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1. In the code segment below, assume that the `int` variable `n` has been properly declared and initialized. The code segment is intended to print a value that is `1` more than twice the value of `n`.

```
/* missing code */
System.out.print(result);
```

Which of the following can be used to replace `/* missing code */` so that the code segment works as intended?

I.
```
int result = 2 * n;
result = result + 1;
```

II.
```
int result = n + 1;
result = result * 2;
```

III.
```
int result = (n + 1) * 2;
```

(A) I only

(B) II only

(C) III only

(D) I and III

(E) II and III

2. Consider the following code segment.

```
int a = 5;
int b = 8;
int c = 3;
System.out.println(a + b / c * 2);
```

What is printed as a result of executing this code?

(A) `2`

(B) `6`

(C) `8`

(D) `9`

(E) `14`

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3. Consider the following class declarations.

```
public class Alpha
{
     private int answer()
     {
         return 10;
     }
}

public class Beta
{
     public double sample()
     {
         Alpha item = new Alpha();
         double temp = item.answer();
         return temp * 2.0;
     }
}
```

Which of the following best describes why an error occurs when the classes are compiled?

(A) The class `Alpha` does not have a defined constructor.

(B) The class `Alpha` must be declared as a subclass of `Beta`.

(C) The class `Beta` must be declared as a subclass of `Alpha`.

(D) The `answer` method cannot be accessed from a class other than `Alpha`.

(E) The result of the method call `item.answer()` cannot be assigned to a variable of type `double`.

4. In the code segment below, assume that the `int` variables `a` and `b` have been properly declared and initialized.

```
int c = a;
int d = b;
c += 3;
d--;
double num = c;
num /= d;
```

Which of the following best describes the behavior of the code segment?

(A) The code segment stores the value of `(a + 3) / b` in the variable `num`.

(B) The code segment stores the value of `(a + 3) / (b - 1)` in the variable `num`.

(C) The code segment stores the value of `(a + 3) / (b - 2)` in the variable `num`.

(D) The code segment stores the value of `(a + 3) / (1 - b)` in the variable `num`.

(E) The code segment causes a runtime error in the last line of code because `num` is type `double` and `d` is type `int`.

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5. Consider the following code segment, which is intended to find the average of two positive integers, `x` and `y`.

```
int x;
int y;
int sum = x + y;
double average = (double) (sum / 2);
```

Which of the following best describes the error, if any, in the code segment?

(A) There is no error, and the code works as intended.

(B) In the expression `(double) (sum / 2)`, the cast to `double` is applied too late, so the average will be less than the expected result for even values of `sum`.

(C) In the expression `(double) (sum / 2)`, the cast to `double` is applied too late, so the average will be greater than the expected result for even values of `sum`.

(D) In the expression `(double) (sum / 2)`, the cast to `double` is applied too late, so the average will be less than the expected result for odd values of `sum`.

(E) In the expression `(double) (sum / 2)`, the cast to `double` is applied too late, so the average will be greater than the expected result for odd values of `sum`.

6. Consider the following static method.

```
public static int calculate(int x)

{

 x = x + x;

 x = x + x;

 x = x + x;



 return x;

}
```

Which of the following can be used to replace the body of calculate so that the modified version of calculate will return the same result as the original version for all x ?

(A) return 3 + x;

(B) return 3 * x;

(C) return 4 * x;

(D) return 6 * x;

(E) return 8 * x;

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7. Consider the following static method.

```
public static int calculate(int x)
{
  x = x + x;
  x = x + x;
  x = x + x;
  return x;
}
```

Which of the following can be used to replace the body of calculate so that the modified version of calculate will return the same result as the original version for all x ?

(A) return 2 * x;

(B) return 4 * x;

(C) return 8 * x;

(D) return 3 * calculate(x);

(E) return x + calculate(x - 1);

8. Consider the following code segment.

```
double num = 9 / 4;
System.out.print(num);
System.out.print(" ");
System.out.print((int) num);
```

What is printed as a result of executing the code segment?

