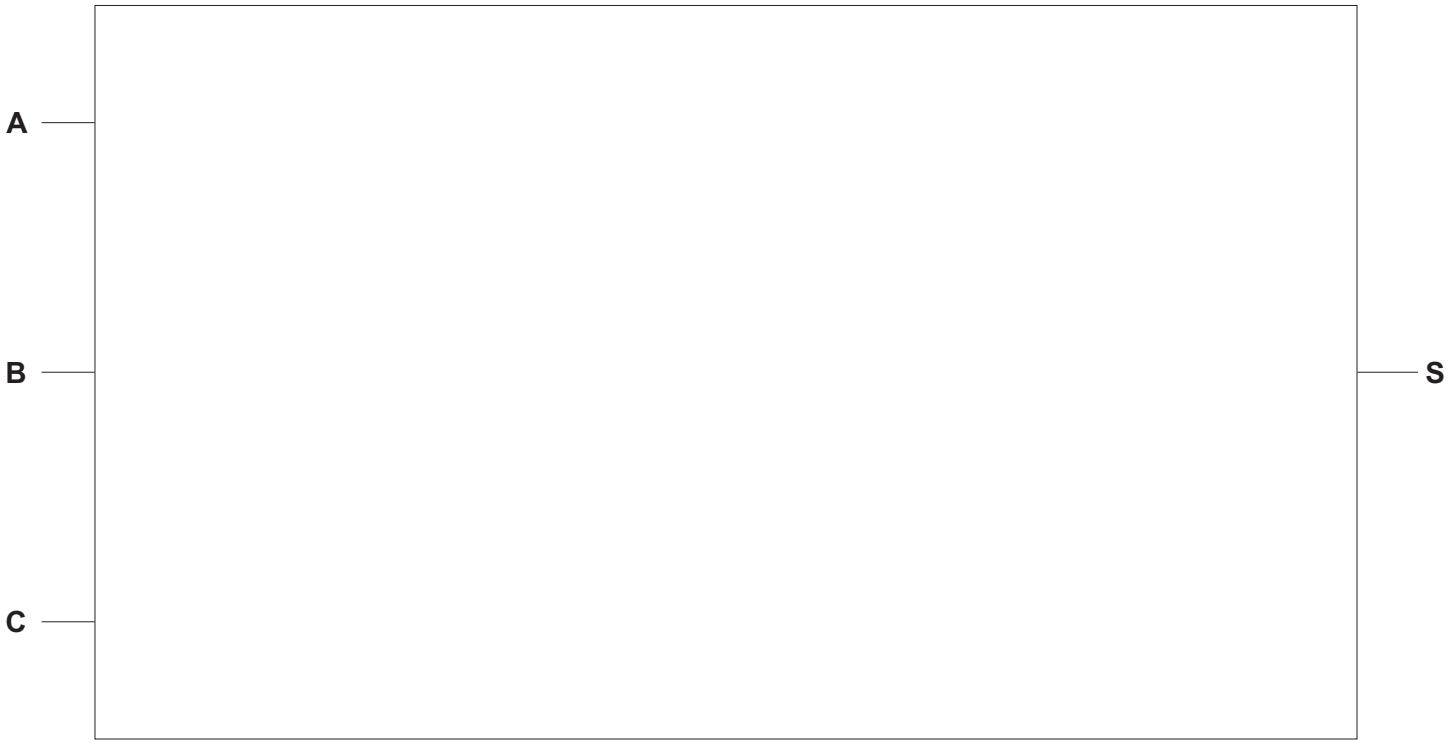
Statement	Free Software Foundation	Open Source Initiative	Shareware	Commercial Software
The user can edit the source code				
The user **must** always pay before being able to use the software				
The user can redistribute the software				
The user always gets a trial period				

[4]

3 A logic expression is given:

S = (**A** AND **B** AND **C**) OR (**B** XOR **C**)

(a) Draw the logic circuit for the given expression.



[4]

(b) Complete the truth table for the logic expression:

S = (**A** AND **B** AND **C**) OR (**B** XOR **C**)

A	B	C	Working space	S
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

4 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
DEC	<register>	Subtract 1 from the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
# denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are:

Address	Instruction
70	IN
71	CMP 100
72	JPE 80
73	CMP 101
74	JPE 76
75	JMP 80
76	LDD 102
77	INC ACC
78	STO 102
79	JMP 70
80	LDD 102
81	DEC ACC
82	STO 102
83	JMP 70
...	
100	68
101	65
102	100

ASCII code table (selected codes only)

ASCII code	Character
65	A
66	B
67	C
68	D

(a) Complete the trace table for the program currently in main memory when the following characters are input:

```
A D
```

Do not trace the program any further when the third input is required.

Instruction address	ACC	Memory address		
		100	101	102
		68	65	100

[4]

(b) Some bit manipulation instructions are shown in the table:

Instruction		Explanation
Opcode	**Operand**	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The contents of the memory address 300 are shown:

Bit Number	7	6	5	4	3	2	1	0
300	0	1	1	0	0	1	1	0

(i) The contents of memory address 300 represent an unsigned binary integer.

Write the denary value of the unsigned binary integer in memory address 300.

..... [1]

(ii) An assembly language program needs to test if bit number 2 in memory address 300 is a 1.

Complete the assembly language instruction to perform this test.

..... #4

[1]

(iii) An assembly language program needs to set bit numbers 4, 5, 6 and 7 to 0, but keep bits 0 to 3 with their existing values.

Write the assembly language instruction to perform this action.

.....

..... [2]

5 Seth uses a computer for work.

(a) Complete the following descriptions of internal components of a computer by writing the missing terms.

The ..... transmits the signals to coordinate events based on the electronic pulses of the ..... .

The ..... carries data to the components, while the ..... carries the address where data needs to be written to or read from.

The ..... performs mathematical operations and logical comparisons.

[5]

(b) Describe the ways in which the following factors can affect the performance of his laptop computer.

Number of cores

.....

.....

.....

.....

Clock speed

.....

.....

.....

.....

[4]

(c) Seth accesses both software and data using cloud computing.

(i) Give **two** benefits of storing data using cloud computing.

1 .....

.....

2 .....

.....

[2]

(ii) Give **two** drawbacks of Seth using cloud computing.

1 .....

.....

2 .....

.....

[2]

(d) Draw **one** line from each term to its **most appropriate** description.

Term	Description
Public IP address	It is only visible to devices within the Local Area Network (LAN)
Private IP address	It increments by 1 each time the device connects to the internet
Dynamic IP address	A new one is reallocated each time a device connects to the internet
Static IP address	It can only be allocated to a router
	It is visible to any device on the internet
	It does not change each time a device connects to the internet

[4]

6 A computer uses the ASCII character set.

(a) State the number of characters that can be represented by the ASCII character set and the extended ASCII character set.

ASCII .....

Extended ASCII .....

[2]

(b) Explain how a word such as 'HOUSE' is represented by the ASCII character set.

.....

.....

.....

..... [2]

(c) Unicode is a different character set.

The Unicode value for the character '1' is denary value 49.

(i) Write the hexadecimal value for the Unicode character '1'.

..... [1]

(ii) Write the denary value for the Unicode character '5'.

..... [1]

7 Jennifer is writing a computer program for her A Level homework.

(a) Jennifer uses a program library to help her write her computer program.

Describe how a program library can be used while writing a computer program.

.....

.....

.....

..... [2]

(b) Jennifer uses an Integrated Development Environment (IDE) to write her computer program.

(i) The IDE allows Jennifer to use both an interpreter and a compiler while creating her computer program.

Describe the ways in which Jennifer can use **both** a compiler **and** an interpreter while developing the program.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) Identify **two** debugging tools that a typical IDE can provide.

1 .....

.....

2 .....

.....
[2]

8 A company has several security measures in place to prevent unauthorised access to the data on its computers.

(a) Describe the difference between the security and privacy of data.

.....

.....

.....

..... [2]

(b) Each employee has a username and password to allow them to log onto a computer. An employee's access rights to the data on the computers is set to either read-only, or read and write.

Identify **one** other software-based measure that could be used to restrict the access to the data on the computers.

.....

..... [1]

(c) The company is also concerned about threats posed by networks and the internet.

Identify **two** threats to the data that are posed by networks and the internet.

Threat 1 .....

.....

Threat 2 .....

.....

[2]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7002132446

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **May/June 2021**

1 hour 30 minutes

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(i) Complete the following table to describe the two terms about graphics.

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File header	....

[2]

(ii) The image is scanned with an image resolution of 1024 × 512 pixels, and a colour depth of 8 bits per pixel.

Calculate an estimate for the file size, giving your answer in mebibytes. Show your working.

Working .....

.....

.....

.....

Answer ..... mebibytes

[3]

(b) The image is compressed using lossless compression.

Identify **one** method of lossless compression that can be used to compress the image **and** describe how the method will reduce the file size.

Lossless compression method .....

Description .....

.....

.....

.....

.....

[3]

(c) One of the colours used in the image has the hexadecimal colour code:

`#FC238A`

`FC` is the amount of red, `23` is the amount of green and `8A` is the amount of blue in the colour.

(i) Convert the hexadecimal code `FC` into denary.

..... [1]

(ii) The amount of green in binary is `00100011`. This has the denary number `15` added to it to create a second colour.

Add the denary number `15` to the binary number `00100011` and give your answer in binary.

Perform the addition in binary. Show your working.

Working .....

.....

.....

.....

.....

Answer (in binary) .....

[3]

(iii) Hexadecimal `23` in two's complement representation is `00100011`. The denary number `10` needs to be subtracted from this value.

Subtract the denary number `10` from the two's complement representation `00100011`.

Give your answer in binary. Show your working.

Working .....

.....

.....

.....

.....

Answer (in binary) .....

[3]

(d) Anya made sure that the image was not subject to any copyright before scanning it.

Describe what is meant by **copyright**.

.....

.....

.....

..... [2]

2 Bingwen's computer comes with an Operating System and utility software.

(a) Draw **one** line from each utility software to its correct description.

Utility software	Description
	Scans software for errors and repairs the problems
Disk formatter	Moves parts of files so that each file is contiguous in memory
Defragmentation	Creates a copy of data that is no longer required
Back-up	Sets up a disk so it is ready to store files
Disk repair	Scans for errors in a disk and corrects them
	Creates a copy of data in case the original is lost

[4]

(b) Identify **four** key management tasks that the Operating System will perform.

1 .....

2 .....

3 .....

4 .....

[4]

3 A processor has one general purpose register, the Accumulator (ACC), and several special purpose registers.

(a) Complete the following description of the role of the registers in the fetch-execute cycle by writing the missing registers.

The ..... holds the address of the next instruction to be loaded. This address is sent to the ..... .

The ..... holds the data fetched from this address.

This data is sent to the ..... and the Control Unit decodes the instruction's opcode.

The ..... is incremented.

[5]

(b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
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LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing: The address to be used is at the given address. Load the contents of this second address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
MOV	<register>	Move the contents of the accumulator to the given register (IX)
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute address or a symbolic address # denotes a denary number, e.g. #123		

The current contents of the main memory and selected values from the ASCII character set are shown.

Address	Instruction
200	LDD 365
201	CMP 366
202	JPE 209
203	INC ACC
204	STO 365
205	MOV IX
206	LDX 365
207	OUT
208	JMP 200
209	END
...	
365	1
366	3
367	65
368	66
IX	0

ASCII code table (selected codes only)

ASCII code	Character
65	A
66	B
67	C
68	D

Complete the trace table for the program currently in main memory.

Instruction address	ACC	Memory address				IX	Output
		365	366	367	368		
		1	3	65	66	0	

[6]

(c) (i) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1

Write the contents of the Accumulator after the processor has executed the following instruction:

```
LSL #2
```


[1]

(ii) The Accumulator currently contains the binary number:

0	0	1	1	0	1	0	1

Identify the mathematical operation that the following instruction will perform on the contents of the accumulator.

```
LSR #3
```

.....

..... [1]

4 Melinda and her friends set up a peer-to-peer network between their computers to share data.

(a) Describe the key features of a peer-to-peer network.

.....

.....

.....

..... [2]

(b) Describe **two** drawbacks to Melinda and her friends of using a peer-to-peer network.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(c) Melinda connects her laptop to the internet through her router.

(i) Tick (✓) **one** box in each row to identify whether the task is performed by the router or not.

Task	Performed by router	Not performed by router
Receives packets from devices		
Finds the IP address of a Uniform Resource Locator (URL)		
Directs each packet to all devices attached to it		
Stores the IP and/or MAC address of all devices attached to it		

[2]

(ii) Melinda mainly uses the internet to watch films and play computer games.

Tick (✓) **one** box to identify whether Melinda should connect to the router using a wired or wireless network **and** justify your choice.

Wired	
Wireless	

Justification .....

.....

.....

.....

.....

..... [3]

(d) Melinda sends emails from her webmail account (email account accessed through a website).

Explain whether Melinda is using the internet, or the World Wide Web (WWW), or both.

.....

.....

.....

.....

.....

..... [3]

5 Kiara has a washing machine and a refrigerator.

(a) She has an embedded system in her washing machine.

Describe what is meant by an **embedded system**, using the washing machine as an example.

.....

.....

.....

..... [2]

(b) The washing machine's embedded system makes use of both Random Access Memory (RAM) and Read Only Memory (ROM).

State the purpose of RAM and ROM within the washing machine's embedded system.

RAM .....

.....

ROM .....

.....
[2]

(c) The temperature in her refrigerator must be kept between 4 and 6 degrees Celsius.

The microprocessor in the refrigerator turns on the cooling if the temperature is too high, and turns off the cooling if the temperature is too low.

Explain why the system in the refrigerator is a control and not a monitoring system.

.....

.....

.....

.....

.....

..... [2]

6 Each of the following algorithms performs data validation.

State the type of validation check that each of the algorithms performs.

(a)

```
INPUT x
IF x < 0 OR x > 10 THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

(b)

```
INPUT x
IF x = "" THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

(c)

```
INPUT x
IF NOT(x = "Red" OR x = "Yellow" OR x = "Blue") THEN
  OUTPUT "Invalid"
ENDIF
```

..... [1]

7 Bobby and Kim are discussing databases.

(a) Bobby tells Kim that a file-based approach is usually better than a relational database.

Explain why Bobby is incorrect.

.....

.....

.....

.....

.....

..... [3]

(b) Bobby has a shop that sells products to customers. His database will store data about his customers, their payment details, orders and the products he sells. Customers will have login details to access their accounts. The database will update customers' payment and login details without keeping any historical records.

(i) Give **one** example of each of the following relationships from Bobby's database.

one-to-one

.....

.....

one-to-many

.....

.....

many-to-many

.....

.....

[3]

(ii) Tick (✓) **one** box to identify the relationship that cannot be directly implemented in a normalised relational database.

Relationship	**Tick** (✓)
one-to-one	
one-to-many	
many-to-many	

[1]

(iii) Bobby wants to name his database `SHOPORDERS`.

Write a Data Definition Language (DDL) statement to define a new database with the name `SHOPORDERS`.

.....

..... [1]

(c) A database has a data dictionary.

Give **three** items that are stored in a data dictionary.

1 .....

2 .....

3 .....

[3]

8 Tick (✓) **one** box in each row to identify the logic gate that each statement describes.

Statement	AND	NAND	NOR	XOR	OR
The output is 1 only when both inputs are 1					
The output is 1 only when both inputs are different					
The output is 1 only when both inputs are 0					

[3]

Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

7938385792

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **May/June 2022**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

1 Computers store data in binary form.

(a) State the difference between a tebibyte and a terabyte.

.....

..... [1]

(b) Convert the signed denary value –100 into an 8-bit two's complement binary integer.

Working .....

.....

Answer ..... [1]

(c) Convert the denary number 251 into hexadecimal. Show your working.

Working .....

.....

.....

.....

Answer .....

[2]

(d) Add the following unsigned binary integers.

```
  0 1 0 1 0 0 0 0
+ 0 0 1 1 1 1 1 0
```

[1]

2 A computer has hardware and software.

(a) The hardware includes different types of memory.

(i) Complete the description of computer memory.

Random Access Memory (RAM) and Read Only Memory (ROM) are both examples of

..... memory.

One item that is stored in RAM is ..... .

One item that is stored in ROM is ..... .

RAM can be either Static RAM (SRAM) or Dynamic RAM (DRAM).

SRAM uses transistors arranged as ..... .

DRAM uses transistors and ..... .

[5]

(ii) Explain the difference between Programmable ROM (PROM), Erasable Programmable ROM (EPROM) and Electrically Erasable Programmable ROM (EEPROM).

.....

.....

.....

.....

.....

..... [3]

(b) A magnetic hard disk is used to store data on the computer.

Describe the principal operations of a magnetic hard disk.

.....

.....

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..... [5]

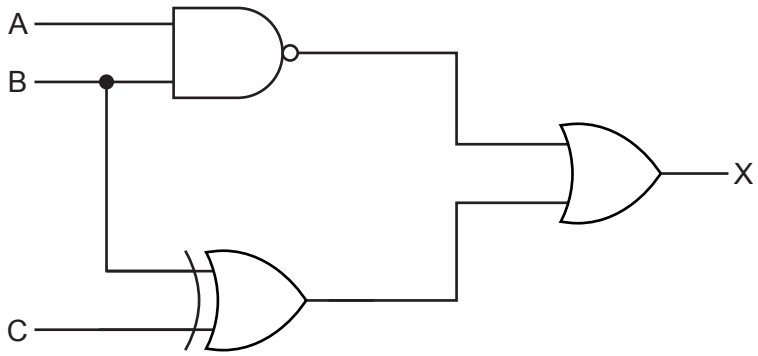
(c) Computers consist of logic gates.

(i) Complete the table by writing **one** set of values (input 1 and input 2) for each gate that will give the output 1.

Gate	Input 1	Input 2	Output
AND			1
NAND			1
XOR			1
NOR			1

[4]

(ii) Write the logic expression for the given logic circuit.



.....

.....

..... [3]

3 A teacher is writing examination papers on a laptop computer. The computer is connected to the internet. The teacher is concerned about the security and privacy of the papers.

(a) State the difference between the security of data and the privacy of data.

.....

.....

..... [1]

(b) Identify **and** describe **two** threats to the data. Identify **one** security measure to protect against each threat. Each security measure must be different.

Threat 1 .....

Description .....

.....

Security measure .....

Threat 2 .....

Description .....

.....

Security measure .....

[6]

4 A teacher uses a relational database, MARKS, to store data about students and their test marks.

The database has the following structure:

STUDENT(StudentID, FirstName, LastName)

TEST(TestID, Description, TotalMarks)

STUDENT_TEST(StudentID, TestID, Mark)

(a) Describe the advantages of using a relational database compared to a file-based approach.

.....

.....

.....

.....

.....

.....

.....

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.....

..... [4]

(b) Give the highest level of Normal Form (NF) the database MARKS is in **and** justify your choice.

Normal Form .....

Justification .....

.....

.....

[3]

(c) (i) Sample data to be stored in the table `STUDENT_TEST` is shown.

StudentID	TestID	Mark
12	A1	50
12	P10	100
13	A1	75
14	P10	60

Write a Structured Query Language (SQL) script to create the table `STUDENT_TEST`.

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(ii) Write a Structured Query Language (SQL) script to find the average mark of students in test A7.

.....

.....

.....

.....

.....

