Please write your solutions on the following page provided, filling in the appropriate circle with pencil to indicate your answer. The answer sheet will be automatically read by a scanner, so you must indicate the single answer clearly.
1. What values do c and d respectively have after the following sequence of statements?

```java
boolean a = true;
boolean b = false;
boolean c = (a || b) && !(a && b);
boolean d = c || (a && b || !(a && b || (a && !b)));
```

(a) (*) true, true  
(b) true, false  
(c) false, true  
(d) false, false  
(e) true, 0

2. Suppose that the class **Drawer** contains an instance variable **sc** which refers to a **SimpleCanvas**, and that it has the following method:

```java
public void mystery() {
    java.awt.Color col1;
    col1 = new java.awt.Color(0,255,0); // Green

    java.awt.Color col2;
    col2 = new java.awt.Color(255,255,0); // Yellow

    for (int i=0;i<400;i++) {
        sc.setForegroundColour(col1);
        sc.drawLine(0,i,400,i);

        if (i > 100 && i < 300) {
            sc.setForegroundColour(col2);
            sc.drawLine(0,i,400,i);
        }
    }
}
```
If you call this method when the SimpleCanvas sc is blank, visible and has size 400 × 400, then what will appear on the screen?

(a) A yellow square centred in a green background.
(b) A green square centred in a yellow background.
(c) A thick green stripe going top to bottom on a yellow background.
(d) A thick yellow stripe going left-to-right on a green background.
(e) A blue square centred in a yellow background.

3. What is the value of the following expression?

100 % 24 / 3

(a) 1.3333333333333333
(b) 0
(c) 2
(d) Evaluation causes an ArithmeticException: Division by Zero
(e) (*)

4. Consider the following sequence of statements where BankAccount is as given in the lectures.

```java
BankAccount b1 = new BankAccount("Bill Gates", 12345, 0);
BankAccount b2 = new BankAccount("Bill Gates", 12345, 0);
BankAccount b3 = new BankAccount("Larry Ellison", 54321, 0);
b1.deposit(200);
b3 = b2;
b2.deposit(350);
b3.withdraw(150);
```

What are the values of

b1 == b2

and

b1.getBalance() == b3.getBalance()
respectively?

(a) true and true
(b) false and false
(c) true and false
(d) (*)false and true
(e) false and 200.

5. If a and b are variables of type boolean then which of the following expressions is true when exactly one of a and b is true, and false under all other circumstances?

(a) a || b
(b) a && b
(c) (a && !b) && (!a && b)
(d) (*) (a || b) && (!a || !b)
(e) (a || b) || (!a || !b)

6. Which of the following methods will correctly calculate the maximum value in an array? All of these methods compile correctly, so you are only looking for logic errors, not syntax errors. (The method Math.max() is a library method from the Java API and returns the maximum of its two arguments.)

```java
public int max1(int[] a) {
    int maxPos = 0;
    for (int i=1; i<a.length; i++) {
        if (a[i] > a[maxPos]) {
            maxPos = i;
        }
    }
    return a[maxPos];
}

public int max2(int[] a) {
    int max = 0;
    for (int i=0; i<a.length; i++) {
        if (a[i] > max) {
```
```java
    max = a[i];
    }
    return max;
    }

public int max3(int[] a) {
    for (int i=1; i<a.length; i++) {
        a[i] = Math.max(a[i],a[i-1]);
    }
    return a[a.length-1];
    }

(a) All of them
(b) max1 and max2 only
(c) max2 and max3 only
(d) (*max1 and max3 only
(e) None of them

7. Consider the following variable declaration
   BankAccount b;
   This declaration
   (a) will cause a syntax error, as it is not permitted to declare a vari-
   able of reference type without constructing the associated object.
   (b) has created a variable called b with the initial value 0.
   (c) creates a BankAccount object called b.
   (d) creates an object only if the class has a no-argument constructor,
        otherwise causes a runtime error.
   (e) (*)creates a variable called b with the initial value null.

8. The statement following the declaration in the previous question is
   b = new BankAccount("Steve Jobs",890,300) ;
   This statement
   (a) will cause a syntax error, because it is not possible to have a
        no-argument constructor in Java.

8
(b) cannot create the object b because it is already null.
(c) (*) creates space for the BankAccount object and assigns the reference value to b.
(d) will fail to compile because a ; is not expected in this statement.
(e) cause a run-time error because the object b has already been declared.

9. You are writing a program to keep track of your audio CD collection, and are defining a class CD to represent a single compact disc. You are defining instance variables to store the title, number of tracks and cost of each CD.

What are the most appropriate types for those variables (in that order)?

(a) String, double, String
(b) char, int, int
(c) (*) String, int, double
(d) String, int, long
(e) boolean, String, String

10. What will the method call mystery(958) return, if the method is defined as follows:

```java
public int mystery(int n) {
    int m = 0;
    while (n > 0) {
        m = 10*m + n%10;
        n = n/10;
    }
    return m;
}
```

(a) 0
(b) .958
11. What does the method call fib(7) return if fib is defined as follows?

