

**QUESTION 1**

What is the sum of  $DAD_{16}$  and  $715_{16}$ ?

- A.  $13C3_{16}$       B.  $1FCF_{16}$       C.  $14C2_{16}$       D.  $4B2_{16}$       E.  $2128_{16}$

**QUESTION 2**

What is output by the code to the right?

- A. 15      B. 9      C. 12  
D. 11      E. 125

```
int x = 3;
int y = 2;
int z = x + y * 3;
System.out.println( z );
```

**QUESTION 3**

What is output by the code to the right?

- A. 9      B. 0      C. 10  
D. -11      E. 11

```
int tot = 0;
for(int i = 10; i > 0; i--) {
    tot++;
}
System.out.print( tot );
```

**QUESTION 4**

What is output by the code to the right?

- A. lusual      B. sisua      C. usualc  
D. lusualc      E. usual

```
String la = "visualc++";
String next = la.substring(2, 6);
next = la.charAt(3) + next;
System.out.print( next );
```

**QUESTION 5**

What is output by the code to the right?

- A. null      B. 0      C. 1  
D. There is no output due to a syntax error.  
E. There is no output due to a runtime error.

```
int[] vals = new int[10];
System.out.print( vals[0] );
```

**QUESTION 6**

What is output by the code to the right?

- A. 0      B. 28      C. 6  
D. 4      E. 0.21428571428571427

```
int r = 6;
int s = 28;
System.out.println( r % s );
```

**QUESTION 7**

Which answer is logically equivalent to the following boolean expression, where p and q are boolean variables?

$!p \&& !q$

- A.  $! (q \mid\mid p)$       B.  $! (p \&\& q)$       C.  $!q \&\& p$       D.  $!p \mid\mid !q$       E.  $!!p \&\& !!q$

**QUESTION 8**

What is output by the code to the right?

- A. 23
- B. 1
- C. 123
- D. 2
- E. 13

```
String n = "kuipers";
if( Character.isLetter(n.charAt(1)) )
    System.out.print( 1 );
else if ( n.length() > 4 )
    System.out.print( 2 );
if( n != null )
    System.out.print( 3 );
```

**QUESTION 9**

What replaces <\*> in the code to the right so that other classes do not have access to the instance variables freq and letter?

- A. public
- B. private
- C. public static
- D. private static
- E. private static final

Assume <\*> is filled in correctly.

```
public class Count{
    <*> int freq;
    <*> char letter;

    public Count(char let){
        letter = let;
        freq = 0;
    }

    public String toString(){
        return letter + ":" + freq;
    }
}
```

```
///////////////////////////////
// client code
Count c1 = new Count('A');
System.out.print( c1 );
```

**QUESTION 10**

What is output by the client code to the right?

- A. A:0
- B. 0:A
- C. A0
- D. 65:0
- E. The output cannot be determined until runtime.

**QUESTION 11**

What is output by the code to the right?

- A. 31
- B. 15
- C. 16
- D. 1
- E. 47

```
int m = 29;
int n = 18;
System.out.print( m & n );
```

**QUESTION 12**

What are the possible values res will store after the code to the right is executed?

- A. -2
- B. -2, -1, 0, 1, 2
- C. -2, -1, 0, 1
- D. -3, -2, -1, 0, 1, 2
- E. -3, -2, -1, 0

```
double init = Math.random();
int res = (int)(init * 4) - 2;
```

**QUESTION 13**

How many lines of output does the code to the right produce?

- A. 5
- B. 4
- C. 6
- D. 1
- E. 2

```
System.out.println("ABBA\nStar");
System.out.println("Roll\nBe");
```