..... [3]

(d) The mark a student is awarded in a test will be entered into the database. This mark needs to be a whole number between 0 and the maximum number of marks for that test (inclusive).

Explain how data validation **and** data verification can be used when a mark is entered.

.....

.....

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.....

..... [4]

5 A programmer uses an Integrated Development Environment (IDE) to develop a program.

(a) Draw **one** line from each IDE feature to its correct description.

IDE feature	Description
Context-sensitive prompt	Executes one line of the program and then stops
Dynamic syntax check	Underlines or highlights statements that do not meet the rules of the language
Breakpoint	Outputs the contents of variables and data structures
Single stepping	Stops the code executing at a set line
Report window	Displays predictions of the code being entered

[4]

(b) The programmer wants to allow users to edit, improve and redistribute the program.

Identify **two** different types of software licence that the programmer could use.

1 .....

2 .....

[2]

(c) Explain the benefits to the programmer of using program libraries.

.....

.....

.....

.....

.....

.....

.....

..... [3]

6 **(a)** A computer system is designed using the basic Von Neumann model.

(i) Describe the role of the registers in the Fetch-Execute (F-E) cycle.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(ii) Describe when interrupts are detected in the F-E cycle **and** how the interrupts are handled.

Detected .....

.....

Handled .....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[5]

(b) Identify **one** factor that can affect the performance of the computer system **and** state how it impacts the performance.

Factor .....

Impact .....

.....

.....

[2]

Question 6 continues on the next page.

(c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
`AND`	`#n`	Bitwise AND operation of the contents of ACC with the operand
`XOR`	`#n`	Bitwise XOR operation of the contents of ACC with the operand
`OR`	`#n`	Bitwise OR operation of the contents of ACC with the operand
`LSL`	`#n`	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
`LSR`	`#n`	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
# denotes a denary number, e.g. #123		

(i) Complete the register to show the result **after** the instruction `AND #2` is executed.

Register before:	0	1	1	0	1	1	0	1
Register after:								

[1]

(ii) Complete the register to show the result **after** the instruction `OR #8` is executed.

Register before:	0	1	1	0	1	1	0	1
Register after:								

[1]

(iii) Complete the register to show the result **after** the operation `LSL #4` is executed.

Register before:	0	1	1	0	1	1	0	1
Register after:								

[1]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
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4708712398

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **May/June 2022**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
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- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
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INFORMATION

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This document has **16** pages. Any blank pages are indicated.

1 **(a)** Draw **one** line from each image representation term to its correct definition.

Term	Definition
Pixel	The number of pixels wide by the number of pixels high
Bit depth	The smallest identifiable component of an image
Image resolution	Stores data about the image file, e.g. file format, number of bits per pixel, file size
File header	The number of bits used to represent each colour

[3]

(b) The following section of a bitmap image is 10 pixels wide and 5 pixels high. In this example, each colour is represented by a letter, e.g. B is blue.

B	B	B	B	B	B	B	B	B	B
Y	Y	P	Y	Y	Y	P	Y	Y	Y
R	R	M	R	P	K	T	T	R	R
B	O	P	Y	Y	Y	P	G	P	P
R	O	R	P	P	P	R	R	R	R

The complete image can have up to 256 colours.

(i) Identify the smallest number of bits that can be used to represent each colour in the complete bitmap image.

..... [1]

(ii) Calculate an estimate for the file size of the section of the bitmap image shown, giving your answer in bytes. Use your answer from **part (b)(i)**.

Show your working.

Working .....

.....

.....

.....

Answer ..... bytes

[2]

(c) Describe how changing the colour depth of an image affects its file size.

.....

.....

.....

..... [2]

(d) The first row of pixels in the image from **part (b)** is shown:

B	B	B	B	B	B	B	B	B	B

Explain how this row of pixels can be compressed using lossless compression.

.....

.....

.....

..... [2]

[Turn over

2 A car has several features.

(a) One feature is a lane detection system. This system monitors the lines on either side of the lane. If the car gets too close to one line, the system automatically moves the car away from the line.

Explain why the lane detection system is an example of an embedded system.

.....

.....

.....

..... [2]

(b) Two other features:

- record the number of miles travelled in the current journey, from when the engine is turned on to when it is turned off
- record the total number of miles the car has travelled since it was built.

Identify the data that will be stored in the primary **and** secondary storage of the car for these **two** features.

Primary .....

.....

Secondary .....

.....

[2]

(c) The car has a resistive touchscreen for the user to select options.

Tick (✓) **one** box in each row to show whether each statement about a resistive touchscreen is true or false.

Statement	True	False
The screen always has five different layers		
A processor determines the horizontal and vertical coordinates of the point of contact		
The touchscreen will work if any object touches the screen		

[1]

3 The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123		

(a) The ACC currently contains the following positive binary integer:

0	1	1	0	0	1	0	1

Write the bit manipulation instruction that would change the binary integer in ACC to:

1	1	1	1	1	1	1	1

Opcode ..... Operand .....

[2]

(b) The ACC currently contains the following positive binary integer:

0	1	1	0	0	1	0	1

Write the bit manipulation instruction that would change the binary integer in ACC to:

1	0	0	1	1	0	1	0

Opcode ..... Operand .....

[2]

(c) Convert the following positive binary integer into hexadecimal.

0 1 1 1 1 1 1 0

..... [1]

(d) A **three-place logical shift** to the **left** is performed on the following positive binary integer.

Show the result of this logical shift.

0 1 1 1 1 1 1 0

..... [1]

(e) Convert the denary numbers 127 and 12 to 8-bit binary and then perform the subtraction 12 − 127 in binary.

Show your working.

127 in binary .....

12 in binary .....

12 − 127 in binary .....

.....

.....

.....

.....

[3]

4 A school stores personal data about its staff and students on its computer system.

(a) Explain why the school needs to keep both its data **and** its computer system secure from unauthorised access.

Data .....

.....

Computer system .....

.....

[2]

(b) Complete the table by identifying **two** security threats to the data on a computer.

Describe each threat.

Give a different prevention method for each threat.

Threat	Description	Prevention method
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

[6]

(c) Data is encrypted when it is transmitted within the school network, or externally such as over the internet.

Describe what is meant by encryption **and** explain why it is used.

.....

.....

.....

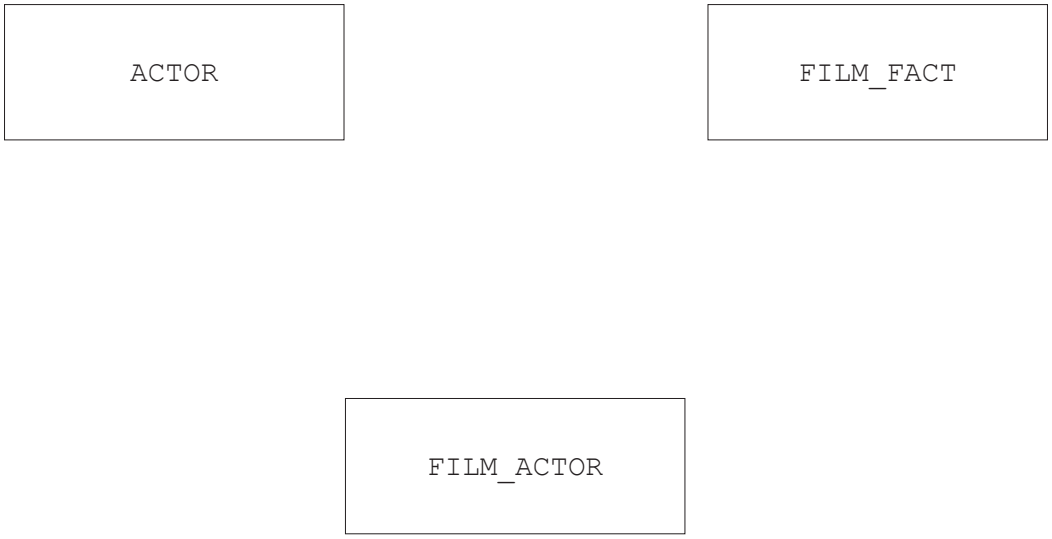
..... [2]

5 A database, FILMS, stores information about films and actors.

Part of the database is shown:

ACTOR(ActorID, FirstName, LastName, DateOfBirth)
FILM_FACT(FilmID, FilmTitle, ReleaseDate, Category)
FILM_ACTOR(ActorID, FilmID)

(a) Complete the entity-relationship (E-R) diagram.



[2]

(b) A composite primary key consists of two or more attributes that together form the primary key.

Explain why the table FILM_ACTOR has a composite primary key.

.....

.....

.....

..... [2]

(c) Complete the SQL script to return the IDs of all the actors in the film with the title Cinderella.

```
SELECT .....

FROM FILM_ACTOR

INNER JOIN .....

ON FILM_FACT.FilmID = .....

WHERE FILM_FACT.FilmTitle = ..... ;
```

[4]

(d) Write an SQL script to count the number of films that were released in January 2022.

.....

.....

.....

.....

.....

..... [3]

(e) A Database Management System (DBMS) is used to create and manipulate the database.

Complete the descriptions of the features and tools found in a DBMS using the given terms. Not all terms will be used.

Boolean	**data dictionary**	**data redundancy**	**field names**
input	**interface**	**logical schema**	**normalisation**
operating system	**output**	**primary keys**	**query**
structure			

A DBMS provides data management. This includes the development of a

..... that stores information about the data stored, such as

..... and ..... .

The ..... uses methods, such as an E-R diagram, to show the structure of the database and its relationships.

The ..... processor allows a user to perform searches to find specific data. The DBMS also provides a developer ..... that allows the user to create tables, forms and reports.

[6]

6 A programmer uses language translators when writing and testing a program.

(a) Describe the operation of a compiler.

.....

.....

.....

..... [2]

(b) Describe the operation of an interpreter.

.....

.....

.....

..... [2]

(c) Explain how a programmer can make use of a typical Integrated Development Environment (IDE) when writing **and** testing a program.

Writing .....

.....

.....

.....

Testing .....

.....

.....

.....

[4]

7 Complete the truth table for the following logic expression:

X = (**A** XOR **B**) AND NOT **C**

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

8 Describe **one** application of Artificial Intelligence (AI).

.....

.....

.....

.....

.....

..... [3]

9 **(a)** The following incomplete table contains four network devices and their descriptions.

Complete the table by writing the missing devices and missing descriptions.

Device	Description
.....	Receives and sends data between two networks operating on the same protocol
Wireless Network Interface Card (WNIC)	....
.....	Restores the digital signal so it can be transmitted over greater distances
Wireless Access Point (WAP)	....

[4]

(b) Describe **three** differences between fibre-optic cables and copper cables.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(c) Ethernet uses Carrier Sense Multiple Access/Collision Detection (CSMA/CD).

Describe CSMA/CD.

.....

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.....

.....

..... [4]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4158944315

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **May/June 2022**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
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- You may use an HB pencil for any diagrams, graphs or rough working.
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INFORMATION

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This document has **16** pages. Any blank pages are indicated.

1 Text and numbers are examples of data stored in a computer.

(a) A character set is used to represent characters in a computer.

(i) Describe what is meant by a **character set**.

.....

.....

.....

.....

.....

..... [2]

(ii) Identify **two** character sets and state **one** difference between them.

Character set 1 .....

Character set 2 .....

Difference .....

.....

[3]

(iii) Describe how lossless compression can be used to reduce the file size of a text file.

.....

.....

.....

.....

.....

..... [2]

(iv) Explain why lossy compression should **not** be used on a text file.

.....

.....

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.....

..... [2]

(b) A computer can represent numerical data in different forms.

Complete the table by writing the answer to each statement.

Statement	Answer
The hexadecimal value 11 represented in denary	
The smallest denary number that can be represented by an unsigned 8-bit binary integer	
The denary number 87 represented in Binary Coded Decimal (BCD)	
The denary number 240 represented in hexadecimal	
The denary number –20 represented in 8-bit two's complement binary	

[5]

Working space

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2 **(a)** The Fetch-Execute (F-E) cycle is represented in register transfer notation.

Describe each of the given steps.

Step	Description
PC ← [PC] + 1	....
MDR ← [[MAR]]	....
MAR ← [PC]	....

[3]

(b) Explain how interrupts are handled during the F-E cycle.

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..... [5]

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3 (a) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDI	<address>	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

The current contents of main memory are:

Address	
100	101
101	67
102	104
103	100
104	68

Complete the table by writing the value stored in the accumulator after the execution of each instruction.

Instruction	Accumulator
LDM #103	
LDD 102	
LDI 103	

[3]

(b) The instructions in **part (a)** are examples of the data movement group.

Describe **two other** instruction groups.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(c) The table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC).

Instruction		Explanation
Opcode	**Operand**	
AND	Bn	Bitwise AND operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the operand
B denotes a binary number, e.g. B01001010		

The binary value `00111101` is stored in the memory address 200.

Each instruction in the diagram is performed on the data in memory address 200.

Draw **one** line from each instruction to its correct result.

Instruction	Result
	01111101
XOR B11110000	00111101
OR B01010101	11111111
AND B11111111	11000010
	11001101

[3]

4 A computer has system software including an operating system.

(a) Describe the key management tasks of an operating system.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Utility software is a type of system software.

(i) Describe the purpose of back-up software and defragmentation software.

Back-up software .....

.....

.....

.....

Defragmentation software .....

.....

.....

.....

[4]

(ii) Give **one other** example of utility software.

..... [1]

5 A company wants to store data about its employees in a computer system. The owner of the company wants to ensure the security and integrity of the data.

(a) (i) State why data needs to be kept secure.

.....

..... [1]

(ii) One way the data stored in a computer can be kept secure is by using back-up software.

Give **two other** ways the data stored in a computer can be kept secure.

1 .....

.....

2 .....

.....
[2]

(b) The data about the employees is currently stored on paper. The data needs to be transferred into the computer system.

Data validation and verification are used to help maintain the integrity of the data.

(i) Identify **and** describe **one** method of data verification that can be used when transferring the data from paper to the computer.

Method .....

Description .....

.....

.....
[2]

(ii) The company needs to transfer the date of birth of each employee into the computer system.

Give **one** example of how each of the following data validation rules can be used to validate the date of birth when it is entered into the system.

Range check .....

.....

Presence check .....

.....

Length check .....

.....
[3]

(iii) Explain why the data in the system may **not** be correct even after validating and verifying the data.

.....

.....

.....

.....

.....

..... [2]

6 A relational database, TECHNOLOGY, stores data about the staff in a company and the computer devices used by the staff.

The database has the following tables:

STAFF(StaffID, FirstName, LastName, DateOfBirth, JobTitle)

DEVICE(DeviceID, Type, DatePurchased, StaffID)

(a) Describe the relationship between the two tables. Refer to the primary and foreign keys in your answer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The database uses a Data Definition Language (DDL) and Data Manipulation Language (DML).

(i) Complete the SQL script to return the number of devices stored in the database for the staff member with the first name 'Ali' and last name 'Khan'.

```
SELECT ..... (STAFF.StaffID)

FROM .....

INNER JOIN DEVICE

..... STAFF.StaffID = DEVICE.StaffID

WHERE STAFF.FirstName = 'Ali'

..... STAFF.LastName = 'Khan';
```

[4]

(ii) The table `DEVICE` needs a new attribute to store whether the device has been returned by the staff member, or not.

Write a Structured Query Language (SQL) script to insert the new attribute into the table `DEVICE`.

.....

.....

.....

..... [2]

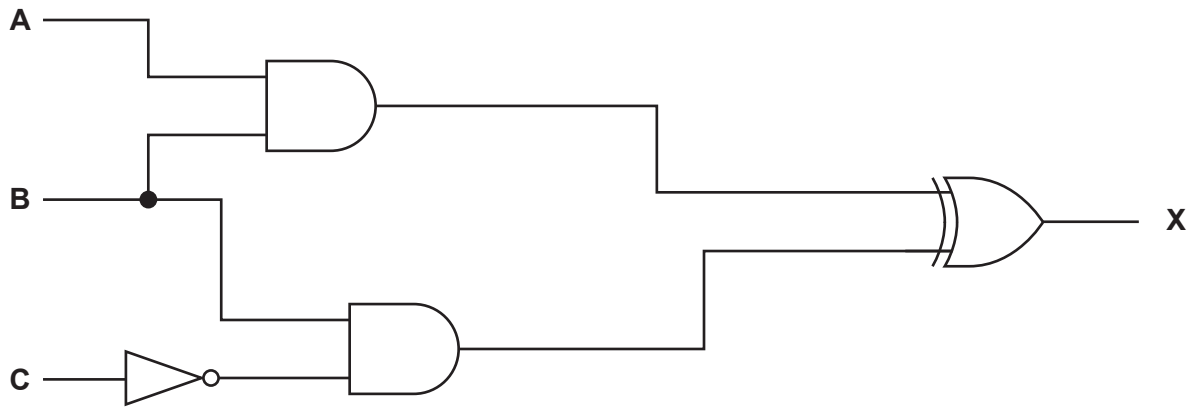
(c) The database is in Third Normal Form (3NF).

Complete the table by describing the three normal forms.

Normal Form	Description
First Normal Form (1NF)	....
Second Normal Form (2NF)	....
Third Normal Form (3NF)	....

[3]

7 **(a)** Write the logic expression for the following logic circuit.



.....

..... [3]

(b) Complete the truth table for the following logic expression:

X = (**A** NAND **B**) OR (**A** AND NOT **C**)

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

8 A company uses cloud computing.

(a) Define cloud computing.

.....

..... [1]

(b) State what is meant by a public cloud and a private cloud.

Public cloud .....

.....

Private cloud .....

.....
[2]

(c) Give **two** benefits and **one** drawback of using cloud computing.

Benefit 1 .....

.....

Benefit 2 .....

.....

Drawback .....

.....
[3]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0942416285

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **May/June 2023**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

1 Images are being created to advertise holidays.

Some of the images are bitmap images and some are vector graphics.

(a) Complete the table by defining the image terms.

Term	Definition
Drawing list	....
Pixel	....
Colour depth	....

[3]

(b) The bitmap images are photographs of the holiday locations.

(i) Colour depth and image resolution are both included in the file header of a bitmap image.

Identify **two other** items that could be included in the file header of each photograph.

1 .....

2 .....

[2]

(ii) One of the photographs has a bit depth of 8 bytes and an image resolution of 1500 pixels wide and 3000 pixels high.

Calculate the file size of the photograph in megabytes. Show your working.

Working .....

.....

.....

.....

File size ..... MB

[2]

(c) The photographs are compressed before they are uploaded to a web server. Customers download the photographs from this web server.

(i) Explain the reasons why compressing the photographs will benefit the customers.

.....

.....

.....

.....

.....

..... [3]

(ii) An image can be compressed using run-length encoding (RLE).

Explain the reasons why RLE may **not** reduce the file size of a bitmap image. Give **one** example in your answer.

.....

.....

.....

.....

.....

..... [3]

2 An organisation uses a database to store data about the types of bird that people have seen.

(a) The database is managed using a Database Management System (DBMS).

(i) State what is meant by a data dictionary **and** give **one** example of an item typically found in a data dictionary.

Definition .....

.....

Example .....

.....
[2]

(ii) State what is meant by data integrity **and** give **one** example of how this is implemented in a database.

Definition .....

.....

Example .....

.....
[2]

(b) The database, `Birds`, stores information about the types of bird and the people who have seen them.

