

QUESTION 1

What is the number AC_{16} when converted to binary?

- A. 100111100_2 B. 10011010_2 C. 101011100_2 D. 10101010_2 E. None of these

QUESTION 2

What is the value of $A[3]$ after executing the code to the right?

- A. 3
B. 4
C. 5
D. 12
E. None of these

```
int [] A = {1, 2, 3, 4, 5};
int [] B;
```

```
B = A;
B[3] = 12;
```

QUESTION 3

The constructor for the `Clock` class takes three integer parameters, and sets the private data members to those three parameters if they are all valid, and to all zeros otherwise. Valid values for `hour` are 0-23, inclusive. Valid values for `min` and `sec` are 0-59, inclusive. Which of these correctly implements the constructor?

- A. `public Clock() {}`
B. `public Clock(int h, int m, int s) {
 if (h >= 0 && h < 24 &&
 m >= 0 && m < 60 &&
 s >= 0 && s < 60) {
 hour = h;
 min = m;
 sec = s;
 }
}`
C. `public Clock(int h, int m, int s) {
 hour = ((h >= 0 && h < 24) ? h : 0);
 min = ((m >= 0 && m < 60) ? m : 0);
 sec = ((s >= 0 && s < 60) ? s : 0);
}`
D. Both B and C
E. None of these

```
public class Clock {  
  
    // Constructor not shown  
  
    private int hour;  
    private int min;  
    private int sec;  
}
```

QUESTION 4

What is output by the code to the right?

- A. 128 B. 100
C. 64 D. 7
E. None of these

```
int i = 1;  
  
do {  
    i = i*2;  
} while (i < 100);  
  
System.out.print(i);
```

QUESTION 5

Which of the following replaces **<*1>** in the code to the right to produce a string consisting of the first name, a space, and the last name?

- A. `return "firstName lastName";`
- B. `return firstName + " " + lastName;`
- C. `return "this.firstName "`
`"this.lastName";`
- D. `return firstName" "lastName;`
- E. None of these

```
public class Person {  
  
    public Person(String first, String last){  
        firstName = first;  
        lastName = last;  
    }  
  
    public String toString() {  
        <*1>  
    }  
  
    private String firstName;  
    private String lastName;  
}
```

QUESTION 6

Which of the following declares a variable of type `Person` and initializes it to Jane Doe?

- A. `Person p = new Person("Jane", "Doe");`
- B. `Person p = new Person("Jane Doe");`
- C. `Person p("Jane", "Doe");`
- D. `Person p("Jane Doe");`
- E. None of these

QUESTION 7

Assume that **<*1>** is filled in correctly and that `p` is declared correctly to represent Jane Doe. What is output by the statement below?

```
System.out.print(p);
```

- A. Nothing
- B. Doe, Jane
- C. JaneDoe
- D. Jane Doe
- E. None of these

QUESTION 8

Assume static method `readLine()` reads a line from standard input. Which of these checks whether the line read is "Hello"?

- A. `"Hello" == s`
- B. `"Hello".equals(s)`
- C. `s == "Hello"`
- D. `s.equals("Hello")`
- E. More than one of these

```
String s = readLine();
```

QUESTION 9

What replaces **<*1>** in the code to the right to generate a random integer between 1 and 6, inclusive?

- A. `r.next(new Integer(), 6)`
- B. `r.nextInt(6) + 1`
- C. `r.next(6)`
- D. `r.nextInt(1, 7)`
- E. None of these

```
public static int roll(int x, int y) {
    Random r = new Random();
    int[] rolls = new int[x];
    for(int i=0; i<x; ++i)
        rolls[i] = <*1>;
    Arrays.sort(rolls);
    int sum=0;
    for (int i=y; i<x; ++i)
        sum += rolls[i];
    return sum;
}
```

QUESTION 10

Assume **<*1>** is filled in correctly. What does the static method `roll()` simulate?

- A. Rolling x dice, dropping the lowest y values
- B. Rolling x dice, dropping the highest y values
- C. Rolling y dice, dropping the lowest x values
- D. Rolling y dice, dropping the highest x values
- E. None of these

QUESTION 11

What replaces **<*1>** in the code to the right to return the string in `sb`?

- A. `return (String) sb`
- B. `return sb.toString()`
- C. `return sb.data`
- D. `System.out.print(sb)`
- E. None of these

```
public static String mangle(String s) {
    StringBuffer sb = new StringBuffer(s);
    for (int i=0; i<s.length()/2; ++i)
        sb.setCharAt(i*2, sb.charAt(i));
    <*1>;
}
```

QUESTION 12

Assume **<*1>** has been filled in correctly. What is returned by the static method call `mangle("Freedom!")`?

- A. "FreeFree"
- B. "FFeeddmm"
- C. "Erreroe!"
- D. "!modeerF"
- E. None of these

QUESTION 13

Which of these could be used anywhere to declare variable a to have type A, and to create an instance with data member x set to 10?