(A) `2 2`

(B) `2.0 2`

(C) `2.0 2.0`

(D) `2.25 2`

(E) `2.25 2.0`

9. Which of the following expressions evaluate to `3.5` ?

I. `(double) 2 / 4 + 3`
II. `(double) (2 / 4) + 3`
III. `(double) (2 / 4 + 3)`

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(A) I only
(B) III only
(C) I and II only
(D) II and III only
(E) I, II, and III

10. Consider the following code segment.

```
double x = (int) (5.5 - 2.5);
double y = (int) 5.5 - 2.5;
System.out.println(x - y);
```

What is printed as a result of executing the code segment?

(A) `-1.0`
(B) `-0.5`
(C) `0.0`
(D) `0.5`
(E) `1.0`

11. Consider the following code segment.

```
int w = 1;
int x = w / 2;
double y = 3;
int z = (int) (x + y);
```

Which of the following best describes the results of compiling the code segment?

(A) The code segment compiles without error.
(B) The code segment does not compile, because the `int` variable `x` cannot be assigned the result of the operation `w / 2`.
(C) The code segment does not compile, because the integer value `3` cannot be assigned to the `double` variable `y`.
(D) The code segment does not compile, because the operands of the addition operator cannot be of different types `int` and `double`.
(E) The code segment does not compile because the result of the addition operation is of type `double` and cannot be cast to an `int`.

12. Consider the following code segment.

```
double x = 4.5;
int y = (int) x * 2;
System.out.print(y);
```

What is printed as a result of executing the code segment?

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(A) `8`

(B) `8.0`

(C) `9`

(D) `9.0`

(E) `10`

13. The code segment below is intended to calculate the circumference `c` of a circle with the diameter `d` of `1.5`. The circumference of a circle is equal to its diameter times `pi`.

```
/* missing declarations */
c = pi * d;
```

Which of the following variable declarations are most appropriate to replace `/*` *missing declarations* `*/` in this code segment?

(A)
```
int pi = 3.14159;
int d = 1.5;
final int c;
```

(B)
```
final int pi = 3.14159;
int d = 1.5;
int c;
```

(C)
```
final double pi = 3.14159;
double d = 1.5;
double c;
```

(D)
```
double pi = 3.14159;
double d = 1.5;
final double c = 0.0;
```

(E)
```
final double pi = 3.14159;
final double d = 1.5;
final double c = 0.0;
```

14. Consider the following code segment.

```
int a = 5;
int b = 4;
int c = 2;
a *= 3;
b += a;
b /= c;
System.out.print(b);
```

What is printed when the code segment is executed?

(A) `2`

(B) `4`

(C) `9`

(D) `9.5`

(E) `19`

15. Consider the following method.

```
public int getTheResult(int n)

{

int product = 1;

for (int number = 1; number < n; number++)

{

if (number % 2 == 0)

product *= number;

}

return product;

}
```

What value is returned as a result of the call getTheResult(8) ?

(A) 48
(B) 105
(C) 384
(D) 5040
(E) 40320

16. Consider the following code segment.

```
int x = 5;
int y = 6;
/* missing code */
z = (x + y) / 2;
```

Which of the following can be used to replace `/* missing code */` so that the code segment will compile?

I. `int z = 0;`
II. `int z;`
III. `boolean z = false;`

(A) I only

(B) II only

(C) I and II only

(D) II and III only

(E) I, II, and III

17. A code segment (not shown) is intended to determine the number of players whose average score in a game exceeds `0.5`. A player's average score is stored in `avgScore`, and the number of players who meet the criterion is stored in the variable `count`.

Which of the following pairs of declarations is most appropriate for the code segment described?

(A)
```
double avgScore;
boolean count;
```

(B)
```
double avgScore;
double count;
```

(C)
```
double avgScore;
int count;
```

(D)
```
int avgScore;
boolean count;
```

(E)
```
int avgScore;
int count;
```

18. Consider the following code segment.

```
int a = 5;
int b = 2;
double c = 3.0;
System.out.println(5 + a / b * c - 1);
```

What is printed when the code segment is executed?

(A) `0.666666666666667`

(B) `9.0`

(C) `10.0`

(D) `11.5`

(E) `14.0`

19. Assume that `x` and `y` are variables of type `int`. Which of the following Java expressions never results in a division by zero?