Data about each bird seen is stored with its location and data about the person who saw the bird.

Database `Birds` has the following tables:

```
BIRD_TYPE(BirdID, Name, Size)

BIRD_SEEN(SeenID, BirdID, Date, Location, PersonID)

PERSON(PersonID, FirstName, LastName, EmailAddress)
```

(i) Complete the table by identifying **two** foreign keys and the database table where each is found.

Foreign key	Database table

[2]

(ii) The database `Birds` has been normalised.

Draw **one** line from each Normal Form to the most appropriate definition.

Normal Form	Definition
First Normal Form (1NF)	All fields are fully dependent on the primary key.
Second Normal Form (2NF)	There are no repeating groups of attributes.
Third Normal Form (3NF)	There are no partial dependencies.

[1]

(iii) Part of the database table `BIRD_TYPE` is shown:

BirdID	Name	Size
0123	Blackbird	Medium
0035	Jay	Large
0004	Raven	Large
0085	Robin	Small

The database only supports these data types:

- character
- varchar
- Boolean
- integer
- real
- date
- time

Write a Structured Query Language (SQL) script to define the table `Bird_Type`.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(iv) The database tables are repeated here for reference:

```
BIRD_TYPE(BirdID, Name, Size)

BIRD_SEEN(SeenID, BirdID, Date, Location, PersonID)

PERSON(PersonID, FirstName, LastName, EmailAddress)
```

Complete the SQL script to return the number of birds of each size seen by the person with the ID of J_123.

```
SELECT BIRD_TYPE.Size, ..... (BIRD_TYPE.BirdID)

       AS NumberOfBirds

FROM BIRD_TYPE, .....

WHERE ..... = "J_123"

AND BIRD_TYPE.BirdID = .....

..... BIRD_TYPE.Size;
```

[5]

3 A computer has an Operating System (OS).

(a) Describe how the Operating System manages the peripheral hardware devices of the computer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) Hardware management is one key management task carried out by the Operating System.

Identify **two other** key management tasks carried out by the Operating System.

1 .....

2 .....
[2]

(c) The Operating System has utility software including defragmentation software.

Explain how defragmentation can improve the performance of the computer.

.....

.....

.....

.....

.....

..... [3]

(d) The computer stores data in binary form.

(i) State the difference between a kibibyte and a kilobyte.

.....

..... [1]

(ii) Convert the denary number 964 into Binary Coded Decimal (BCD).

.....

..... [1]

(iii) Convert the positive binary integer 11110010 into hexadecimal.

.....

..... [1]

(iv) Give the smallest **and** largest two's complement binary number that can be represented using 8 bits.

Smallest .....

Largest .....

[2]

(v) Add the following two binary integers using binary addition. Show your working.

```
  1 0 1 1 0 0 0 0
+ 0 0 0 1 1 0 1 1
```

[2]

(vi) Show the result of a 3-place right logical shift on the binary number:

11001100

..... [1]

4 A networked closed-circuit television (CCTV) system in a house uses sensors and cameras to detect the presence of a person. It then tracks the person and records a video of their movements.

Data from the CCTV cameras is transmitted to a central computer.

(a) This computer has both Read Only Memory (ROM) and Random Access Memory (RAM).

(i) Describe the contents of the ROM in the central computer.

.....

.....

.....

..... [2]

(ii) The central computer has Dynamic RAM (DRAM).

Identify **two** advantages of using DRAM instead of Static RAM (SRAM).

1 .....

.....

2 .....

.....
[2]

(b) The central computer stores the video files on secondary storage.

Describe **two** reasons why magnetic storage is more appropriate than solid state storage for this computer.

1 .....

.....

.....

.....

2 .....

.....

.....

.....
[4]

(c) The CCTV system uses Artificial Intelligence (AI) to identify the presence of a person in the house and to track their movements.

Describe how AI is used in this system.

.....

.....

.....

.....

.....

..... [3]

(d) The CCTV cameras are connected to a network and transfer their data wirelessly to the central computer.

(i) Each device on the network has an IP address.

Complete the description of IP addresses.

An IPv4 address contains ..... groups of digits. Each group is represented in ..... bits and the groups are separated by full stops.

An IPv6 address contains ..... groups of digits. Each group is represented in ..... bits. Multiple groups that only contain zeros can be replaced with a ..... .

[5]

(ii) The network makes use of subnetting.

Describe **two** benefits of subnetting a network.

1 .....

.....

.....

.....

2 .....

.....

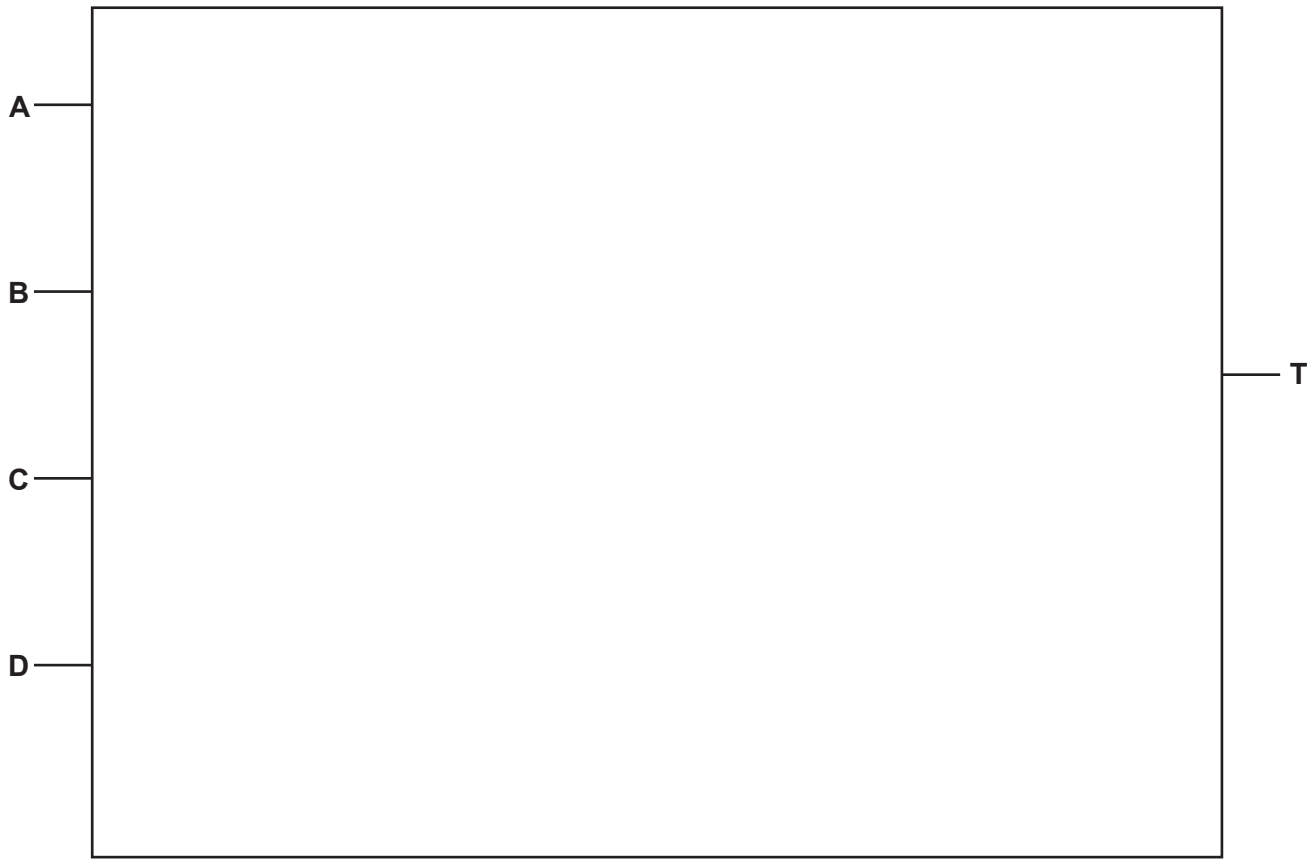
.....

.....

[4]

5 **(a)** Draw the logic circuit for this logic expression:

T = (NOT **A** OR **B**) XOR (**C** NAND **D**)



[2]

(b) Describe the function of the NAND and NOR logic gates.

NAND .....

.....

NOR .....

.....

[2]

6 An interrupt is generated when a key is pressed on a computer keyboard.

Explain how the computer handles this interrupt.

.....

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.....

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.....

.....

..... [5]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3355746943

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **May/June 2023**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
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- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

1 A company has a LAN (local area network).

(a) Give **two** benefits of connecting computers to a LAN.

1 .....

.....

2 .....

.....

[2]

(b) Give **two** characteristics of a LAN.

1 .....

.....

2 .....

.....

[2]

(c) One of the company's offices has one server and four computers connected in a star topology.

Draw a diagram to show the layout of the office's star topology.

[2]

(d) Computers can be connected using Ethernet.

Describe what is meant by **Ethernet**.

.....

.....

.....

.....

.....

..... [3]

(e) The network runs as a thick-client model.

Describe what is meant by a **thick-client** model.

.....

.....

.....

..... [2]

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2 A horse riding school uses a database, `Lessons`, to store data about lesson bookings.

This database is created and managed using a Database Management System (DBMS).

(a) The table contains names and descriptions of DBMS features and tools.

Complete the table by writing down the missing names and descriptions.

Name	Description
Data dictionary	....
Query processor	....
....	A model of a database that is not specific to one DBMS.
....	A software tool that allows the user to create items such as tables, forms and reports.

[4]

(b) Explain the reasons why referential integrity is important in a database.

.....

.....

.....

.....

.....

..... [3]

(c) The database `Lessons` has the following tables:

`HORSE(HorseID, Name, Height, Age, HorseLevel)`

`STUDENT(StudentID, FirstName, LastName, RiderLevel, PreferredHorseID)`

`LESSON(LessonID, Date, Time, StudentID, HorseID, LessonContent)`

Dates in this database are stored in the format `#DD/MM/YYYY#`.

The fields `RiderLevel` and `HorseLevel` can only have the values: `Beginner`, `Intermediate` or `Advanced`.

(i) Describe **two** methods of validating the field `RiderLevel`.

1 .....

.....

.....

2 .....

.....

.....

[2]

(ii) Write a Structured Query Language (SQL) script to return the names of all the horses that have the horse level intermediate or beginner.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(iii) The following SQL script should return the number of riders that have the rider level beginner and have a lesson booked on 09/09/2023.

```
SELECT SUM(STUDENT.RiderLevel) AS NumberOfRiders

FROM STUDENT, LESSON

WHERE StudentID = StudentID

OR Date = #09/09/2023#

AND STUDENT.RiderLevel = Beginner;
```

There are **four** errors in the script.

Identify **and** correct each error.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

[4]

3 A program is written in assembly language.

(a) The program is converted into machine code by a two-pass assembler.

Draw **one or more** lines to identify the pass or passes in which each action takes place.

Action	Pass
generates object code	first
reads the source code one line at a time	second
removes white space	
adds labels to the symbol table	

[3]

(b) Assembly language statements can use different modes of addressing.

Complete the following description of addressing modes.

..... addressing is when the operand holds the memory address of the data.

..... addressing is when the operand holds a memory address that stores the memory address of the data.

..... addressing is when the operand is the data.

[3]

4 Data in a computer is stored in binary form.

(a) State the number of unique binary values that can be represented in 16 bits.

..... [1]

(b) Give the 8-bit one's complement representation of the denary number −120.

Show your working.

Working .....

.....

.....

.....

Answer .....
[2]

(c) Convert the hexadecimal number A04 into denary.

Show your working.

Working .....

.....

.....

.....

Answer .....
[2]

(d) Show the result of a 2-place left logical shift on the binary number:

01001111

..... [1]

5 A student has purchased a new laptop.

(a) The laptop is designed using the Von Neumann model for a computer system.

Identify **two** types of signal that a control bus can transfer.

1 .....

2 .....

[2]

(b) Describe **two** ways the hardware of a laptop can be upgraded to improve the performance **and** explain how each upgrade improves the performance.

1 .....

.....

.....

.....

.....

.....

2 .....

.....

.....

.....

.....

.....

[4]

(c) Peripherals are connected to the laptop using ports.

(i) A printer is connected to a Universal Serial Bus (USB) port.

Describe how data is transmitted through a USB port.

.....

.....

.....

..... [1]

(ii) A monitor is connected to the laptop using a different type of port.

Identify **one** other type of port that can be used to connect the monitor.

..... [1]

(d) The laptop has systems software.

(i) Describe how the Operating System (OS) manages processes in the computer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(ii) Describe the purpose of utility software in a computer.

.....

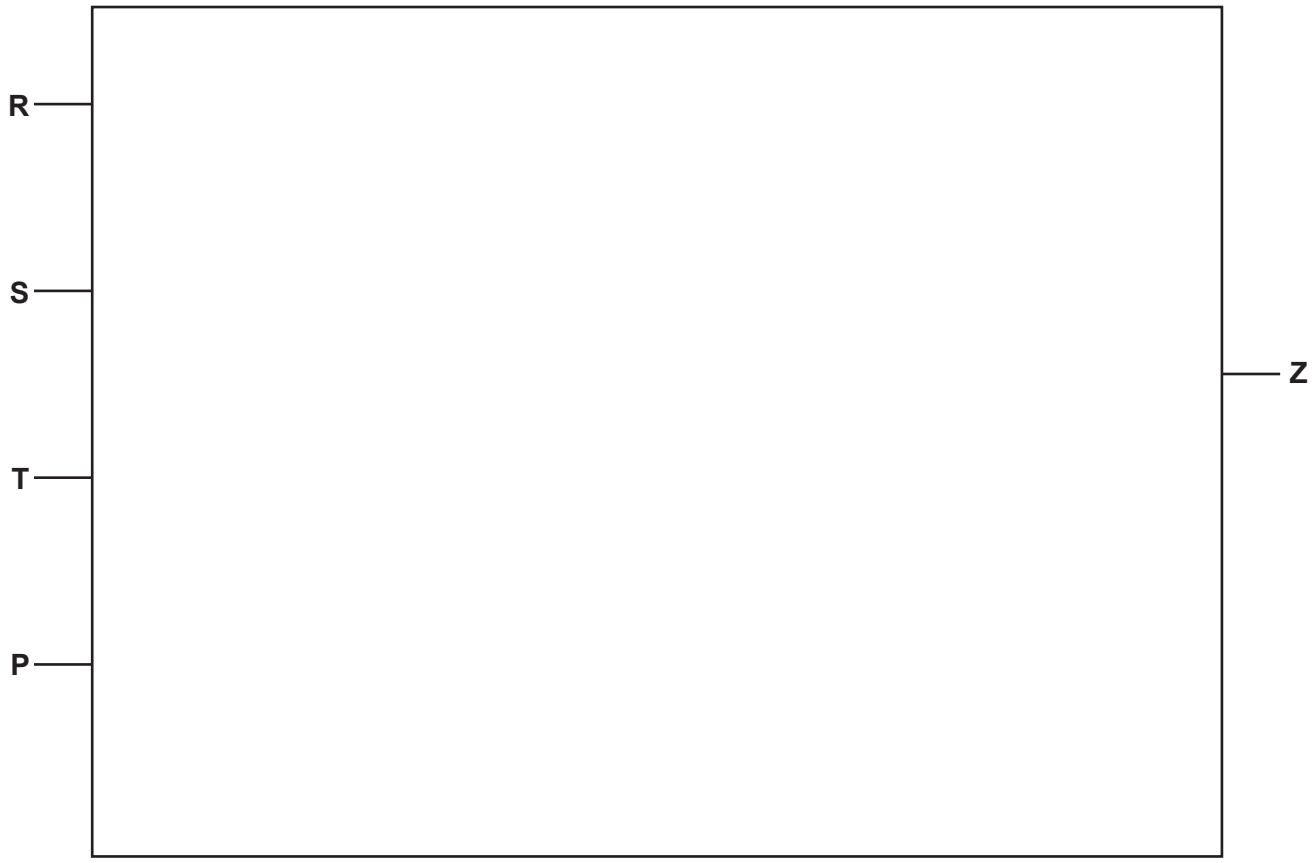
.....

.....

..... [2]

6 **(a)** Draw the logic circuit for this logic expression:

Z = (**R** XOR **S**) AND (NOT **T** NOR **P**)



[2]

(b) Complete the truth table for this logic expression:

Z = (NOT **P** OR **Q**) XOR (**R** NOR **Q**)

P	Q	R	Working space	Z
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

7 A software developer is working in a team writing a program for a client.

(a) The developer is writing a new program library to be used by the other team members.

(i) Define the term **program library**.

.....

.....

.....

..... [2]

(ii) Explain **two** benefits to the developer of choosing to create a Dynamic Link Library (DLL).

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(b) The development team needs to use a translator whilst writing the program for the client.

Identify whether an interpreter or a compiler would be more appropriate at this stage of the program development.

Justify your choice.

Translator .....

Justification .....

.....

.....

.....

.....

..... [3]

(c) The development team uses an Integrated Development Environment (IDE).

Complete the table by describing the typical features found in an IDE.

Feature	Description
Breakpoints	....
Dynamic syntax checks	....
Context-sensitive prompts	....
Single stepping	....

[4]

(d) One section of the program being developed will convert user's speech into commands.

Explain how Artificial Intelligence (AI) can be used in this program.

.....

.....

.....

.....

.....

..... [3]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

5648189233

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **May/June 2023**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
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INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

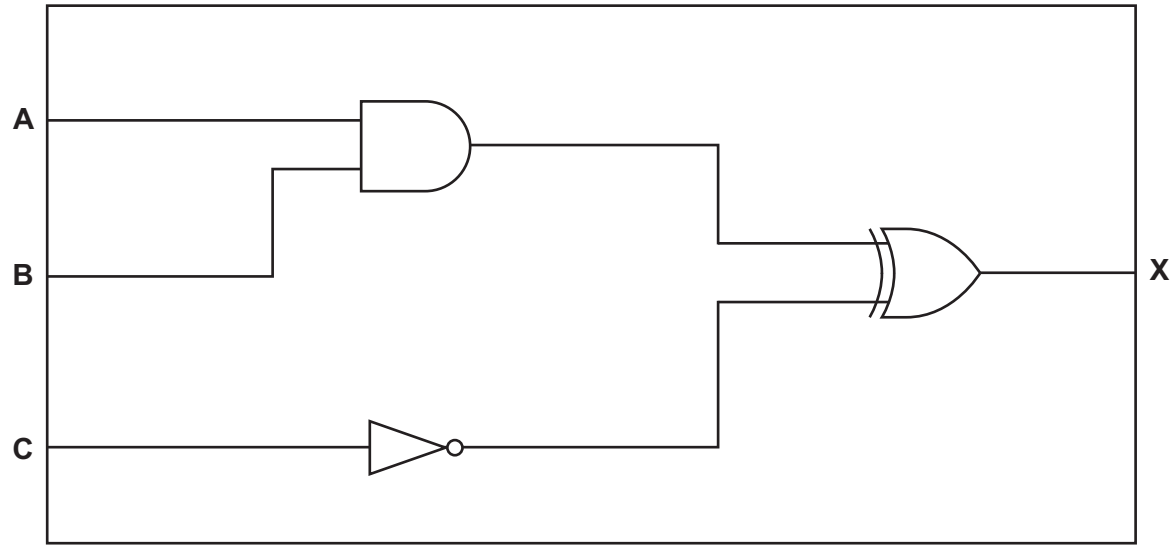
This document has **16** pages. Any blank pages are indicated.