<b>QUESTION 14</b> What is output by the code to the right? A. true      B. false      C. 0 D. 1      E. 12	<pre>System.out.printf("%b", 12);</pre>
<b>QUESTION 15</b> What is returned by the method call <code>myst(4, 2)</code> ? A. 3      B. 2      C. -1 D. 5      E. 4	<pre>public int myst(int x, int y){     x++;     y--;     x -= y;     return x; }</pre>
<b>QUESTION 16</b> What is output by the code to the right? A. 2a      B. 1A      C. 1a D. 2A      E. 297	<pre>char ch = 'A'; if( Character.isDigit( ch ) )     System.out.print( 1 ); else     System.out.print( 2 ); System.out.print(Character.toUpperCase(ch));</pre>
<b>QUESTION 17</b> What is output by the code to the right? A. 6      B. 8.0 C. 8      D. 7 E. There is no output due to a syntax error.	<pre>double a = 2.5; a *= 3; int x = (int)a; System.out.print( x );</pre>
<b>QUESTION 18</b> What is output by the code to the right? A. true      B. false      C. null D. There is no output due to a syntax error. E. There is no output due to a runtime error.	<pre>ArrayList&lt;String&gt; list1, list2; list1 = new ArrayList&lt;String&gt;(); list2 = new ArrayList&lt;String&gt;(); list1.add("Glenn"); list2.add( list1.get(0) ); System.out.print( list1 == list2 );</pre>
<b>QUESTION 19</b> What is output by the client code to the right? A. 3      B. -13      C. -6 D. -2      E. 0	<pre>// pre: dt1.length == dt2.length public int comp(int[] dt1, int[] dt2){     int total = dt1[0] - dt2[0];     int index = 1;     while( total &gt; 0 &amp;&amp; index &lt; dt1.length){         total += (dt1[index] - dt2[index]);         index++;     }     return total; }</pre>
<b>QUESTION 20</b> If a section of client code does not meet the precondition of method <code>comp</code> , but is otherwise syntactically correct, which of the following is true? A. The client code will not compile. B. <code>comp</code> will <b>always</b> return 0. C. <code>comp</code> will <b>never</b> generate a runtime error. D. <code>comp</code> will <b>sometimes</b> generate a runtime error. E. <code>comp</code> will <b>always</b> generate a runtime error.	<pre>//client code int[] arr1 = {10, 4, 8, 3, 12}; int[] arr2 = {4, 2, 5, 16, 7}; System.out.println( comp(arr1, arr2) );</pre>

**QUESTION 21**

What is output by the code to the right when method `show` is called?

- A. 3
- B. 4
- C. 7
- D. There is no output due to a runtime error.
- E. There is no output due to an infinite loop that occurs when method `show` is called.

**QUESTION 22**

Which of the following best describes the programming language feature demonstrated by the two methods named `red`?

- A. inheritance
- B. recursion
- C. method overriding
- D. polymorphism
- E. method overloading

**QUESTION 23**

If the parameter `s1` contains the values [1, 2, 3] and the parameter `s2` contains the values [1, 2, 4], what values are in the Set returned by method `demo`?

- A. [1, 1, 2, 2, 3, 4]
- B. [1, 2, 3]
- C. [1, 2, 4]
- D. [1, 2]
- E. [1, 2, 3, 4]

**QUESTION 24**

What is output by the code to the right?

- A. 0.0 0.0 0.0 2.0
- B. -0.7 0.0 0.7 2.5
- C. 0.0 0.0 0.0 0.0
- D. 2.5 0.7 0.0 -0.7
- E. 0.7 -0.7 2.5 0.0

**QUESTION 25**

What is output by the code to the right?

- A. [M, G, B]
- B. [G, M, B]
- C. [B, M, G]
- D. [B, G, M]
- E. [G, B, M]

```
// all three methods are part of
// the same class.
```

```
public int red(int x, int y){
    return red(y) + red(x);
}
```

```
public int red(int a){
    return a / 3;
}
```

```
public void show(){
    int y = 7;
    System.out.print( red(y, y) );
}
```

```
public Set<Integer> demo(Set<Integer> s1,
                           Set<Integer> s2){
    Set<Integer> result;
    result = new HashSet<Integer>();
    result.addAll( s1 );
    result.addAll( s2 );
    return result;
}
```

```
double[] nums = { .7, -.7, 2.5, 0.0 };
Arrays.sort( nums );
for( double d : nums )
    System.out.print( d + " " );
```

```
LinkedList<String> sample;
sample = new LinkedList<String>();
sample.addFirst("M");
sample.add(0, "B");
sample.addFirst("G");
System.out.print( sample.toString() );
```

**QUESTION 26**

- What is output by the code to the right?
- 6.0
  - 5.5
  - 5.0
  - 5
  - There is no output due to a syntax error.

```
double p = 2.5;
int m = 3;
p += m;
System.out.print( p );
```

**QUESTION 27**

- What is output by the code to the right?
- 12.7
  - 9.4
  - 7.0
  - 90.0
  - There is no output due to a runtime error.

```
String start = "12.7 9.4 90";
String[] elems = start.split("\s+");
double d;
d = Double.parseDouble( elems[1] );
System.out.print( d );
```

**QUESTION 28**

Methods `search` and `helper` attempt to implement the binary search algorithm, but there is a logic error in method `helper` that causes the method to return an incorrect value in some situations. Which of the following best describes how to correct the logic error?