(A) `(y / x) == 0`

(B) `((y / x) == 0) && (x != 0)`

(C) `((y / x) == 0) || (x != 0)`

(D) `(x != 0) && ((y / x) == 0)`

(E) `(x != 0) || ((y / x) == 0)`

20. Consider the following code segment.

```
System.out.print("Hello System.out.println");
System.out.print("!!!");
```

What is printed as a result of executing the code segment?

(A) `Hello!!!`

(B) `Hello System.out.println!!!`

(C)
```
Hello
!!!
```

(D)
```
Hello System.out.println
!!!
```

(E) Nothing is printed because the text `"System.out.println"` cannot appear inside a print statement.

21. Consider the method `getHours`, which is intended to calculate the number of hours that a vehicle takes to travel between two *mile markers* on a highway if the vehicle travels at a constant speed of 60 miles per hour. A mile marker is a sign showing the number of miles along a road between some fixed location (for example, the beginning of a highway) and the current location.

The following table shows two examples of the intended behavior of `getHours`, based on the `int` parameters `marker1` and `marker2`.

marker1	marker2	**Return Value**
100	220	2.0
100	70	0.5

Consider the following implementation of `getHours`.

```
public static double getHours(int marker1, int marker2)
{
     /* missing statement */
     return hours;
}
```

Which of the following statements can replace `/* missing statement */` so `getHours` works as intended?

(A) `double hours = (Math.abs(marker1) - Math.abs(marker2)) / 60.0;`

(B) `double hours = Math.abs(marker1 - marker2 / 60.0);`

(C) `double hours = Math.abs(marker1 - marker2) / 60.0;`

(D) `double hours = Math.abs((marker1 - marker2) / 60);`

(E) `double hours = (double) (Math.abs(marker1 - marker2) / 60);`

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22. Consider the following code segment.

```
double firstDouble = 2.5;
int firstInt = 30;
int secondInt = 5;
double secondDouble = firstInt - secondInt / firstDouble + 2.5;
```

What value will be assigned to `secondDouble` when the code segment is executed?

(A) `5.0`

(B) `12.5`

(C) `25.5`

(D) `29.0`

(E) `30.5`

23. The following code segment is intended to interchange the values of the `int` variables `x` and `y`. Assume that `x` and `y` have been properly declared and initialized.

```
int temp = x;
/* missing code */
```

Which of the following can be used to replace `/* missing code */` so that the code segment works as intended?

(A)
```
x = y;
x = temp;
```

(B)
```
x = y;
y = temp;
```

(C)
```
y = x;
x = temp;
```

(D)
```
y = x;
temp = y;
```

(E)
```
y = x;
temp = x;
```

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24. Consider the following method.

```
public static int mystery(boolean a, boolean b, boolean c)
{
     int answer = 7;

     if (!a)
     {
         answer += 1;
     }

     if (b)
     {
         answer += 2;
     }

     if (c)
     {
         answer += 4;
     }

     return answer;
}
```

Which of the following method calls will return the value `11` ?

(A) `mystery(true, true, true)`

(B) `mystery(true, false, true)`

(C) `mystery(false, true, false)`

(D) `mystery(false, false, true)`

(E) `mystery(false, false, false)`

25. Consider the following code segment.

```
num += num;
num *= num;
```

Assume that `num` has been previously declared and initialized to contain an integer value. Which of the following best describes the behavior of the code segment?

(A) The value of `num` is two times its original value.

(B) The value of `num` is the square its original value.

(C) The value of `num` is two times the square of its original value.

(D) The value of `num` is the square of twice its original value.

(E) It cannot be determined without knowing the initial value of `num`.

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26. Consider the following code segment, which is intended to print the digits of the two-digit `int` number `num` in reverse order. For example, if `num` has the value `75`, the code segment should print `57`. Assume that `num` has been properly declared and initialized.

```
/* missing code */
System.out.print(onesDigit);
System.out.print(tensDigit);
```

Which of the following can be used to replace `/* missing code */` so that the code segment works as intended?