1 **(a)** Write the logic expression for this truth table:

A	B	C	X
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	0
1	1	1	0

..... [1]

(b) Complete the truth table for this logic circuit:



A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

2 A university has two sites. Each site has several computer rooms. The computers are all connected as a WAN (wide area network).

(a) Identify **two** differences between a WAN and a LAN (local area network).

1 .....

.....

2 .....

.....

[2]

(b) The network uses different topologies in different areas of the sites. In one building there are five computers connected in a mesh topology.

(i) Describe what is meant by a mesh topology.

.....

.....

.....

..... [2]

(ii) Give **two** advantages of using a mesh topology instead of a bus topology.

1 .....

.....

2 .....

.....

[2]

(c) The computers in one room are set up as thin-clients in a client-server model.

Describe the role of the different computers in this model.

.....

.....

.....

..... [2]

(d) Students can connect their devices to the university network using cables or a wireless connection.

Explain the benefits to the students of allowing them to use **both** wired and wireless connections.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(e) One site has split the network into several subnetworks.

An IP address in a subnetwork is divided into two parts.

Identify **and** describe the **two** parts of an IP address in a subnetwork.

.....

.....

.....

.....

.....

..... [3]

3 A mobile telephone is used to record a video.

(a) The mobile telephone has a touchscreen. There are different types of touchscreen.

Complete the description of the principal operation of touchscreens.

A ..... touchscreen has two layers. When the user touches the screen, the layers touch and a ..... is completed.

A ..... touchscreen has several layers. When the top layer is touched, there is a ..... in the electric current.

A microprocessor identifies the ..... of the touch.

[5]

(b) The mobile telephone uses a built-in digital camera to record the video.

The digital camera automatically focuses on the faces of people.

Explain how Artificial Intelligence (AI) is used by the camera to automatically focus on the faces of people.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(c) The video includes a sound recording.

(i) Describe how sound is represented in a computer.

.....

.....

.....

.....

.....

..... [3]

(ii) A second video is recorded. The sound in the second video needs to be more precise.

Explain the reasons why increasing the sampling rate and the sampling resolution will improve the precision of the second recording.

Sampling rate .....

.....

.....

.....

Sampling resolution .....

.....

.....

.....

[4]

4 A shop rents cars to customers. The shop uses a relational database to store information about the rentals.

(a) Describe **two** ways in which a relational database addresses the limitations of a file-based approach.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(b) Complete the table by writing the missing term or description for each database feature.

Term	Description
....	An object that data is stored about.
Tuple	....
Secondary key	....
....	A field in one table that is linked to a primary key in another table.

[4]

(c) The car rental database is not normalised. The current database design is:

```
BOOKING(CarRegistration, StartDate, EndDate,
        CarModel, CarColour, CustomerFirstName)

CUSTOMER(CustomerFirstName, CustomerLastName, EmailAddress,
         TelephoneNumber)
```

Write a normalised database design for this database.

All tables must be in Third Normal Form (3NF).

Use the field names given **and** underline the primary key fields.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) The data is validated and verified when it is entered into the database.

(i) The car registration number must be: 1 letter, followed by 3 numbers, followed by 2 letters.

For example, A123AA is valid but A12AA is invalid.

One way that a registration number can be validated is by using a presence check to make sure the registration number has been entered.

Describe **two other** ways that the car registration number can be validated.

1 .....

.....

2 .....

.....

[2]

(ii) Describe **two** ways that the car registration number can be verified when it is entered into the database.

1 .....

.....

2 .....

.....
[2]

(iii) State why the car registration number might be incorrect even after it has been validated and verified.

.....

..... [1]

5 A programmer is developing a computer game in a high-level language to sell to the public.

(a) The programmer uses both an interpreter and a compiler at different stages of the development of the program.

(i) Explain the reasons why the programmer uses an interpreter while writing the program code.

.....

.....

.....

..... [2]

(ii) Explain the reasons why the programmer uses a compiler when the program has been written.

.....

.....

.....

.....

.....

..... [3]

(b) The programmer needs to publish the game under a software licence so that it can be sold to the public.

Identify the **most appropriate** type of software licence for the game **and** justify your choice.

Licence .....

Justification .....

.....

.....

.....

.....

.....

[4]

6 Data needs to be kept secure when stored on a computer and during transmission over a network.

(a) Explain how a digital signature is used to authenticate a digital document during transmission over a network.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(b) Complete the table by identifying **and** describing **two** types of software that can be installed on a computer to prevent threats over a network.

Type of software	Description
…….. …….. 	....
…….. …….. 	....

[2]

7 A computer stores data in binary form.

(a) Draw **one** line from each description to its matching denary value.

Description	Denary value
	–127
The smallest integer that can be represented in 8-bit two's complement.	127
	–255
The largest integer that can be represented in 8-bit two's complement.	–128
	–256
The largest unsigned integer that can be represented in 8 bits.	256
	128
	255

[3]

(b) The computer has a Control Unit (CU), system clock and control bus.

Explain how the CU, system clock and control bus operate to transfer data between the components of the computer system.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Complete the table by writing the register transfer notation for each stage of the Fetch-Execute (F-E) cycle given in the table.

Stage description	Register transfer notation
The Program Counter (PC) is incremented	.....
The data in the address stored in the Memory Address Register (MAR) is copied to the Memory Data Register (MDR)	.....

[2]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1949442064

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **October/November 2021**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

1 **(a)** Draw **one** line from each binary value to its equivalent (same) value on the right.

Binary value	
8 bits	1 kibibyte
8000 bits	1 gigabyte
1000 kilobytes	1 byte
1024 mebibytes	1 kilobyte
8192 bits	1 gibibyte
	1 megabyte
	1 mebibyte

[5]

(b) **(i)** Perform the following binary addition. Show your working.

```
  10101010
+ 00110111
```

[2]

(ii) State how an overflow can occur when adding two binary integers.

.....

..... [1]

(c) Convert the hexadecimal value F0 into denary.

.....

..... [1]

2 Xanthe wants to maintain the integrity and security of data stored on her computer.

(a) Explain the difference between data security and data integrity.

.....

.....

.....

..... [2]

(b) Xanthe uses both data validation and data verification when entering data on her computer.

(i) Describe how data validation helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example .....
[2]

(ii) Describe how data verification helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example .....
[2]

(c) Two malware threats are spyware and viruses.

Give **two** similarities and **one** difference between spyware and a virus.

Similarity 1 .....

.....

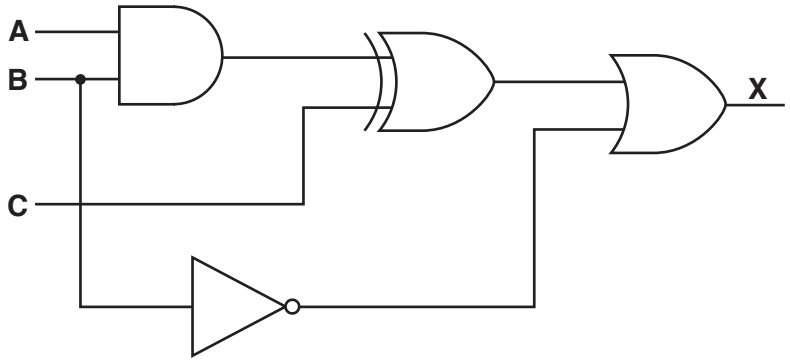
Similarity 2 .....

.....

Difference .....

.....
[3]

3 A logic circuit is shown:



(a) Write the logic expression for the logic circuit.

.....

..... [3]

(b) Complete the truth table for the given logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(c) Identify **one** logic gate **not** used in the given logic circuit. Draw the symbol for the logic gate **and** complete its truth table.

Logic gate: ……

Symbol:

Truth table:

A	B	Output
0	0	
0	1	
1	0	
1	1	

[3]

4 Francis is starting his first job as a software developer for a multinational company.

(a) Francis has been advised to join a professional ethical body.

Describe the benefits to Francis of joining a professional ethical body.

.....

.....

.....

.....

.....

..... [3]

(b) Francis is shown the software he will be working on. He is unfamiliar with the Integrated Development Environment (IDE) he is required to use.

(i) Describe the ways in which Francis can act ethically in this situation.

.....

.....

.....

..... [2]

(ii) A typical IDE provides debugging tools to support the testing of a program.

Identify **three** other tools or features found in a typical IDE to support the writing of the program.

1 .....

2 .....

3 .....

[3]

(c) Francis is part of a team writing a program. He finds an error in part of the program that has already been tested. He decides not to tell anyone because he is worried about the consequences.

Explain the reasons why Francis acted unethically in this situation.

.....

.....

.....

..... [2]

(d) Francis's team use language translators.

Complete the descriptions of language translators by writing the missing words.

..... are usually used when a high-level language program is complete. They translate all the code at the same time and then run the program.

They produce ..... files that can be run without the source code.

..... translate one line of a high-level language program at a time, and then run that line of code. They are most useful while developing the programs because errors can be corrected and then the program continues from that line.

Assemblers are used to translate assembly code into ..... .

[4]

5 Javier owns many shops that sell cars. He employs several managers who are each in charge of one or more shops. He uses the relational database `CARS` to store the data about his business.

Part of the database is shown:

```
SHOP(ShopID, ManagerID, Address, Town, TelephoneNumber)

MANAGER(ManagerID, FirstName, LastName, DateOfBirth, Wage)

CAR(RegistrationNumber, Make, Model, NumberOfMiles, ShopID)
```

(a) Tick (✓) **one** box in each row to identify whether each field is a primary key or a foreign key.

Table	Field name	Primary key	Foreign key
MANAGER	ManagerID		
SHOP	ManagerID		
CAR	RegistrationNumber		
CAR	ShopID		

[2]

(b) Describe the ways in which access rights can be used to protect the data in Javier's database from unauthorised access.

.....

.....

.....

.....

.....

..... [3]

(c) Javier uses Data Definition Language (DDL) and Data Manipulation Language (DML) statements in his database.

(i) Complete the following DML statements to return the number of cars for sale in each shop.

```
SELECT COUNT(.....)

FROM .....

..... ShopID
```

[3]

(ii) Complete the DML statement to include the following car in the table `CAR`.

Field	Data
RegistrationNumber	123AA
Make	Tiger
Model	Lioness
NumberOfMiles	10500
ShopID	12BSTREET

```
.....  ..... CAR

..... ("123AA","Tiger","Lioness",10500,"12BSTREET")
```

[2]

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6 **(a)** There are **two** errors in the following register transfer notation for the fetch-execute cycle.

```
1   MAR ←[PC]

2   PC ← [PC] - 1

3   MDR ← [MAR]

4   CIR ← [MDR]
```

Complete the following table by:

- identifying the line number of each error
- describing the error
- writing the correct statement.

Line number	Description of the error	Correct statement

[4]

(b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

The current contents of main memory are shown:

Address	Data
100	00001111
101	11110000
102	01010101
103	11111111
104	00000000

Each row of the following table shows the current contents of ACC in binary and the instruction that will be performed on those contents.

Complete the table by writing the new contents of the ACC after the execution of each instruction.

Current contents of the ACC	Instruction	New contents of the ACC
11111111	OR 101	
00000000	XOR #15	
10101010	LSR #2	
01010101	AND 104	

[4]

7 Bobby is recording a sound file for his school project.

(a) He repeats the recording of the sound several times, with a different sample rate each time.

(i) Describe the reasons why the sound is closer to the original when a higher sample rate is used.

.....

.....

.....

..... [2]

(ii) Describe the reasons why the sound file size increases when a higher sample rate is used.

.....

.....

.....

..... [2]

(b) Bobby wants to email the sound file to his school email address. He compresses the file before sending the email.

(i) Explain the reasons why Bobby compresses the sound file.

.....

.....

.....

..... [2]

(ii) Bobby uses lossless compression.

Describe how lossless compression can compress the sound file.

.....

.....

.....

..... [2]

8 A school is setting up a network within one of its buildings.

(a) State whether the network will be a LAN (local area network) or a WAN (wide area network). Justify your choice.

.....

.....

.....

.....

.....

..... [3]

(b) One classroom in the building has 30 computers. The computers need to be connected to the network. Each computer has a network interface card (NIC).

Identify **two** possible devices that can be used to physically connect the 30 computers to the rest of the network.

1 .....

2 .....
[2]

(c) The school has several laptops. Each laptop has a Wireless Network Interface Card (WNIC).

Describe the functions of a Wireless Network Interface Card.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5440440993

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **October/November 2021**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
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- Do **not** write on any bar codes.
- You may use an HB pencil for any diagrams, graphs or rough working.
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INFORMATION

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This document has **16** pages. Any blank pages are indicated.

1 When designing computer systems, it is important to consider the security, integrity and privacy of the data.

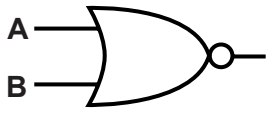
Draw **one** line from each measure to indicate whether it keeps data secure or protects the integrity of data.

Measure

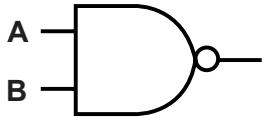
Firewall	Data Security
Double entry	Data Integrity
Presence check	
Access rights	
Password	

[2]

2 **(a)** Complete the truth table for each of the following two logic gates.



A	B	Output
0	0	
0	1	
1	0	
1	1	

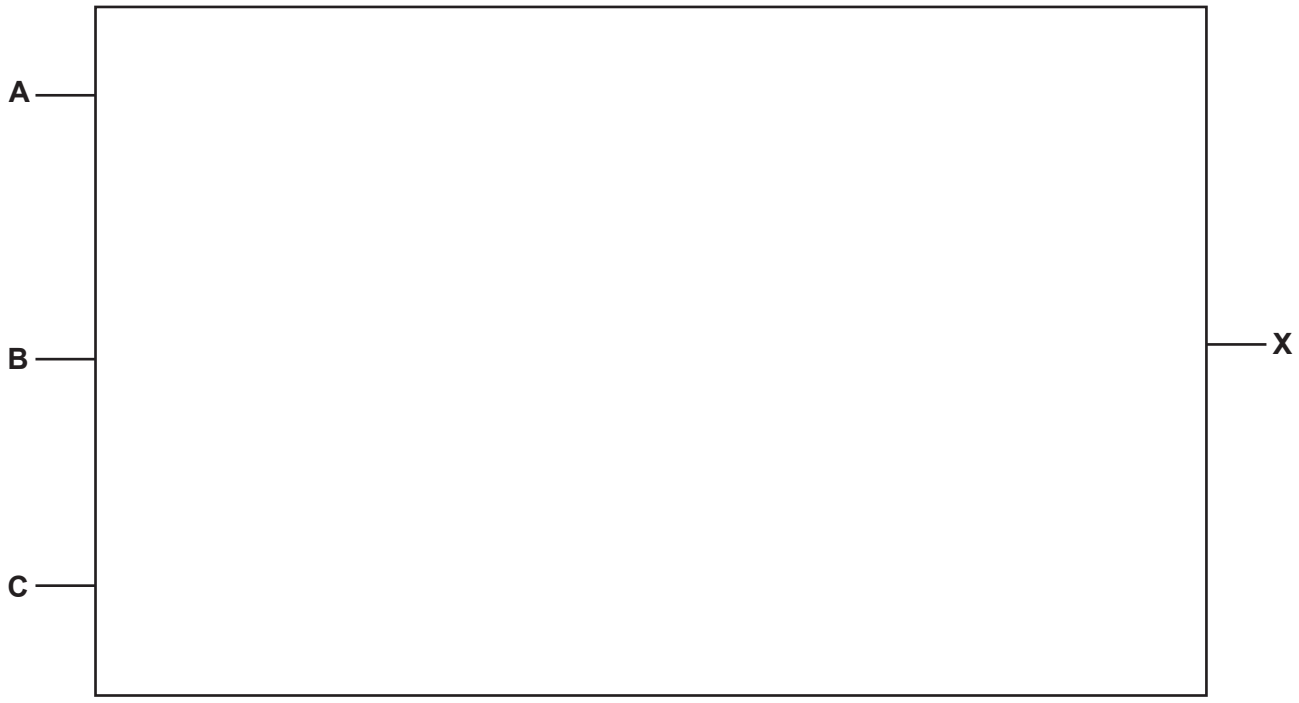


A	B	Output
0	0	
0	1	
1	0	
1	1	

[2]

(b) Draw a logic circuit for the following logic expression.

X = NOT(NOT(**A** AND **B**)AND **C**)



[2]

3 Andy likes to play computer games.

(a) Andy uses several input devices to play the games. These include a keyboard and a microphone.

Describe the principal operation of a microphone.

.....

.....

.....

.....

.....

..... [3]

(b) Andy plays some of the computer games over the internet. He has several devices that connect wirelessly to the router in his house.

(i) Identify the topology of Andy's home network. Justify your choice.

Topology .....

Justification .....

.....
[2]

(ii) The router has a wireless access point (WAP) to allow the devices to connect wirelessly.

Identify **three** functions of the router in Andy's network.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

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4 A register stores the following binary number:

1	1	0	0	1	1	0	1

(a) The binary value in the register represents an unsigned binary integer.

Convert the unsigned binary integer into denary.

..... [1]

(b) The binary value in the register represents a two's complement binary integer.

Convert the two's complement binary integer into denary.

..... [1]

(c) The binary value in the register represents a hexadecimal number.

Convert the binary number into hexadecimal.

..... [1]

(d) State why the value in the register cannot be interpreted as a Binary Coded Decimal (BCD).

.....

..... [1]

(e) The binary contents of **two** registers are:

Register 1	0	0	1	1	1	1	0	1
Register 2	0	0	1	0	1	1	0	1

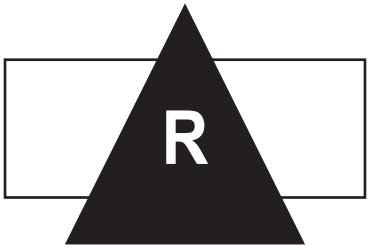
(i) Add the contents of **Register 1** and **Register 2**. Show your working.

Answer .....
[2]

(ii) Subtract the contents of **Register 2** from the contents of **Register 1**. Show your working.

Answer .....
[2]

5 Riya has created the following logo as a vector graphic.



(a) Complete the table by writing a description of each vector graphic term **and** give an example for this logo.

Term	Description	Example from logo
Property		
Drawing list		

[4]

(b) Riya takes a photograph using a digital camera. The photograph is stored as a bitmap image.

(i) Describe **two** differences between a vector graphic and a bitmap image.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(ii) Riya needs to email the photograph. She compresses the photograph before sending it using an email.

Describe **two** lossy methods that Riya can use to compress the image.

Method 1 .....

.....

.....

.....

Method 2 .....

.....

.....

.....

[4]

6 A shop sells plants to customers. The shop manager has a relational database to keep track of the sales.

The database, PLANTSALES, has the following structure:

PLANT(PlantName, QuantityInStock, Cost)

CUSTOMER(CustomerID, FirstName, LastName, Address, Email)

PURCHASE(PurchaseID, CustomerID)

PURCHASE_ITEM(PurchaseID, PlantName, Quantity)

(a) The database is normalised.