```java
public int fib(int n) {
    int[] a = new int[n];
    a[0] = 1;
    a[1] = 1;
    for (int i=2; i<n; i++) {
        a[i] = a[i-1] + a[i-2];
    }
    return a[n-1];
}
```

(a) 6  
(b) 8  
(c) (*)13  
(d) 21  
(e) 55

12. Which of the following statements about constructors are true?

1. A class can have zero, one or more constructors.  
2. Constructors can have zero, one or more parameters.  
3. The constructor must have the same name as the class and no return type.  

(a) 1 and 2 only  
(b) 2 and 3 only  
(c) 1 and 3 only  
(d) (*)1, 2 and 3
13. What is the value of the expression 
\[ 10 + 5 \times 4 / 3 - 13 \% 3 \]
(a) 12.66666666667
(b) 15.66666666667
(c) 12
(d) 16
(e) (*)15

14. What are the respective values of the following two expressions?

\[ 4.0 \times 7 / 2 \]
\[ 4.0 \times (7 / 2) \]
(a) 14.0 and 6.0
(b) 14.0 and 14.0
(c) (*)14.0 and 12.0
(d) 12.0 and 14.0
(e) 12.0 and 12.0

15. Consider the following class with a single method

```java
public class Doubler {
    public void doubleIt(int n) {
        n = 2*n;
    }
}
```

What happens when the class is compiled, and the following sequence of statements (which is in a method of another class) is compiled and executed?

```java
int x = 20;
Doubler d = new Doubler();
d.doubleIt(x);
System.out.println(x);
```
(a) The code for `Doubler` will not compile because there is no instance variable called `n`.
(b) The value 40 will be printed out on the terminal window.
(c) (*) The value 20 will be printed out on the terminal window.
(d) The code for `Doubler` will not compile, because the class has no constructors.
(e) The code for `Doubler` will not compile because a parameter variable is read-only and cannot be assigned a value.

16. What is the output of `loop(8)`, where `loop` is defined as follows?

```java
public void loop(int n) {
    for (int i=0; i<n; i++) {
        System.out.print(i*(i-1)/2);
        System.out.print(" ");
    }
    System.out.println();
}
```

(a) 0 0 0 3 4 10 12 21
(b) 0 1 3 6 10 15 21 28
(c) (*) 0 0 1 3 6 10 15 21
(d) 0 3 4 10 12 21 24 36
(e) 0 0 3 4 10 12 21 24

17. If `a` and `b` are defined as follows:

```java
double[] a = {0.1, 0.2, 0.3};
double[] b = {0.1, 0.2, 0.3};
```

then what is the value of the expression `a==b`, and why?

(a) `true` because both arrays have the same type, size and values.
(b) (*) `false` because the two arrays are different objects, even though they are identical.
(c) A runtime error occurs because `==` can only be used for primitive types.
(d) We cannot tell because it depends on internal details of the arrays that the client cannot access.

(e) false because numerical round-off error means that the floating point numbers cannot be stored exactly.

18. Given the following method (you may assume it has all compiled correctly so there are no syntax errors), what will be output?

```java
public void printloop()
{
    int i;

    for (i=1; i<9; i++)
    {
        if (i%2 == 0)
            System.out.print(i + " ");

        System.out.println();
    }
}
```

(a) 2 4 6 8
(b) 8
(c) Nothing is output.
(d) (*)9
(e) 2 4 6

19. The alternating sum of an array `a` is equal to the value


Which of the following three methods correctly calculates the alternating sum of the argument array?

```
// Method 1
public int alternatingSum(int[] a) {
    int sum = 0;
    for (int i=0; i<a.length; i=i+2) {
        sum = sum + a[i] - a[i+1];
    }
    return sum;
}
```
// Method 2
public int alternatingSum(int[] a) { 
    int sum = 0;
    for (int i=0; i<a.length; i++) {
        if (i % 2 == 0) {
            sum = sum - a[i];
        } else {
            sum = sum + a[i];
        }
    }
    return sum;
}

// Method 3
public int alternatingSum(int[] a) { 
    int sum = 0;
    int mult = 1;
    for (int i=0; i<a.length; i++) {
        sum = sum + mult*a[i];
        mult = -mult;
    }
    return sum;
}

(a) (*)Method 3 only
(b) Methods 1 and 3 only
(c) None of them
(d) Method 1 only
(e) Method 2 only

20. If somebody’s height in inches is stored in a variable h, then which of the following commands will correctly translate this into US-style feet-and-inches terminology (one foot contains 12 inches, so somebody who is 74 inches tall is usually said to be “6 feet and 2 inches”).

(a) int feet = h/12;
    int inches = (h - feet*12)/12;
(b) int feet = h%12;
    int inches = h;

(c) double feet = h/12;
    int inches = h%12;

(d) (*)
    int feet = h/12;
    int inches = h%12;

(e) int feet = h-12;
    int inches = h/12;