(A)
```
int onesDigit = num % 10;
int tensDigit = num / 10;
```

(B)
```
int onesDigit = num / 10;
int tensDigit = num % 10;
```

(C)
```
int onesDigit = 10 / num;
int tensDigit = 10 % num;
```

(D)
```
int onesDigit = num % 100;
int tensDigit = num / 100;
```

(E)
```
int onesDigit = num / 100;
int tensDigit = num % 100;
```

27. Consider the following code segment.

```
int a = 3 + 2 * 3;
int b = 4 + 3 / 2;
int c = 7 % 4 + 3;
double d = a + b + c;
```

What is the value of `d` after the code segment is executed?

(A) `14.0`

(B) `18.0`

(C) `20.0`

(D) `20.5`

(E) `26.0`

28. Which of the following expressions evaluate to `7` ?

I. `9 + 10 % 12`
II. `(9 + 10) % 12`
III. `9 - 2 % 12`

(A) I only

(B) II only

(C) I and III

(D) II and III

(E) I, II, and III

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29. Consider the following code segment.

```
int x = 5;
x += 6 * 2;
x -= 3 / 2;
```

What value is stored in `x` after the code segment executes?

(A) `-1.5`

(B) `1`

(C) `9`

(D) `15.5`

(E) `16`

30. Consider the following code segment, where `k` and `count` are properly declared and initialized `int` variables.

```
k++;
k++;
count++;
k--;
count++;
k--;
```

Which of the following best describes the behavior of the code segment?

(A) The code segment leaves both `k` and `count` unchanged.

(B) The code segment increases both `k` and `count` by `2`.

(C) The code segment increases `k` by `4` and `count` by `2`.

(D) The code segment leaves `k` unchanged and increases `count` by `2`.

(E) The code segment increases `k` by `2` and leaves `count` unchanged.

31. Consider the following code segment.

```
int a = 4;
int b = 5;
a++;
b++;
int c = a + b;
a -= 1;
System.out.println(a + c);
```

What is printed when the code segment is executed?

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(A) `9`

(B) `10`

(C) `14`

(D) `15`

(E) `25`

32. Consider the following code segment.

```
System.out.print("AP");
System.out.println();
System.out.println("CS");
System.out.print("A");
```

What is printed as a result of executing the code segment?

(A) `APCSA`

(B)
```
APCS
A
```

(C)
```
AP
CSA
```

(D)
```
AP
CS
A
```

(E)
```
AP

CS
A
```

33. Consider the following code segment.

```
System.out.print(I do not fear computers. );   // Line 1
System.out.println(I fear the lack of them.);  // Line 2
System.out.println(--Isaac Asimov);            // Line 3
```

The code segment is intended to produce the following output but may not work as intended.

```
I do not fear computers. I fear the lack of them.
--Isaac Asimov
```

Which change, if any, can be made so that the code segment produces the intended output?

(A) In line 1, `print` should be changed to `println`.

(B) In lines 2 and 3, `println` should be changed to `print`.

(C) The statement `System.out.println()` should be inserted between lines 2 and 3.

(D) In lines 1, 2, and 3, the text that appears in parentheses should be enclosed in quotation marks.

(E) No change is needed; the code segment works correctly as is.

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34. Consider the following code segment.

```
System.out.print(*);     // Line 1
System.out.print("*");   // Line 2
System.out.println();    // Line 3
System.out.println("*"); // Line 4
```

The code segment is intended to produce the following output, but may not work as intended.

```
**
*
```

Which line of code, if any, causes an error?

(A) Line 1

(B) Line 2

(C) Line 3

(D) Line 4

(E) The code segment works as intended.

35. Consider the following code segment.

```
System.out.print("*");
System.out.println("**");
System.out.println("***");
System.out.print("****");
```

What is printed as a result of executing the code segment?

(A)
```
*
**
***
****
```

(B)
```
*
**
*******
```

(C)
```
*
*****
****
```

(D)
```
***
***
****
```

(E)
```
***
*******
```

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36. Consider the following code segment.

```
System.out.print("One");   // Line 1
System.out.print("Two");   // Line 2
System.out.print("Three"); // Line 3
System.out.print("Four");  // Line 4
```

The code segment is intended to produce the following output, but does not work as intended.

```
OneTwo
ThreeFour
```

Which of the following changes can be made so that the code segment produces the intended output?