(i) The table lists the following three stages of normalisation:

- The first stage is from a database that is not normalised (0NF) to First Normal Form (1NF).
- The second stage is from 1NF to Second Normal Form (2NF).
- The third stage is from 2NF to Third Normal Form (3NF).

Tick (✓) **one** box in each row to identify the appropriate stage for each task.

Task	Normalisation stage		
	0NF to 1NF	**1NF to 2NF**	**2NF to 3NF**
Remove any partial key dependencies			
Remove any repeating groups of attributes			
Remove any non-key dependencies			

[2]

(ii) Draw an entity-relationship (E-R) diagram for the database PLANTSALES.

PLANT

CUSTOMER

PURCHASE_ITEM

PURCHASE

[3]

(b) The shop manager uses a Database Management System (DBMS).

Describe the purpose **and** contents of the data dictionary in the DBMS.

.....

.....

.....

.....

.....

..... [3]

(c) The shop manager uses both Data Definition Language (DDL) and Data Manipulation Language (DML) statements to create and search the database.

(i) Complete the DML statements to return the total number of items purchased with the purchase ID of 3011A.

```
SELECT SUM(.....)

FROM .....

WHERE ..... = .....;
```

[4]

(ii) Write DDL statements to include a field in the table `PURCHASE` to store the date of the order.

.....

.....

.....

..... [3]

7 A computer has system software.

(a) The Operating System handles interrupts.

Tick (✓) **one** box in each row to identify whether each event is an example of a hardware interrupt or a software interrupt.

Event	Hardware interrupt	Software interrupt
Buffer full		
Printer is out of paper		
User has pressed a key on the keyboard		
Division by zero		
Power failure		
Stack overflow		

[3]

(b) Describe the file management tasks that an Operating System performs.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Identify **two** utility programs that can be used to improve the performance of a computer **and** state how they improve the performance.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

8 The Von Neumann model for a computer system uses registers.

(a) Describe the role of the following special purpose registers in the fetch-execute (F-E) cycle.

(i) Memory Address Register (MAR) .....

.....

.....

.....

Memory Data Register (MDR) .....

.....

.....

.....

[4]

(ii) Another special purpose register is the Index Register.

Identify **one other** special purpose register used in the Von Neumann model for a computer system.

.....

..... [1]

(b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

The current contents of main memory are shown:

Address	Data
100	01010101
101	11110000
102	00001111
103	00000000
104	11111111

(i) In the following table, each row shows the current contents of the ACC in binary and the instruction that will be performed on those contents.

Complete the table by writing the new contents of the ACC after the execution of each instruction.

Current contents of the ACC	Instruction	New contents of the ACC
01010101	XOR 101	
11110000	AND 104	
00001111	LSL #4	
11111111	OR 102	

[4]

(ii) The following table contains five assembly language instruction groups.

Write an appropriate assembly language instruction for each instruction group, using the given instruction set. The first one has been completed for you.

Instruction Group	Instruction
Data movement	LDM #2
Input and output of data	
Arithmetic operations	
Unconditional and conditional instructions	
Compare instructions	

[4]

(iii) The opcode `LDM` uses immediate addressing. The opcode `LDD` uses direct addressing.

Identify **and** describe **one additional** mode of addressing.

Mode of addressing .....

Description .....

.....

.....

[2]

Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

0392410263

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **October/November 2021**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
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1 **(a)** Draw **one** line from each binary value to its equivalent (same) value on the right.

Binary value	
8 bits	1 kibibyte
8000 bits	1 gigabyte
1000 kilobytes	1 byte
1024 mebibytes	1 kilobyte
8192 bits	1 gibibyte
	1 megabyte
	1 mebibyte

[5]

(b) **(i)** Perform the following binary addition. Show your working.

```
  10101010
+ 00110111
```

[2]

(ii) State how an overflow can occur when adding two binary integers.

.....

..... [1]

(c) Convert the hexadecimal value F0 into denary.

.....

..... [1]

2 Xanthe wants to maintain the integrity and security of data stored on her computer.

(a) Explain the difference between data security and data integrity.

.....

.....

.....

..... [2]

(b) Xanthe uses both data validation and data verification when entering data on her computer.

(i) Describe how data validation helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example .....
[2]

(ii) Describe how data verification helps to protect the integrity of the data. Give an example in your answer.

Description .....

.....

.....

Example .....
[2]

(c) Two malware threats are spyware and viruses.

Give **two** similarities and **one** difference between spyware and a virus.

Similarity 1 .....

.....

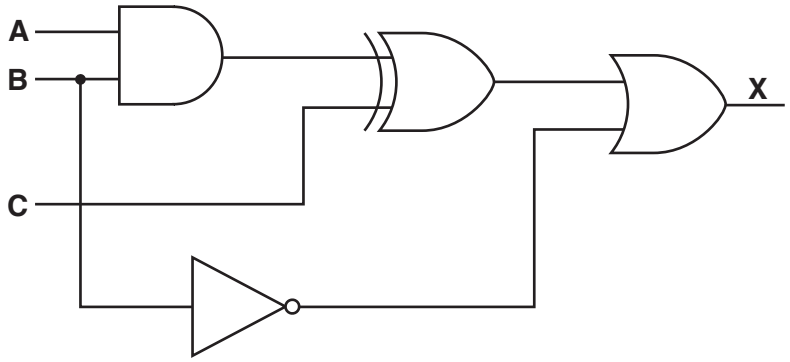
Similarity 2 .....

.....

Difference .....

.....
[3]

3 A logic circuit is shown:



(a) Write the logic expression for the logic circuit.

.....

..... [3]

(b) Complete the truth table for the given logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(c) Identify **one** logic gate **not** used in the given logic circuit. Draw the symbol for the logic gate **and** complete its truth table.

Logic gate: ……

Symbol:

Truth table:

A	B	Output
0	0	
0	1	
1	0	
1	1	

[3]

4 Francis is starting his first job as a software developer for a multinational company.

(a) Francis has been advised to join a professional ethical body.

Describe the benefits to Francis of joining a professional ethical body.

.....

.....

.....

.....

.....

..... [3]

(b) Francis is shown the software he will be working on. He is unfamiliar with the Integrated Development Environment (IDE) he is required to use.

(i) Describe the ways in which Francis can act ethically in this situation.

.....

.....

.....

..... [2]

(ii) A typical IDE provides debugging tools to support the testing of a program.

Identify **three** other tools or features found in a typical IDE to support the writing of the program.

1 .....

2 .....

3 .....

[3]

(c) Francis is part of a team writing a program. He finds an error in part of the program that has already been tested. He decides not to tell anyone because he is worried about the consequences.

Explain the reasons why Francis acted unethically in this situation.

.....

.....

.....

..... [2]

(d) Francis's team use language translators.

Complete the descriptions of language translators by writing the missing words.

..... are usually used when a high-level language program is complete. They translate all the code at the same time and then run the program.

They produce ..... files that can be run without the source code.

..... translate one line of a high-level language program at a time, and then run that line of code. They are most useful while developing the programs because errors can be corrected and then the program continues from that line.

Assemblers are used to translate assembly code into ..... .

[4]

5 Javier owns many shops that sell cars. He employs several managers who are each in charge of one or more shops. He uses the relational database `CARS` to store the data about his business.

Part of the database is shown:

```
SHOP(ShopID, ManagerID, Address, Town, TelephoneNumber)

MANAGER(ManagerID, FirstName, LastName, DateOfBirth, Wage)

CAR(RegistrationNumber, Make, Model, NumberOfMiles, ShopID)
```

(a) Tick (✓) **one** box in each row to identify whether each field is a primary key or a foreign key.

Table	Field name	Primary key	Foreign key
MANAGER	ManagerID		
SHOP	ManagerID		
CAR	RegistrationNumber		
CAR	ShopID		

[2]

(b) Describe the ways in which access rights can be used to protect the data in Javier's database from unauthorised access.

.....

.....

.....

.....

.....

..... [3]

(c) Javier uses Data Definition Language (DDL) and Data Manipulation Language (DML) statements in his database.

(i) Complete the following DML statements to return the number of cars for sale in each shop.

```
SELECT COUNT(.....)

FROM .....

..... ShopID
```

[3]

(ii) Complete the DML statement to include the following car in the table `CAR`.

Field	Data
RegistrationNumber	123AA
Make	Tiger
Model	Lioness
NumberOfMiles	10500
ShopID	12BSTREET

```
.....  ..... CAR

..... ("123AA","Tiger","Lioness",10500,"12BSTREET")
```

[2]

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6 **(a)** There are **two** errors in the following register transfer notation for the fetch-execute cycle.

```
1   MAR ←[PC]

2   PC ← [PC] - 1

3   MDR ← [MAR]

4   CIR ← [MDR]
```

Complete the following table by:

- identifying the line number of each error
- describing the error
- writing the correct statement.

Line number	Description of the error	Correct statement

[4]

(b) The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store the contents of ACC at the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
JMP	<address>	Jump to the given address
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

The current contents of main memory are shown:

Address	Data
100	00001111
101	11110000
102	01010101
103	11111111
104	00000000

Each row of the following table shows the current contents of ACC in binary and the instruction that will be performed on those contents.

Complete the table by writing the new contents of the ACC after the execution of each instruction.

Current contents of the ACC	Instruction	New contents of the ACC
11111111	OR 101	
00000000	XOR #15	
10101010	LSR #2	
01010101	AND 104	

[4]

7 Bobby is recording a sound file for his school project.

(a) He repeats the recording of the sound several times, with a different sample rate each time.

(i) Describe the reasons why the sound is closer to the original when a higher sample rate is used.

.....

.....

.....

..... [2]

(ii) Describe the reasons why the sound file size increases when a higher sample rate is used.

.....

.....

.....

..... [2]

(b) Bobby wants to email the sound file to his school email address. He compresses the file before sending the email.

(i) Explain the reasons why Bobby compresses the sound file.

.....

.....

.....

..... [2]

(ii) Bobby uses lossless compression.

Describe how lossless compression can compress the sound file.

.....

.....

.....

..... [2]

8 A school is setting up a network within one of its buildings.

(a) State whether the network will be a LAN (local area network) or a WAN (wide area network). Justify your choice.

.....

.....

.....

.....

.....

..... [3]

(b) One classroom in the building has 30 computers. The computers need to be connected to the network. Each computer has a network interface card (NIC).

Identify **two** possible devices that can be used to physically connect the 30 computers to the rest of the network.

1 .....

2 .....
[2]

(c) The school has several laptops. Each laptop has a Wireless Network Interface Card (WNIC).

Describe the functions of a Wireless Network Interface Card.

.....

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.....

.....

.....

.....

.....

..... [4]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9371434837

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **October/November 2022**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

1 **(a)** **(i)** Convert the unsigned binary integer into denary.

00100111

Answer ..... [1]

(ii) Convert the Binary Coded Decimal (BCD) into denary.

00100111

Answer ..... [1]

(iii) Convert the 8-bit two's complement binary integer into denary.

11100111

Answer ..... [1]

(b) Perform the following binary subtraction. Show your working.

$$\begin{array}{rr} & 1\ 0\ 1\ 1\ 0\ 0\ 1\ 1 \\ - & 0\ 1\ 1\ 1\ 0\ 1\ 0\ 1 \\ \hline \end{array}$$

[2]

(c) Give **one** similarity and **two** differences between the ASCII and Unicode character sets.

Similarity .....

.....

Difference 1 .....

.....

Difference 2 .....

.....

[3]

(d) Sound samples are recorded and saved in a file.

(i) State what is meant by **sampling rate**.

.....

..... [1]

(ii) Explain the effect of increasing the **sampling resolution** on the sound file.

.....

.....

.....

..... [2]

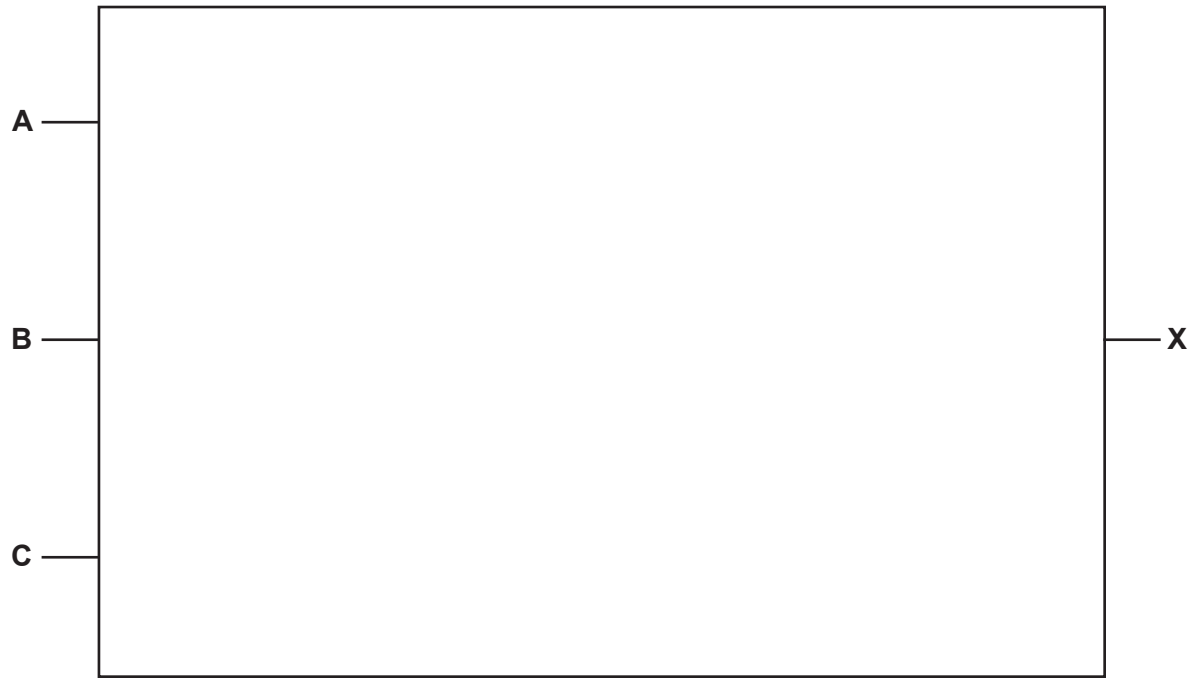
2 Draw **one** line from each security feature to its most appropriate description.

Security feature	Description
firewall	converts data to an alternative form
pharming	redirects a user to a fake website
anti-virus software	verifies the authenticity of data
encryption	scans files on the hard drive for malicious software
	accepts or rejects incoming and outgoing packets based on criteria

[4]

3 **(a)** Draw a logic circuit for the logic expression:

X = NOT ((NOT **A** AND NOT **B**) OR (NOT **B** AND NOT **C**))



[2]

(b) Complete the truth table for the logic expression:

X = NOT ((NOT **A** AND NOT **B**) OR (NOT **B** AND NOT **C**))

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

4 A photographer creates a relational database to store data about photographs taken at birthday parties.

The database, PHOTOGRAPHS, stores details of the customer, the party, the photographs taken and the cameras used.

The photographer has several cameras that are used for taking the photographs at the parties.

Each camera has a specific lens type (for example, XY32Z) and lighting type (for example, F1672).

Data about each photograph is stored in the database including the party at which it was taken, the time it was taken and the camera used.

The database has these four tables:

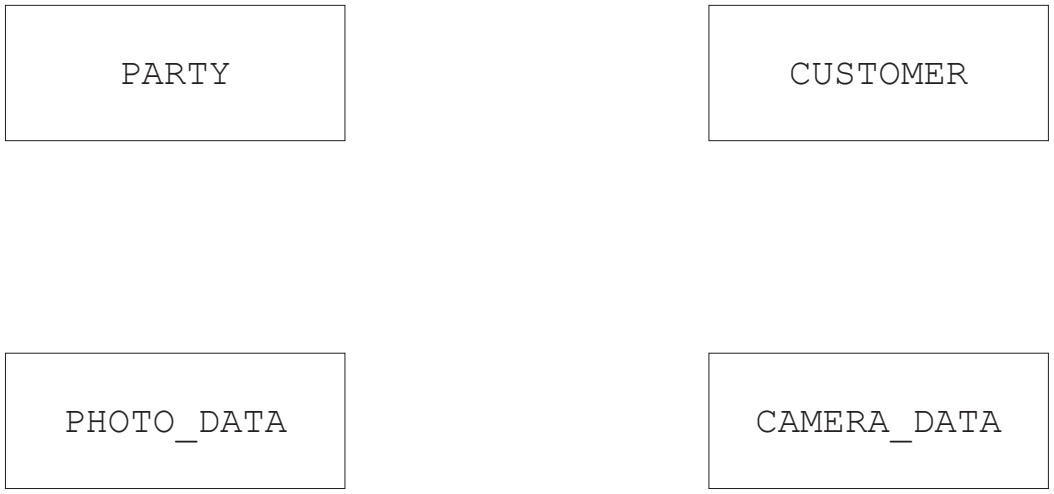
CUSTOMER(CustomerID, FirstName, LastName, Telephone)

PARTY(PartyID, CustomerID, PartyDate, StartTime)

PHOTO_DATA(PhotoID, PartyID, TimeTaken, CameraID)

CAMERA_DATA(CameraID, LensType, LightingType)

(a) Complete the entity-relationship (E-R) diagram for the database PHOTOGRAPHS.



[3]

(b) The database is normalised and is in Third Normal Form (3NF).

Describe the characteristics of a database that is in Third Normal Form (3NF).

.....

.....

.....

.....

.....

..... [3]

(c) The table shows some sample data for the table PHOTO_DATA.

PhotoID	PartyID	TimeTaken	CameraID
ST23-56	BD987	08:34	NIK-02
ST23-57	BD987	08:55	NIK-02
ST23-60	BC08	09:01	CAN-01
ST23-61	BC08	10:23	CAN-12
ST23-62	BC08	10:56	NIK-01

(i) State what is meant by a **tuple**. Give an example of a tuple from PHOTO_DATA.

Tuple .....

.....

Example .....

.....

[2]

(ii) Complete the Structured Query Language (SQL) script to display the total number of photographs that have been taken using a camera with a camera ID starting with CAN.

```
SELECT ..... (.....)
FROM .....
WHERE CameraID LIKE ..... ;
```

[4]

(d) Write an SQL script to include two new fields in `CAMERA_DATA` to store the number of photographs currently on the camera **and** the date the camera was last used.

.....

.....

.....

.....

.....

..... [3]

Question 5 begins on page 10.

5 **(a)** State what is meant by the **stored program concept** in the Von Neumann model of a computer system.

.....

..... [1]

(b) A Central Processing Unit (CPU) contains several special purpose registers and other components.

(i) State the role of the following registers.

Program Counter (PC) .....

.....

.....

Index Register (IX) .....

.....

.....

Status Register (SR) .....

.....

.....
[3]

(ii) Tick (✓) **one** box in each row to identify the system bus used by each CPU component.

CPU component	Data bus	Address bus	Control bus
System clock			
Memory Address Register (MAR)			

[1]

(iii) Describe the purpose of the Control Unit (CU) in a CPU.

.....

.....

.....

..... [2]

(c) Describe the purpose of an interrupt in a computer system.

.....

.....

.....

..... [2]

(d) Identify **two** causes of a software interrupt.

1 .....

.....

2 .....

.....