- A. `A a = new A();`
`a.x = 10;`
- B. `A a = new A;`
`a.x = 10;`
- C. `A a = new A;`
`a.setX(10);`
- D. `A a = new A();`
`a.setX(10);`
- E. More than one of these

```
public class A {
    public void setX(int x) { this.x = x; }
    public int getX() { return x; }

    private int x;
}

public class B <*1> {
    // methods and data not shown
}
```

QUESTION 14

Which of these replaces <*1> in the declaration of class B to indicate that B is a subclass of A?

- A. `implements A`
- B. `extending A`
- C. `superclass A`
- D. `subclass of A`
- E. None of these

QUESTION 15

Which of these replaces <*1> in the code to the right to return 1 if x is not positive?

- A. `if (x<1) return 1;`
- B. `if x < 1 return 1;`
- C. `do { return 1; } if (x<1);`
- D. `do { return 1; } if x < 1;`
- E. More than one of these

```
public static int recurse(int x) {
    <*1>
    else return x * recurse(x/2);
}
```

QUESTION 16

Assume <*1> is filled in correctly. What is returned by `recurse(12)`?

- A. 1
- B. 12
- C. 216
- D. 479001600
- E. None of these

QUESTION 17

Which of these replaces <*1> in the code to the right to make the default constructor call the other constructor with the argument 10?

- A. `this(10);`
- B. `super(10);`
- C. `Stack(10);`
- D. `maxSize=10;`
- E. None of these

QUESTION 18

The `push()` method should add the new item at the location represented by `currentSize` and increment `currentSize`. The `pop()` method should decrement `currentSize` and return the item at the location represented by `currentSize` after the decrement. Which of these replace <*2> and <*3> so that the methods work this way?

- A. <*2>: `items[currentSize++]`
<*3>: `items[currentSize--]`
- B. <*2>: `items[++currentSize]`
<*3>: `items[--currentSize]`
- C. <*2>: `items[++currentSize]`
<*3>: `items[currentSize--]`
- D. <*2>: `items[currentSize++]`
<*3>: `items[--currentSize]`
- E. All of these

QUESTION 19

Assume <*1>, <*2>, and <*3> are filled in correctly. What happens if a stack is built using this class, and a call to `pop()` is made on that stack before any call to `push()`?

- A. The call is ignored
- B. The method returns `null`
- C. The method returns an arbitrary object
- D. An `ArrayIndexOutOfBoundsException` is thrown
- E. None of these

```
public class Stack {
    public Stack() { <*1> }

    public Stack(int max) {
        maxSize = max;
        items = new Object[maxSize];
    }

    public void push(Object o) {
        <*2> = o;
    }

    public Object pop() {
        return <*3>;
    }

    private Object[] items;
    private int maxSize;
    private int currentSize;
}
```

QUESTION 20

If the items 15, 27, and 12 are pushed onto a stack in that order, in what order will they be returned by popping the stack?

- A. 15, 27, 12
- B. 12, 27, 15
- C. 12, 15, 27
- D. 27, 15, 12
- E. None of these

<p>QUESTION 21</p> <p>What is the value of z after the declarations to the right?</p> <p>A. 0 B. 4 C. 12 D. 65536 E. None of these</p>	<pre>int x = 12; int y = 4; int z = x << y;</pre>
<p>QUESTION 22</p> <p>If n is initialized to 10, how many *'s are output by the code to the right?</p> <p>A. 0 B. 9 C. 10 D. 11 E. None of these</p>	<pre>int n; // code to initialize n int i = 0; while (i < n) { ++i; System.out.print('*'); }</pre>
<p>QUESTION 23</p> <p>What is the running time of the loop for an arbitrary n? Choose the smallest correct answer.</p> <p>A. $O(1)$ B. $O(\log n)$ C. $O(n)$ D. $O(n^2)$ E. None of these</p>	
<p>QUESTION 24</p> <p>How many *'s are output by the loop to the right?</p> <p>A. 0 B. 1 C. 10 D. 20 E. None of these</p>	<pre>for (int i=0; i<10; ++i) { System.out.print('*'); if (i%2 == 0) break; System.out.print('*'); }</pre>
<p>QUESTION 25</p> <p>If the break statement in the code to the right is changed to a continue statement, how many *'s are output?</p> <p>A. 0 B. 1 C. 10 D. 20 E. None of these</p>	
<p>QUESTION 26</p> <p>Which of these character sequences can be put inside a string literal to cause a line break?</p> <p>A. <code>\n</code> B. <code>\t</code> C. <code>\l</code> D. <code>\b</code> E. None of these</p>	

QUESTION 27

Which of these declares and initializes `m` to be the array represented below?