(A) Changing `print` to `println` in line 1 only

(B) Changing `print` to `println` in line 2 only

(C) Changing `print` to `println` in line 3 only

(D) Changing `print` to `println` in lines 2 and 3 only

(E) Changing `print` to `println` in lines 1, 2, 3, and 4

37. What is printed as a result of executing the following statement?

```
System.out.println(404 / 10 * 10 + 1);
```

(A) 4

(B) 5

(C) 41

(D) 401

(E) 405

38. Consider the following code segment.

```
for (int k = 0; k < 9; k = k + 2)
{
     if ((k % 2) != 0)
     {
         System.out.print(k + " ");
     }
}
```

What, if anything, is printed as a result of executing the code segment?

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(A) `0 2 4 6 8 10`
(B) `0 2 4 6 8`
(C) `1 3 5 7 9`
(D) `1 3 5 7`
(E) Nothing is printed.

39. Consider the following code segment.

```
double a = 1.1;

double b = 1.2;


if ((a + b) * (a - b) != (a * a) - (b * b))

{

  System.out.println("Mathematical error!");

}
```

Which of the following best describes why the phrase "Mathematical error!" would be printed?

(Remember that mathematically $(a + b) * (a - b) = a^2 - b^2$.)

(A) Precedence rules make the if condition true.
(B) Associativity rules make the if condition true.
(C) Roundoff error makes the if condition true.
(D) Overflow makes the if condition true.
(E) A compiler bug or hardware error has occurred.

40. The following code segment is intended to round `val` to the nearest integer and print the result.

```
double val = -0.7;
int roundedVal = (int) (val + 0.5);
System.out.println(roundedVal);
```

Which of the following best describes the behavior of the code segment?

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(A) The code segment works as intended.

(B) The code segment does not work as intended because `val` and `roundedVal` should be declared as the same data type.

(C) The code segment does not work as intended because the expression `(val + 0.5)` should be cast to a `double` instead of an `int`.

(D) The code segment does not work as intended because `val` should be cast to an `int` before `0.5` is added to it.

(E) The code segment does not work as intended because the expression `(int) (val + 0.5)` rounds to the nearest integer only when `val` is positive.

41. Which of the following statements stores the value `3` in `x` ?

(A) `int x = 4 / 7;`

(B) `int x = 7 / 3;`

(C) `int x = 7 / 4;`

(D) `int x = 5 % 8;`

(E) `int x = 8 % 5;`

Directions: Select the choice that best fits each statement. The following question(s) refer to the following incomplete class declaration.

```
public class TimeRecord
{
  private int hours;
  private int minutes; // 0 ≤ minutes < 60
  /** Constructs a TimeRecord object.
   *  @param h the number of hours
   *         Precondition: h ≥ 0
   *  @param m the number of minutes
   *         Precondition: 0 ≤ m < 60
   */
  public TimeRecord(int h, int m)
  {
    hours = h;
    minutes = m;
  }

  /** @return the number of hours
   */
  public int getHours()
  { /* implementation not shown */ }

  /** @return the number of minutes
   *  Postcondition: 0 ≤ minutes < 60
   */
  public int getMinutes()
  { /* implementation not shown */ }

  /** Adds h hours and m minutes to this TimeRecord.
   *  @param h the number of hours
   *         Precondition: h ≥ 0
   *  @param m the number of minutes
   *         Precondition: m ≥ 0
   */
  public void advance(int h, int m)
  {
    hours = hours + h;
    minutes = minutes + m;
    /* missing code */
  }
  // Other methods not shown
```

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42. Which of the following can be used to replace / * *missing code* * / so that advance will correctly update the time?

(A) minutes = minutes % 60;

(B) minutes = minutes + hours % 60;

(C) hours = hours + minutes / 60;
minutes = minutes % 60;

(D) hours = hours + minutes % 60;
minutes = minutes / 60;

(E) hours = hours + minutes / 60;