[2]

6 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
ADD	#n	Add the denary number n to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	#n	Compare the contents of ACC with number n
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(a) The current contents of main memory and selected values from the ASCII character set are given.

(i) Trace the program currently in memory using the trace table.

Address	Instruction
77	`LDR #0`
78	`LDX 110`
79	`CMP #35`
80	`JPE 92`
81	`ADD 100`
82	`STO 101`
83	`LDM #1`
84	`ADD 100`
85	`STO 100`
86	`INC IX`
87	`LDX 110`
88	`CMP #35`
89	`JPN 81`
90	`LDD 100`
91	`ADD #48`
92	`OUT`
93	`END`
…	…
100	`0`
101	`0`
…	…
110	`66`
111	`65`
112	`35`

ASCII value	Character
49	1
50	2
51	3
52	4
…	…
65	A
66	B
67	C
68	D

Instruction address	ACC	IX	Memory address					Output
			100	101	110	111	112	
			0	0	66	65	35	

[4]

(ii) The following instructions are repeated for your reference.

Instruction		Explanation
Opcode	**Operand**	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
STO	<address>	Store contents of ACC at the given address

State the purpose of this part of an assembly language program.

```
LDD 100
STO 165
LDD 101
STO 100
LDD 165
STO 101
```

.....

.....

[1]

Question 6(b) begins on page 16.

(b) The following table shows another part of the instruction set for the processor.

Instruction		Explanation
Opcode	**Operand**	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	Bn	Bitwise AND operation of the contents of ACC with the binary number n
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the binary number n
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the binary number n
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left-hand end
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(i) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
XOR B00011111
```

.....

.....

[1]

(ii) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
AND B11110000
```

.....

.....

[1]

(iii) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
OR B11001100
```

.....

.....

[1]

(iv) The current contents of the ACC are:

1	0	0	1	0	0	1	1

Show the result after the execution of the following instruction.

```
LSR #2
```

.....

.....

[1]

(c) Tick (✓) **one or more** boxes in each row to indicate whether the task is performed in the first pass or the second pass of a two-pass assembler.

Task	First pass	Second pass
Remove comments.		
Read the assembly language program one line at a time.		
Generate the object code.		
Check the opcode is in the instruction set.		

[2]

7 **(a)** State **two** benefits to a programmer of using Dynamic Link Library (DLL) files.

1 .....

.....

2 .....

.....
[2]

(b) Memory management is one of the tasks performed by an Operating System (OS).

Describe the ways in which memory management organises and allocates Random Access Memory (RAM).

.....

.....

.....

..... [2]

(c) An Operating System may include a utility program to compress text files.

Describe **one** appropriate method of compressing a text file.

.....

.....

.....

.....

.....

..... [3]

(d) Explain the reasons why increasing the amount of cache memory can improve the performance of a CPU.

.....

.....

.....

..... [2]

(e) State the name of a peripheral device port that provides a physical connection in the computer for each of these peripherals.

3D printer .....

Monitor .....
[2]

8 A Local Area Network (LAN) uses a bus topology.

Describe how Carrier Sense Multiple Access / Collision Detection (CSMA / CD) is used in a bus network.

.....

.....

.....

.....

.....

.....

.....

..... [4]

9 Many modern televisions are examples of embedded systems.

(a) Explain why these televisions are embedded systems.

.....

.....

.....

..... [2]

(b) Embedded systems use Electrically Erasable Programmable ROM (EEPROM).

Describe **one** benefit of using EEPROMs in an embedded system.

.....

.....

.....

..... [2]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **October/November 2022**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

1 **(a)** Draw **one** line from each utility software to its most appropriate purpose.

Utility software	Purpose
virus checker	to reorganise files so they are contiguous
disk formatter	to scan for malicious program code
backup	to decrease the file size
disk repair	to initialise a disk
defragmentation	to create copies of files in case the original is lost
	to check for and fix inconsistencies on a disk

[5]

(b) Compilers and interpreters translate programs written in a high-level language into a low-level language.

(i) State **two** drawbacks of using a compiler compared to an interpreter during program development.

1 .....

.....

.....

2 .....

.....

.....

[2]

(ii) Explain why high-level language programs might be partially compiled and partially interpreted.

.....

.....

.....

..... [2]

2 **(a)** **(i)** Convert the two's complement binary integer into denary.

10010110

Answer ..... [1]

(ii) Convert the unsigned binary integer into hexadecimal.

10010110

Answer ..... [1]

(iii) Convert the unsigned binary integer into Binary Coded Decimal (BCD). Show your working.

10010101

Working .....

.....

.....

Answer .....

[2]

(b) Perform the following binary addition.

```
  1 0 0 0 1 1 0 0
+ 0 1 0 0 0 1 1 0
-----------------
```

[1]

3 **(a)** A greenhouse has an automatic window.

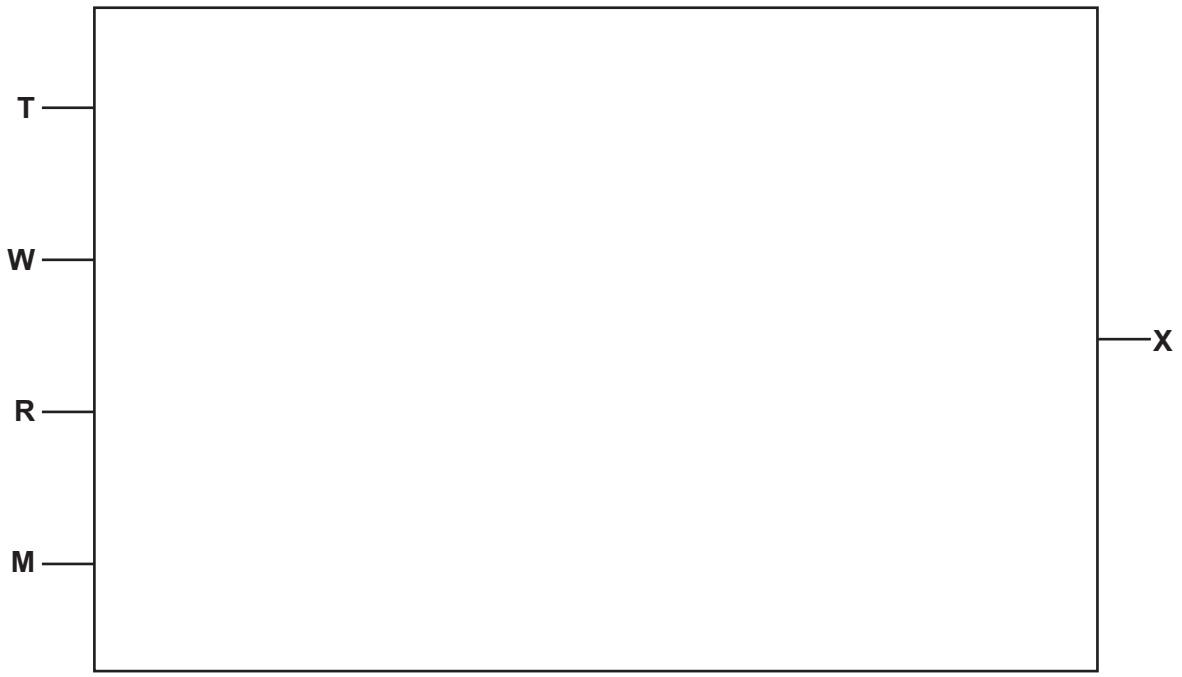
The window (**X**) operates according to the following criteria:

Parameter	Description of parameter	Binary value	Condition
T	Temperature	1	Too high
		0	Acceptable
W	Wind speed	1	Too high
		0	Acceptable
R	Rain	1	Detected
		0	Not detected
M	Manual override	1	On
		0	Off

The window opens (**X** = 1) if:

- the temperature is too high **and** the wind speed is acceptable
- **and**
- rain is not detected, **or** the manual override is off.

Draw a logic circuit to represent the operation of the window.



[3]

(b) Complete the truth table for the logic expression:

X = NOT (**A** OR **B** OR **C**) AND (**B** NOR **C**)

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(c) Embedded systems contain Read Only Memory (ROM) and Random Access Memory (RAM).

Explain the reasons why ROM is used in an embedded system.

.....

.....

.....

.....

.....

..... [2]

4 **(a)** State the difference between **data verification** and **data validation**.

.....

.....

..... [1]

(b) A checksum can be used to detect errors during data transmission.

Describe how a checksum is used.

.....

.....

.....

.....

.....

..... [3]

(c) One validation method is a presence check.

Describe **two other** validation methods that can be used to validate non-numeric data.

1 .....

.....

2 .....

.....

[2]

5 A relational database, GARDEN, has the following tables:

OWNER(OwnerID, FirstName, TelephoneNo, TreeID, TreePosition)

TREE(TreeID, ScientificName, MaxHeight, FastGrowing)

(a) The database is **not** in Third Normal Form (3NF).

Explain how the database can be normalised to 3NF.

.....

.....

.....

.....

.....

..... [3]

(b) Write the Structured Query Language (SQL) script to add a new record in the table TREE to store the following data:

Attribute	Value
TreeID	LOW_1276
ScientificName	Salix_Alba
MaxHeight	30.00
FastGrowing	TRUE

.....

.....

.....

..... [3]

(c) State what is meant by a **candidate key** in a relational database.

.....

..... [1]

(d) (i) Describe, using an example, what is meant by a **data dictionary**.

.....

.....

.....

..... [2]

(ii) Describe what is meant by a **logical schema**.

.....

.....

.....

..... [2]

6 **(a)** A student uses a networked laptop computer to send an email to a colleague.

(i) Explain how a digital signature ensures the email is authentic.

.....

.....

.....

..... [2]

(ii) Describe how a firewall protects the data on the computer.

.....

.....

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.....

.....

..... [3]

(b) The student records a sound file.

(i) Explain the effect of increasing the sampling rate on the accuracy of the sound recording.

.....

.....

.....

..... [2]

(ii) Explain the effect of decreasing the sampling resolution on the file size of the sound recording.

.....

.....

.....

..... [2]

7 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store the contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
ADD	#n	Add the denary number n to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
JMP	<address>	Jump to the given address
CMP	<address>	Compare the contents of ACC with the contents of <address>
CMI	<address>	Indirect addressing. The address to be used is at the given address. Compare the contents of ACC with the contents of this second address
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
END		Return control to the operating system
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(a) Trace the program currently in memory using the trace table, stopping when line `90` is executed for a second time.

Address	Instruction
75	`LDR #0`
76	`LDX 110`
77	`CMI 102`
78	`JPE 91`
79	`CMP 103`
80	`JPN 84`
81	`ADD 101`
82	`STO 101`
83	`JMP 86`
84	`INC ACC`
85	`STO 101`
86	`LDD 100`
87	`INC ACC`
88	`STO 100`
89	`INC IX`
90	`JMP 76`
91	`END`
…	
100	`0`
101	`0`
102	`112`
103	`4`
…	
110	`1`
111	`4`
112	`0`

Instruction address	ACC	IX	Memory address						
			100	101	102	103	110	111	112
			0	0	112	4	1	4	0

[5]

(b) The following table shows another part of the instruction set for the processor.

Instruction		Explanation
Opcode	**Operand**	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the binary number n
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right-hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left-hand end
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

The contents of memory addresses 50 and 51 are shown:

Memory address	Data value
50	01001101
51	10001111

(i) The current contents of the ACC are:

0	1	0	1	0	0	1	1

Show the contents of the ACC after the execution of the following instruction.

```
XOR B00011111
```

.....

.....

[1]

(ii) The current contents of the ACC are:

0	1	0	1	0	0	1	1

Show the contents of the ACC after the execution of the following instruction.

```
AND 50
```

.....

.....

[1]

(iii) The current contents of the ACC are:

0	1	0	1	0	0	1	1

Show the contents of the ACC after the execution of the following instruction.

```
LSL #3
```

.....

.....

[1]

(iv) The current contents of the ACC are:

0	1	0	1	0	0	1	1

Show the contents of the ACC after the execution of the following instruction.

```
OR 51
```

.....

.....

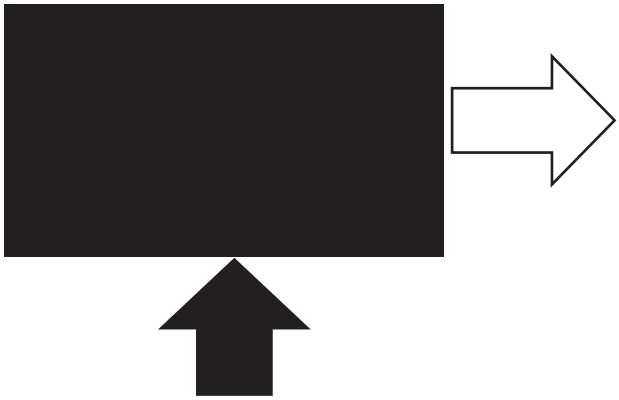
[1]

(c) Write the register transfer notation for each of the stages in the fetch-execute cycle described in the table.

Description	Register transfer notation
Copy the address of the next instruction into the Memory Address Register.	
Increment the Program Counter.	
Copy the contents of the Memory Data Register into the Current Instruction Register.	

[3]

8 The following bitmap image has a resolution of 4096 × 4096 pixels and a colour depth of 24 bits per pixel.



The image is displayed on a monitor that has a screen resolution of 1920 × 1080 pixels.

(a) Tick (✓) **one** box in each row to identify the effect of each action on the image file size.

Action	Increases the file size	Decreases the file size	No change to the file size
Change the colour depth of the image file to 16 bits per pixel.			
Change the screen resolution to 1366 × 768 pixels.			
Change the colour of the rectangle from black to red.			

[2]

(b) State **two** benefits of creating a vector graphic instead of a bitmap image.

1 .....

.....

2 .....

.....

[2]

(c) A second bitmap image is stored using a colour depth of 8 bits per pixel.

The file is compressed using run-length encoding (RLE).

(i) The table shows the compressed and uncompressed values for parts of the image file.

Each colour of the pixel in the image is represented by a hexadecimal value.

Complete the table. The first row has been completed for you.

Uncompressed image	RLE compressed image
EA F1 F1 F2 F2 F2 EA	1EA 2F1 3F2 1EA
	2AB 2FF 11D 167
32 32 80 81 81	

[2]

(ii) RLE is an example of lossless compression.

Explain why lossless compression is more appropriate than lossy compression for a text file.

.....

.....

.....

.....

..... [2]

9 One use of Artificial Intelligence (AI) is for facial recognition software.

Describe the social impact of using facial recognition software to identify individuals in an airport.

.....

.....

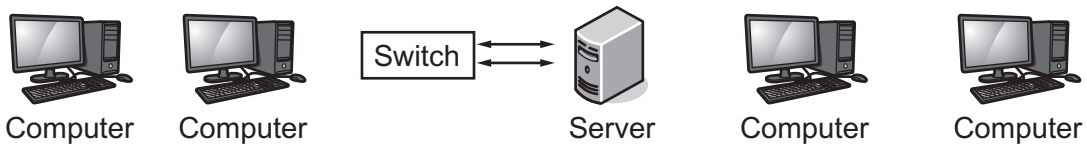
.....

..... [2]

10 A Local Area Network (LAN) consists of four computers, one server and a switch.

The LAN uses a star topology.

(a) Complete the following diagram to show how the hardware is connected.



[1]

(b) A router is attached to one of the devices on the LAN shown in **part (a)** to connect the LAN to the internet.

(i) Identify the device. Give a reason for your choice.

Device .....

Reason .....

.....

.....

[2]

(ii) Describe the role **and** function of the router in the network.

.....

.....

.....

.....

.....

..... [3]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

0903760850

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **October/November 2022**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **20** pages. Any blank pages are indicated.

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1 A digital audio message needs to be recorded.

(a) Tick (✓) **one** box in each row to identify the effect of each action on the accuracy of the recording.

Action	Accuracy increases	Accuracy decreases	Accuracy does not change
Change the sampling rate from 40 kHz to 60 kHz.			
Change the duration of the recording from 20 minutes to 40 minutes.			
Change the sampling resolution from 24 bits to 16 bits.			

[2]

(b) The audio message is recorded with a sampling rate of 50 kHz and a sampling resolution of 16 bits.

The recording is 20 minutes in length.

Calculate the file size of the recording.

Give your answer in megabytes **and** show your working.

Working .....

.....

.....

.....

Answer ..... megabytes

[2]

(c) A computer uses a buffer when playing the audio message.

Explain the purpose of a buffer in a computer system using **one other** example.

.....

.....

.....

.....

.....

..... [3]

2 The relational database ASTRONOMY is used to store data about telescopes, the companies that own the telescopes and the photographs taken by the telescopes.

The database has these three tables:

```
COMPANY(TelephoneNumber, CompanyID, CompanyName)

PHOTOGRAPH(PhotoID, TelescopeID, DateTaken, TimeTaken, Elevation)

TELESCOPE(TelescopeID, CompanyID, SerialNumber)
```

(a) Complete the following table by writing the correct answer for each item.

Item	Answer
a suitable field for the primary key in COMPANY	
a candidate key in TELESCOPE	
the degree of relationship between TELESCOPE and PHOTOGRAPH	

[3]

(b) A Database Management System (DBMS) has several features.

Identify the feature that describes the relationship between data and its structure.

..... [1]

(c) Complete the SQL script to return the total number of telescopes owned by the company whose ID begins with HW.

```
SELECT ..... (.....)