1	2	3
4	5	6
7	8	9

- A. `int[][] m = {{1,2,3},{4,5,6},{7,8,9}};`
- B. `int[3][3] m = {{1,2,3},{4,5,6},{7,8,9}};`
- C. `int[][] m = {{1,4,7},{2,5,8},{3,6,9}};`
- D. `int[3][3] m = {{1,4,7},{2,5,8},{3,6,9}};`
- E. None of these

```
public static void reverse(int[][] matrix){
    for (int i=0; i<matrix.length; ++i)
        for (int j=i; j<matrix.length; ++j)
            matrix[i][j] = matrix[j][i];
}
```

QUESTION 28

What does `m` look like after calling static method `reverse(m)`?

A.

1	4	7
4	5	8
7	8	9

B.

1	2	3
2	5	6
3	6	9

C.

1	2	3
4	5	6
7	8	9

D.

1	4	7
2	5	8
3	6	9

- E. None of these

QUESTION 29

Which of the following data structures stores a collection of items in an array where the position of an item in the array is determined by applying a mapping function to the item's key?

- A. linked list
- B. binary tree
- C. queue
- D. hash table
- E. None of these

QUESTION 30

Assume the static method `readLine()` reads a line from standard input. What is output by the code to the right on the input below?

ABC 123 DEF 456

- A. 0ABC11232DEF3456
- B. 0ABC 1123 2DEF 3456
- C. 0ABC112323DEF456456
- D. ABC 123 DEF 456
- E. None of these

```
String s = readLine();

String regex = "\\s+";

String[] sArray = s.split(regex);

for (int i=0; i < sArray.length; ++i)
    System.out.print(i + sArray[i]);
```

QUESTION 31

Which of these is a valid test condition for a `switch` statement?

- A. `d + i`
- B. `b == true`
- C. `s.charAt(i)`
- D. `d`
- E. More than one of these

```
String s;
boolean b;
int i;
double d;
```

QUESTION 32

What sorting algorithm is being used by `sort()`?

- A. Selection sort
- B. Insertion sort
- C. Quick sort
- D. Merge sort
- E. None of these

```
public static void sort(int[] v) {
    int len=v.length;
    for (int i=0; i<len-1; ++i) {
        int min=i;
        for (int j=i+1; j<len; ++j)
            if (v[j]<v[min]) min=j;
        int temp=v[i];
        v[i]=v[min];
        v[min]=temp;
    }
}
```

QUESTION 33

What is the running time of `sort()` if `v` has length `n`? Choose the smallest correct answer.

- A. $O(\log n)$
- B. $O(n)$
- C. $O(n \log n)$
- D. $O(n^2)$
- E. None of these

QUESTION 34

Which of these replaces <*1> in the code to the right to give the type of objects that implement the interface containing the compareTo() method?

- A. Implements
- B. CompareTo
- C. Comparable
- D. Object
- E. None of these

```
public static <*1> smallest(<*1> [] vec){
    <*1> min = vec[0];
    for (int i=0; i<vec.length; ++i)
        if (<*2>) min = vec[i];
    return min;
}
```

QUESTION 35

Which of these replaces <*2> in the code to the right to check whether the element at the current position in the array is smaller than min?

- A. vec[i].compareTo(min) < 0
- B. vec[i].compareTo(min) > 0
- C. vec[i].compareTo(min) == -1
- D. vec[i].compareTo(min) == 1
- E. None of these

QUESTION 36

What boolean function is represented by this truth table?

a	b	c	d
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

- A. $d = (a || !b) \&\&c$
- B. $d = !(a \&\&b) || c$
- C. $d = (a \&\&c) || (b \&\&!c)$
- D. $d = a || b || c$
- E. None of these

QUESTION 37

Suppose Circle is a subclass of Shape and Shape is a subclass of Picture. If a method takes a parameter of type Shape, the method could be called without a cast using objects of which of these types?

- A. Circle
- B. Shape
- C. Picture
- D. Both A and B
- E. Both B and C

QUESTION 38

What word replaces **<*1>** in the code to the right to indicate that after initialization `jump` cannot be changed?

- A. `static`
- B. `final`
- C. `const`
- D. `fixed`
- E. None of these

For the remaining questions, assume that **<*1>** has been filled in correctly.

QUESTION 39

Which of these declares and builds an object of type `Increment` which starts with a total of 0, and decreases by 2 every time `change()` is called?

- A. `Increment i = new Increment(0,2);`
- B. `Increment i = new Increment(2,0);`
- C. `Increment i = new Increment(0,-2);`
- D. `Increment i = new Increment(-2,0);`
- E. More than one of these

QUESTION 40

Assume `Increment i` is correctly declared according to the previous question. What is output by the code below?

```
i.change();
i.change();
System.out.print(i.getValue());
```

- A. 0
- B. -4
- C. -2
- D. null
- E. None of these

```
public class Increment {

    public Increment(int init, int jump) {
        total = init;
        this.jump = jump;
    }

    public void change() {
        total += jump;
    }

    public int getValue() {
        return total;
    }

    private int total;
    private <*1> int jump;
}
```