FROM TELESCOPE

WHERE ..... LIKE .....;
```

[4]

(d) Write the SQL script to add **one** field to the table `PHOTOGRAPH` to store the resolution of the photograph, e.g. 1920 × 1068.

.....

.....

.....

..... [2]

(e) The photographs are stored as bitmap images.

Complete the statements about bitmap images by writing the missing words.

The ..... of a bitmap image is the number of bits that are used to store each pixel.

Metadata about the image is stored in the ..... of the file.

[2]

(f) Describe the purpose of a query processor in a DBMS.

.....

.....

.....

..... [2]

3 Draw **one** line from each Operating System (OS) management task to its most appropriate description.

OS Management task	Description
hardware management	dynamically allocates memory to processes
security management	marks unallocated file storage for availability
memory management	installs programs for devices connected to external ports
process management	validates user and process authenticity
	allows processes to transfer data to and from each other

[4]

4 **(a)** A Central Processing Unit (CPU) contains several special purpose registers and other components.

(i) State the roles of the following registers.

Memory Address Register (MAR) .....

.....

.....

Memory Data Register (MDR) .....

.....

.....
[2]

(ii) State when interrupts are detected during the Fetch-Execute (F-E) cycle.

.....

..... [1]

(b) A computer system contains a system clock.

Describe the purpose of the system clock.

.....

.....

.....

..... [2]

(c) Upgrading secondary storage to solid state typically improves the performance of computer systems.

Identify **one other** upgrade to the hardware **and** explain why it improves the performance of a computer system.

Upgrade .....

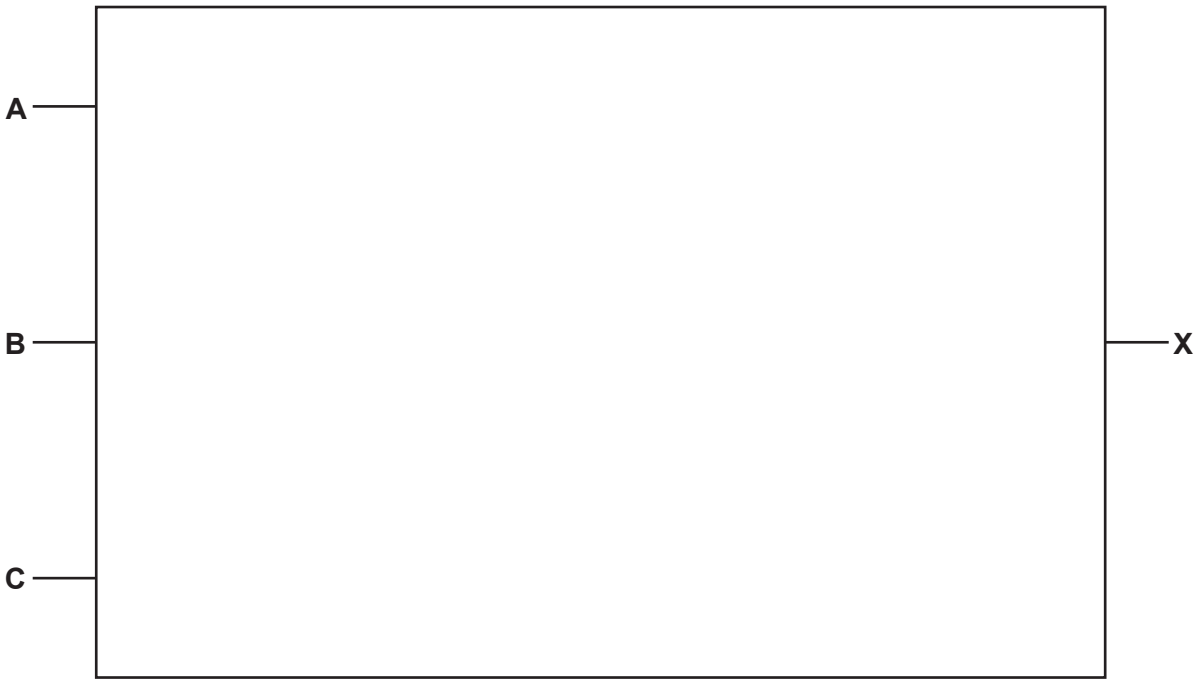
Explanation .....

.....

.....
[2]

5 **(a)** Draw a logic circuit for the logic expression:

X = NOT ((NOT (**A** AND **B**)) OR (NOT (**B** AND **C**)))



[3]

(b) Complete the truth table for the logic expression:

Y = (NOT **P** AND **Q**) OR (**Q** AND NOT **R**)

P	Q	R	Working space	Y
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

Question 6 begins on page 10.

6 The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDM	#n	Immediate addressing. Load the number n to ACC
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
MOV	<register>	Moves the contents of the accumulator to the given register (IX)
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
ADD	#n	Add the denary number n to the ACC
SUB	#n	Subtract the denary number n from the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
JMP	<address>	Jump to the given address
CMP	#n	Compare the contents of ACC with number n
CMI	<address>	Indirect addressing. The address to be used is at the given address. Compare the contents of ACC with the contents of this second address
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
JPN	<address>	Following a compare instruction, jump to <address> if the compare was False
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(a) The current contents of main memory and selected values from the ASCII character set are given.

(i) Trace the program currently in memory using the trace table.

Address	Instruction
75	LDR #0
76	LDD 100
77	CMP #2
78	JPE 91
79	LDX 110
80	SUB #32
81	CMP #65
82	JPN 86
83	LDM #1
84	ADD 101
85	STO 101
86	LDM #1
87	ADD 100
88	STO 100
89	INC IX
90	JMP 76
91	LDD 101
92	ADD #48
93	OUT
94	END
…	
100	1
101	0
…	
110	97
111	98
112	97

ASCII value	Character
49	1
50	2
51	3
52	4
65	A
66	B
67	C
68	D

Instruction address	ACC	IX	Memory address					Output
			100	101	110	111	112	
			1	0	97	98	97	

[4]

(ii) Explain the purpose of **relative addressing** in an assembly language program.

.....

.....

.....

..... [2]

(b) The following table shows another part of the instruction set for the processor.

Instruction		Explanation
Opcode	**Operand**	
AND	#n	Bitwise AND operation of the contents of ACC with the operand
AND	Bn	Bitwise AND operation of the contents of ACC with the binary number n
AND	<address>	Bitwise AND operation of the contents of ACC with the contents of <address>
XOR	#n	Bitwise XOR operation of the contents of ACC with the operand
XOR	<address>	Bitwise XOR operation of the contents of ACC with the contents of <address>
OR	#n	Bitwise OR operation of the contents of ACC with the operand
OR	Bn	Bitwise OR operation of the contents of ACC with the binary number n
OR	<address>	Bitwise OR operation of the contents of ACC with the contents of <address>
LSL	#n	Bits in ACC are shifted logically n places to the left. Zeros are introduced on the right-hand end
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left-hand end
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(i) The current contents of the ACC are:

0	0	1	1	0	1	1	0

Show the contents of the ACC after the execution of the following instruction.

```
AND B01001100
```

.....

.....

[1]

(ii) The current contents of the ACC are:

1	0	0	1	0	1	0	1

Show the contents of the ACC after the execution of the following instruction.

```
OR B01001111
```

.....

.....

[1]

(iii) The current contents of the ACC are:

1	0	0	1	1	1	0	1

Show the contents of the ACC after the execution of the following instruction.

```
LSR #2
```

.....

.....

[1]

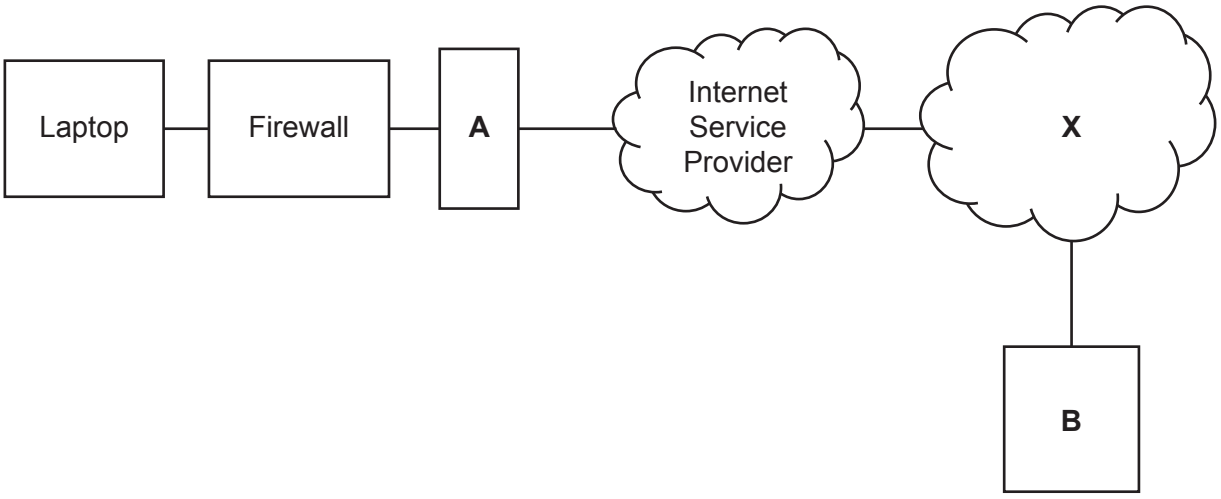
(c) One instruction group is data movement.

Give the name of **one other** instruction group.

.....

..... [1]

7 **(a)** The diagram shows the hardware and software used to retrieve files stored on the cloud.



Complete the following table by writing the answer for each row.

	Answer
The name of device **A** that allows the laptop to connect to the internet	
A type of cloud, **X**	
An example of an application, **B**, that can run on the cloud	

[3]

(b) Give **one** advantage and **two** disadvantages of transmitting data using satellites instead of copper cables.

Advantage 1 .....

.....

Disadvantage 1 .....

.....

Disadvantage 2 .....

.....

[3]

(c) Local Area Networks (LANs) can be made up of several subnetworks.

(i) Give **two** benefits of dividing a network into subnetworks by subnetting the LAN.

1 .....

.....

2 .....

.....

[2]

(ii) A subnet mask is used when subnetting a LAN.

Two devices on the LAN are located in different subnetworks.

The IP addresses and corresponding subnet masks are shown:

Device IP address	Subnet mask
10.10.12.1	255.0.0.0
192.168.12.4	255.255.255.0

Identify the following network ID and host ID.

The network ID for the device with the IP address 10.10.12.1

.....

The host ID for the device with the IP address 192.168.12.4

.....

[2]

8 **(a)** **(i)** Explain why some programs are distributed under an open source licence.

.....

.....

.....

..... [2]

(ii) Explain how a programmer benefits from distributing a program under a commercial licence.

.....

.....

.....

..... [2]

(b) A commercial program for a vehicle repair garage includes an Artificial Intelligence (AI) module that can diagnose faults and suggest repairs.

Describe **one** economic impact the AI module may have on the garage.

.....

.....

.....

..... [2]

9 **(a)** **(i)** Convert the unsigned binary value into hexadecimal.

10010011

Answer ..... [1]

(ii) Convert the unsigned binary value into denary.

10010011

Answer ..... [1]

(b) State **two** benefits of using Binary Coded Decimal (BCD) to represent values.

Benefit 1 .....

.....

Benefit 2 .....

.....

[2]

10 (a) Explain the importance of feedback in a control system.

.....

.....

.....

.....

.....

..... [3]

(b) (i) Identify **one** sensor that could be used in a car alarm system.

Justify your choice.

Sensor .....

Justification .....

.....

.....

.....

[2]

(ii) The car alarm is an example of an embedded system.

Describe the characteristics of an embedded system.

.....

.....

.....

.....

.....

..... [3]

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Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4877195459

COMPUTER SCIENCE **9618/11**

Paper 1 Theory Fundamentals **October/November 2023**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

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1 **(a)** Draw **one** line from each vector graphic term to its most appropriate description.

Term	Description
drawing list	a component created using a formula
drawing object	defines one characteristic of a component
property	data required to create all components in the graphic

[2]

(b) State what is meant by the **bit depth** of a bitmap image **and** explain how changing the bit depth affects the image.

Definition .....

.....

Explanation .....

.....

.....

.....

[3]

(c) Explain why a bitmap image is often compressed before it is attached to an email.

.....

.....

.....

..... [2]

2 A school has a Local Area Network (LAN).

(a) The LAN connects to the internet using a router.

Describe the function of a router in a network.

.....

.....

.....

.....

.....

..... [3]

(b) Complete the following table by writing the purpose of each of these other hardware devices used to support the LAN.

Hardware device	Purpose
switch	....
Wireless Access Point (WAP)	....
bridge	....

[3]

(c) The students can save their school files on a public cloud.

Identify **two** drawbacks of the students storing their files on the public cloud.

1 .....

.....

2 .....

.....

[2]

(d) A new classroom is being set up with 20 computers and a switch.

Explain **one** advantage of implementing a star topology instead of a bus topology in the new classroom.

.....

.....

.....

..... [2]

3 A shop manager has designed a relational database to store customer orders.

The database will have the following tables:

CUSTOMER(CustomerID, FirstName, LastName, Town)

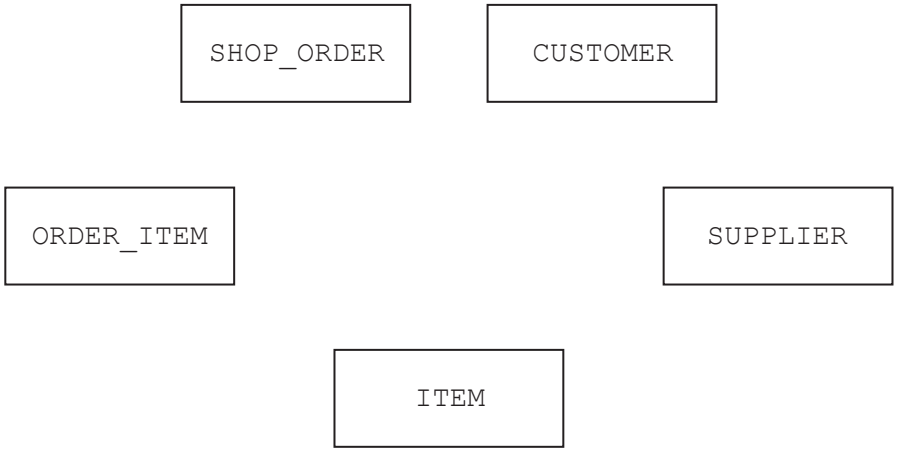
SHOP_ORDER(OrderNo, CustomerID, OrderDate)

SUPPLIER(SupplierID, EmailAddress, TelephoneNumber)

ITEM(ItemNumber, SupplierID, Description, Price)

ORDER_ITEM(ItemNumber, OrderNo, Quantity)

(a) Complete the entity-relationship (E-R) diagram for the relational database.



[3]

(b) Identify **three** advantages of a relational database compared to a file-based approach.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(c) (i) Write a Structured Query Language (SQL) script to define the database called `SHOP`.

.....

..... [1]

(ii) Write the SQL script to return the total quantity of items that the customer with the ID of HJ231 has ordered.

.....

.....

.....

.....

.....

..... [4]

4 **(a)** Complete the truth table for the logic expression:

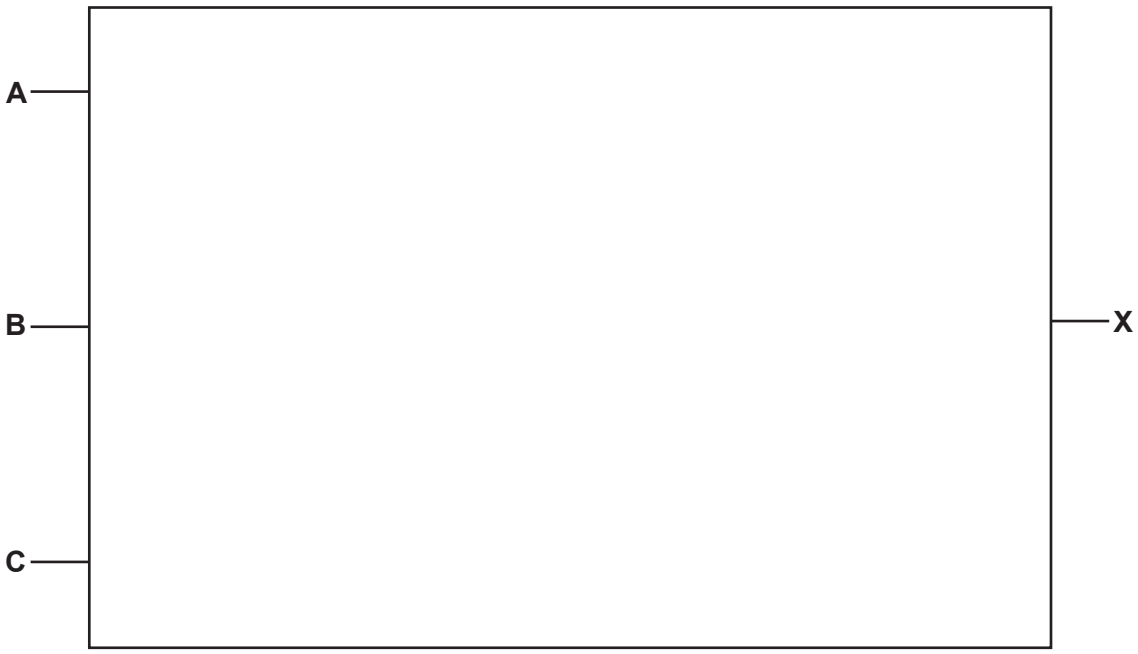
X = NOT (**A** NAND **B**) XOR (NOT **B** AND (**B** NOR **C**))

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(b) Draw a logic circuit for the logic expression:

X = (**A** AND NOT (**B** OR **C**)) AND (**B** NOR **C**)



[2]

5 The Central Processing Unit (CPU) of the basic Von Neumann model for a computer system contains several special purpose registers.

(a) The Memory Data Register (MDR), Index Register (IX) and the Accumulator (ACC) are examples of special purpose registers.

Identify **two other** special purpose registers **and** state their role in the CPU.

Special purpose register 1 .....

Role .....

.....

.....

Special purpose register 2 .....

Role .....

.....

.....

[4]

(b) Describe what is meant by the **Immediate Access Store (IAS)** in a computer system.

.....

.....

.....

..... [2]

(c) A computer has a single 2.1 GHz CPU.

(i) Describe how increasing the clock speed to 4 GHz can increase the performance of the computer.

.....

.....

..... [1]

(ii) A second computer has a CPU with two 2.1 GHz cores.

Explain why the second computer does not always run twice as fast as the computer with one 2.1 GHz CPU.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

6 A programmer uses both a compiler and an interpreter to translate a program written in a high-level language.

(a) Describe the advantages of using the interpreter compared to the compiler to translate the program.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) State **one** reason why some high-level languages are partially compiled and partially interpreted.

.....

..... [1]

(c) **(i)** Identify **two** features that support the visual presentation of the code in a typical Integrated Development Environment (IDE).

1 .....

.....

2 .....

.....

[2]

(ii) Identify **two** features that support the debugging of the code in a typical IDE.

1 .....

.....

2 .....

.....

[2]

7 **(a)** Describe the principal operations of a 3D printer.

.....

.....

.....

.....

.....

.....

.....

..... [3]

(b) Describe the purpose of a temperature sensor within the 3D printer.

.....

.....

.....

..... [2]

(c) A 3D printer contains 1 GB of Dynamic RAM (DRAM) to store print data.

State **two** advantages of the printer having Dynamic RAM instead of Static RAM (SRAM).

1 .....

.....

2 .....

.....

[2]

8 **(a)** Identify the purpose of the first pass of a two-pass assembler.

.....

..... [1]

(b) The following table shows part of the instruction set for a processor. The processor has two registers, the Accumulator (ACC) and the Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store contents of ACC at the given address
ADD	<address>	Add the contents of the given address to the ACC
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	#n	Compare the contents of ACC with number n
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
OUT		Output to the screen the character whose ASCII value is stored in ACC
<address> can be an absolute or symbolic address # denotes a denary number, e.g. #123		

(i) Give **one** example of an instruction that belongs to **each** of the following instruction groups.

Only use the instructions given in the table. Each instruction must have a suitable operand.

Data movement .....

Arithmetic operation .....

Conditional instruction .....

[3]

(ii) The instruction `LDR #2` uses immediate addressing.

Give **one** similarity and **one** difference between direct addressing and indexed addressing.

Similarity .....

.....

.....

Difference .....

.....

.....

[2]

(iii) Identify **one other** mode of addressing.

.....

..... [1]

(c) The following table shows another part of the instruction set for the same processor.

Instruction		Explanation
Opcode	**Operand**	
AND	Bn	Bitwise AND operation of the contents of ACC with the operand
XOR	Bn	Bitwise XOR operation of the contents of ACC with the operand
LSR	#n	Bits in ACC are shifted logically n places to the right. Zeros are introduced on the left hand end
# denotes a denary number, e.g. #123 B denotes a binary number, e.g. B01001101		

(i) The current contents of the ACC are:

0	1	0	0	1	1	1	1

Show the contents of the ACC after the execution of the following instruction.

```
AND B10100101
```

.....

.....

[1]

(ii) The current contents of the ACC are:

0	0	0	1	0	1	1	1

Show the contents of the ACC after the execution of the following instruction.

```
LSR #3
```

.....

.....

[1]

(iii) The current contents of the ACC are:

1	1	1	1	0	1	1	1

Show the contents of the ACC after the execution of the following instruction.

```
XOR B00100101
```

.....

.....

[1]

9 **(a)** Explain the importance of feedback in a control system.

.....

.....

.....

..... [2]

(b) Give **one** example of an embedded system **and** explain why it is an example of an embedded system.

Example .....

.....

Explanation .....

.....

.....

.....

.....

.....

[3]

Cambridge Assessment International Education

Cambridge International AS & A Level

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0133149701

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **October/November 2023**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- 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.
- You may use an HB pencil for any diagrams, graphs or rough working.
- Calculators must **not** be used in this paper.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [ ].
- No marks will be awarded for using brand names of software packages or hardware.

This document has **16** pages. Any blank pages are indicated.

1 A factory makes chocolate bars.

The factory uses a conveyor belt that moves the products from one stage of production to the next stage.

(a) An automated system counts the number of chocolate bars made at the end of production.

The system includes a sensor positioned above the conveyor belt.

Identify **one** appropriate type of sensor that can be used.

..... [1]

(b) A second automated system removes chocolate bars with an incorrect weight from the production line.

Describe the role of an **actuator** in this second system.

.....

.....

.....

..... [2]

(c) The factory has many different machines with embedded systems.

(i) Identify **two** features of embedded systems.

1 .....

.....

2 .....

.....
[2]

(ii) Identify **one** drawback of embedded systems.

.....

..... [1]

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2 **(a)** State what is meant by the following terms in a relational database model.

Entity .....

.....

.....

Primary key .....

.....

.....

Referential integrity .....

.....

.....
[3]

(b) Authentication is one method a Database Management System (DBMS) can use to improve the security of a database.

Describe **other** methods that a DBMS can use to improve the security of a database.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) The following database table is not normalised.

StudentName	DateOfBirth	TutorGroup	Subject	SubjectCode
Yuwei Chen	01/09/2004	SMH	English, Maths, Computer Science	EN, MA, CS
Claudia Raj	23/02/2005	JMB	Maths, Physics, Art	MA, PY, AR
Aamil Akram	24/01/2005	KMB	Art, Design, English language	AR, DE, EN
Areeba Faraz	21/12/2004	SMH	English language, Chemistry, Design	EN, CH, DE

Explain how to modify the table to put it into First Normal Form (1NF).

.....

.....

.....

.....

.....

.....

.....

..... [4]

3 **(a)** State **one** difference between a kibibyte and a megabyte.

.....

..... [1]

(b) **(i)** Convert the denary value into a 12-bit two's complement binary integer.

−196

Answer ..... [1]

(ii) Convert the Binary Coded Decimal (BCD) into denary.

100001100101

Answer ..... [1]

(iii) Convert the unsigned binary integer into denary.

000111010110

Answer ..... [1]

(c) Identify **one** practical application of BCD **and** justify why BCD is used in this application.

Application .....

.....

Justification .....

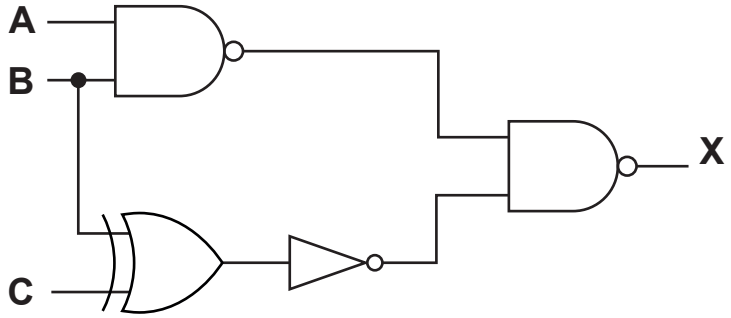
.....

.....

.....

[2]

4 **(a)** Write the Boolean expression that corresponds to the following logic circuit.



.....

..... [3]

(b) Complete the truth table for the logic expression:

X = **A** XOR (**B** AND (**A** NAND **B**) AND NOT **C**)

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

5 **(a)** State the meaning of **privacy of data**.

.....

..... [1]

(b) State the meaning of **integrity of data**.

.....

..... [1]

(c) Describe the following threats to a computer system.

Phishing email .....

.....

.....

.....

Spyware .....

.....

.....

.....

[4]

6 **(a)** A real-time video of a music concert needs to be streamed to subscribers.

Tick (✓) **one** box to identify the most appropriate type of compression **and** justify your answer.

Lossy	Lossless

Justification .....

.....

.....

.....

.....

..... [3]

(b) Explain the impact of changing the sampling resolution on the accuracy of a sound recording.

.....

.....

.....

.....

.....

..... [3]

(c) A bitmap image has a resolution of 2048 pixels wide and 1024 pixels high.

The image has a bit depth of 10 bits per pixel.

Estimate the file size of the bitmap image in mebibytes. Show your working.

Working .....

.....

.....

.....

.....

.....

Estimated file size in mebibytes .....
[2]

7 A Local Area Network (LAN) contains four devices:

- a router
- two laptop computers
- a server.

(a) The server has the IP address 192.168.3.2

Explain why this is **not** an IPv6 address.

.....

.....

.....

..... [2]

(b) **(i)** The LAN is set up as a star topology.

Draw a diagram of the topology of the LAN.

[2]

(ii) Explain how data is transmitted between the two laptops in the LAN.

.....

.....

.....

..... [2]

(iii) Subnetting can be used to separate a network into logical segments.

Describe **two other** reasons why subnetting is used in a network.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(c) State **three** tasks performed by devices to deal with collisions when using the Carrier Sense Multiple Access / Collision Detection (CSMA/CD) protocol in a network.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(d) The following incomplete table contains types of IP addresses and their descriptions.

Complete the table by writing the missing types of IP addresses and the missing descriptions.

Type of IP address	Description
....	an IP address that is assigned to a device to allow direct access on the internet
static IP address	....
....	an IP address used for internal LAN communication only
dynamic IP address	....

[4]

8 A computer has an Operating System (OS).

(a) State **one** purpose of the Operating System.

.....

..... [1]

(b) The Operating System has utility software.

The purpose of some utility software is to improve security.

Identify **one** example of utility software that is **not** intended to improve security.

Explain why this software is needed.

Utility software .....

Explanation .....

.....

.....

.....

.....

[3]

(c) An optical disc reader/writer is connected to the computer.

(i) Give the name of **one** port that can provide a connection for the optical disc reader/writer.

..... [1]

(ii) Describe the roles of the address bus, the data bus **and** buffers in the process of writing data to the optical disc reader/writer.

.....

.....

.....

.....

.....

..... [3]

9 The following table shows part of the instruction set for a processor. The processor has two registers, the Accumulator (ACC) and the Index Register (IX).

Instruction		Explanation
Opcode	**Operand**	
LDD	<address>	Direct addressing. Load the contents of the location at the given address to ACC
LDX	<address>	Indexed addressing. Form the address from <address> + the contents of the index register. Copy the contents of this calculated address to ACC
LDR	#n	Immediate addressing. Load the number n to IX
STO	<address>	Store the contents of ACC at the given address
ADD	#n	Add the denary number n to the ACC
JMP	<address>	Jump to the given address
INC	<register>	Add 1 to the contents of the register (ACC or IX)
CMP	<address>	Compare the contents of ACC with the contents of <address>
CMI	<address>	Indirect addressing. The address to be used is at the given address. Compare the contents of ACC with the contents of this second address
JPE	<address>	Following a compare instruction, jump to <address> if the compare was True
IN		Key in a character and store its ASCII value in ACC
OUT		Output to the screen the character whose ASCII value is stored in ACC
END		Return control to the operating system
<address> can be an absolute or a symbolic address # denotes a denary number, e.g. #123		

(a) The instructions in the processor's instruction set can be grouped according to their function.

Identify the instruction group for each of the following opcodes.

IN .....

ADD .....

JPE .....

CMI .....

[4]

(b) The current contents of main memory and selected values from the ASCII character set are given on page 15.

Trace the program currently in memory using the trace table when the input is '1'.

Address	Instruction
10	LDR #0
11	IN
12	STO 101
13	LDX 110
14	CMP 100
15	JPE 21
16	LDD 101
17	ADD #16
18	INC IX
19	STO 100
20	JMP 13
21	OUT
22	END
...	
100	0
101	0
...	
110	51
111	65

ASCII value	Character
49	1
50	2
51	3
52	4
...	
65	A
66	B
67	C
68	D

Instruction address	ACC	IX	Memory address				Output
			100	101	110	111	
			0	0	51	65	

[4]

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Cambridge Assessment International Education

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4673944950

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **October/November 2023**

1 hour 30 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen.
- Write your name, centre number and candidate number in the boxes at the top of the page.
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INFORMATION

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1 **(a)** State what is meant by **analogue data**.

..... [1]

(b) Draw **one** line from each term to its most appropriate description.

Term	Description
sampling	the number of samples taken per second
sampling rate	taking measurements at regular intervals and storing the values
sampling resolution	the number of bits used to store each sample

[2]

2 **(a)** Describe the impact of increasing the image resolution on the quality of a bitmap graphic.

.....

.....

.....

..... [2]

(b) Calculate the file size of a bitmap image using the following information:

- image resolution of 2048 pixels wide and 1024 pixels high
- bit depth of 16 bits.

Give your answer in kibibytes. Show your working.

Working .....

.....

.....

.....

.....

Answer in kibibytes .....
[2]

3 A company sells online Computer Science courses to students in different countries.

The courses are stored on a public cloud.

(a) (i) Explain why the company uses a public cloud to store these courses.

.....

.....

.....

..... [2]

(ii) Describe **two** disadvantages of storing data on a public cloud compared to storing data on a server in a Local Area Network (LAN).

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[4]

(iii) State how the following security measures can be used to protect computer systems.

Firewall .....

.....

Encryption .....

.....

Passwords .....

.....

[3]

(b) The company uses a database, COURSES, to store data about the courses and their tutors.

Each course starts at different times of the year and may have a different tutor.

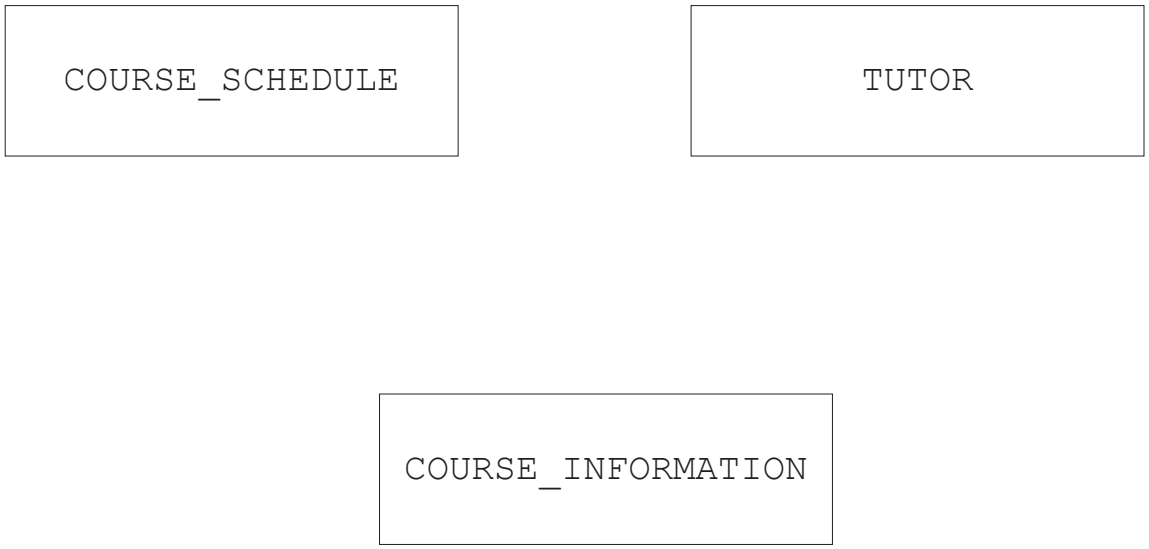
The database has the following structure:

COURSE_INFORMATION(CourseID, Description, Cost)

TUTOR(TutorID, TelephoneNumber, EmailAddress, TutorName)

COURSE_SCHEDULE(CourseID, DateStarted, TutorID)

(i) Complete the entity-relationship (E-R) diagram for the database COURSES.



[1]

(ii) Write the Structured Query Language (SQL) script to return the total number of courses that have started after 9 September 2023.

The value returned must have an appropriate field name.

.....

.....

.....

.....

.....

..... [4]

(c) An example of a tutor ID is NK16C6.

An administrative officer enters the tutor ID into the `TUTOR` table.

Explain how data verification can be used when the tutor ID is entered.

.....

.....

.....

.....

.....

.....

.....

..... [4]

4 **(a)** Complete the truth table for the logic expression:

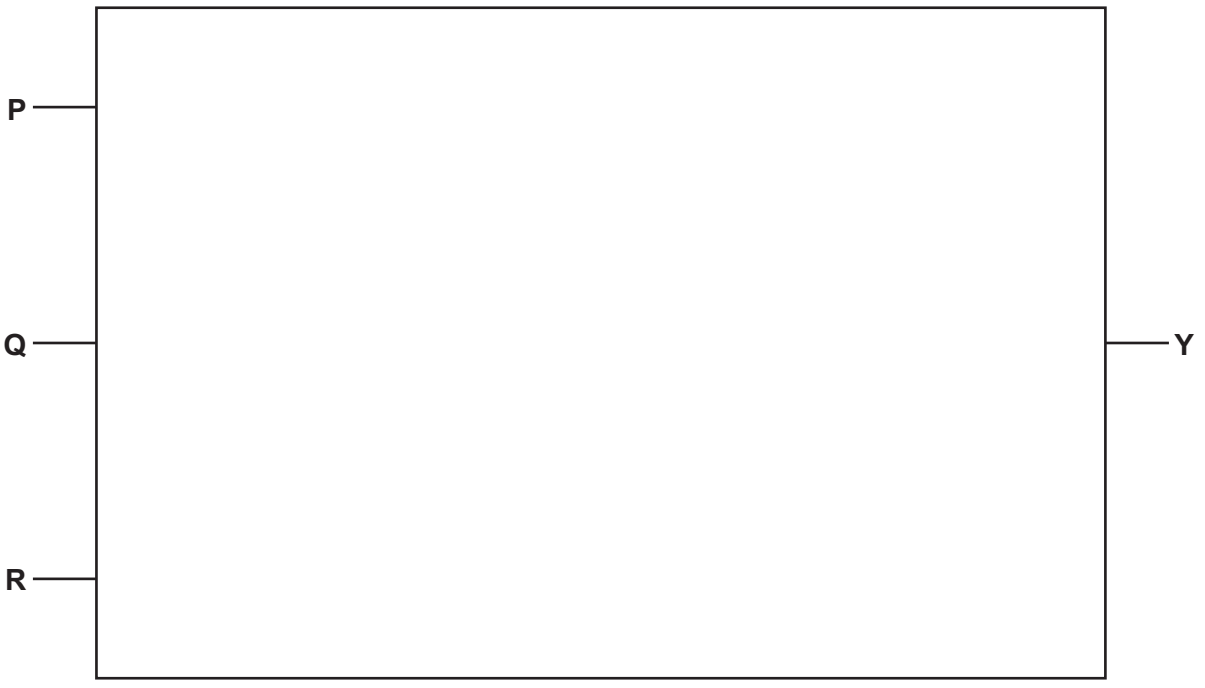
Y = ((**P** AND **Q**) XOR ((NOT **Q**) OR **R**)) AND NOT **P**

P	Q	R	Working space	Y
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[2]

(b) Draw a logic circuit for the logic expression:

Y = ((**P** AND **Q**) XOR ((NOT **Q**) OR **R**)) AND NOT **P**



[2]

5 A programmer uses an Integrated Development Environment (IDE) to develop a program that monitors air quality.

(a) Describe the following features of a typical IDE.

Context-sensitive prompts .....

.....

.....

.....

Single stepping .....

.....

.....

.....

.....

[4]

(b) The program is distributed by downloading the source code and its library files from a web server.

(i) Explain the reasons for compressing the files.

.....

.....

.....

..... [2]

(ii) The program files are stored on a new hard disk after they have been downloaded.

Describe the reasons why a hard disk formatter is needed for the new hard disk.

.....

.....

.....

.....

.....

..... [3]

6 **(a)** State **two** benefits to a programmer of distributing a program using a shareware licence.

1 .....

.....

2 .....

..... [2]

(b) Explain why it is important for a programmer to join a professional ethical body.

.....

.....

.....

.....

.....

.....

.....

..... [4]

7 A laptop computer has Static RAM (SRAM).

A virtual reality headset and a laser printer are connected to the laptop.

(a) Explain why Static RAM is used in the laptop instead of Dynamic RAM.

.....

.....

.....

..... [2]

(b) Identify **two** reasons for using Electrically Erasable Programmable ROM (EEPROM) in a virtual reality headset.

1 .....

.....

2 .....

.....

[2]

(c) Describe how the laser printer makes use of a buffer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) Identify **one** port that could be used to connect the virtual reality headset to the laptop.

Justify your choice.

Port .....

Justification .....

.....

.....

.....

[3]

8 **(a)** Data verification is one method of protecting the integrity of data.

Describe **one** other method of protecting the integrity of data.

.....

.....

.....

..... [2]

(b) State **one** difference and **one** similarity between pharming and phishing.

Difference .....

.....

Similarity .....

.....
[2]

(c) Explain how the data security risks of malware can be restricted.

.....

.....

.....

.....

.....

..... [3]

9 A computer system is designed using the basic Von Neumann model.

Registers and buses are components in the Von Neumann model.

(a) (i) Identify **three other** components in the Von Neumann model of a computer system.

Do not include registers or buses in your answers.

1 .....

2 .....

3 .....

[3]

(ii) Identify **two** differences between special purpose registers and general purpose registers.

1 .....

.....

2 .....

.....

[2]

(b) The following incomplete table contains steps of the Fetch-Execute (F-E) cycle and their descriptions.

Complete the table by writing the missing steps using register transfer notation **and** the missing descriptions.

Step	Description
.....	The address in PC is incremented.
MDR ← [[MAR]]	....
MAR ← [PC]	....
.....	The contents of MDR are copied into CIR.

[4]

(c) Interrupts can be caused by software programs or hardware devices.

State **one** cause of a software interrupt.

.....

..... [1]

(d) The following statements describe the stages that the CPU performs when an interrupt is detected.

There are **three** missing statements.

Write the letter of the missing statements from the table in the correct place to complete the description.

1 At the end of each Fetch-Execute (F-E) cycle, the processor checks if an interrupt flag is set.

2 .....

3 If the interrupt priority is high enough, the processor saves the current contents of the registers.

4 .....

5 When servicing of the interrupt is complete, the processor restores the registers.

6 .....

Letter	Stage
A	The address of the Interrupt Service (ISR) handling routine is loaded into the Program Counter (PC).
B	Lower priority interrupts are re-enabled.
C	The device causing the interrupt transfers data to the CPU.
D	The processor identifies the source of the interrupt and checks the priority of the interrupt.
E	The ISR is incremented.

[3]

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