- Replace the line  
`if( s <= e ) {`  
with the following  
`if( s < e ) {`
- Replace the line  
`int m = (s + e) / 2;`  
with the following  
`int m = (s + e) * 2;`
- Replace the line  
`else if( data[m] > t )`  
with the following  
`else if( data[m] >= t )`
- Replace the line  
`return helper(data, t, 0, m - 1);`  
with the following  
`return  
    helper(data, t, s, m - 1);`
- Replace the line  
`return helper(data, t, m + 1, e);`  
with the following  
`return helper(data, m + 1, t, e);`

```
// pre: the elements of data
// are sorted in ascending order
// post: return an index in data that
// contains tgt. return -1 if tgt is
// not present
public int search(int[] data, int tgt){
    int e = data.length - 1;
    return helper(data, tgt, 0, e);
}

private int helper(int[] data, int t,
                  int s, int e){
    if( s <= e ){
        int m = (s + e) / 2;
        if( data[m] == t )
            return m;
        else if( data[m] > t )
            return helper(data, t, 0, m - 1);
        else
            return helper(data, t, m + 1, e);
    }
    else
        return -1;
}
```

**QUESTION 29**

Assume the logic error in method `search` in question 28 has been corrected. Which of the following best describes what kind of method `helper` is?

- A class method
- An iterative method
- A constant method
- An accessor method
- A recursive method

**QUESTION 30**

What is output by the code to the right?

- A. trivial simple concat add
- B. concat add trivial simple
- C. trivial easy simple concat add
- D. concat add trivial easy simp
- E. add concat easy simple trivial

```
TreeMap<String, String> translate;
translate = new TreeMap<String, String>();
translate.put("trivial", "easy");
translate.put("concat", "add");
translate.put("trivial", "simple");
for(Map.Entry<String, String> ent :
    translate.entrySet() ){
    System.out.print( ent.getKey() + " ");
    String temp = ent.getValue();
    System.out.print( temp + " " );
}
```

**QUESTION 31**

What is returned by the method call

`progress(mat, 2, 1)` where mat  
is the 2D array below?

10	2	8	10	9	5
9	4	3	2	9	1
6	2	0	6	0	0
4	7	3	2	5	12
7	7	4	2	1	4
11	4	12	1	7	3
8	4	0	8	1	3

- A. 24
- B. 26
- C. 27
- D. 17
- E. 8

```
public int progress(int[][] mat,
                    int r, int c){
    int total = 0;
    int rowLim = mat.length;
    int colLim = mat[0].length;
    while( r < rowLim && c < colLim ){
        total += mat[r][c];
        if( mat[r][c] % 2 == 0 )
            r++;
        else
            c++;
    }
    return total;
}
```

**QUESTION 32**

Which sorting algorithm do methods swap and sort implement?

- A. quicksort
- B. insertion sort
- C. bubble sort
- D. merge sort
- E. selection sort

```
public void swap(int[] list, int i, int j){
    int temp = list[i];
    list[i] = list[j];
    list[j] = temp;
}
```

```
public void sort(int[] list,
                 int st, int end){
    if( st >= end )
        return;
    int p = (st + end) / 2;
    swap(list, p, st);
    int j = st;
    for(int i = st + 1; i <= end; i++){
        if( list[i] <= list[st] ){
            j++;
            swap(list, i, j);
        }
    }
}
```

```
swap(list, st, j);
sort(list, st, j - 1);
sort(list, j + 1, end);
```

**QUESTION 33**

Assume in the initial call to method sort the parameter list contains N unique elements already sorted in ascending order, where N = list.length. What is the Big O of method sort in that case? Choose the most restrictive correct answer.

- A.  $O(N \log N)$
- B.  $O(N^{3/2})$
- C.  $O(1)$
- D.  $O(N^2)$
- E.  $O(N)$

**QUESTION 34**

What is output by the following client code?

```
Structure s1 = new Structure();
System.out.print( s1.isEmpty() );
```

- A. false
- B. true
- C. 0
- D. 1
- E. The output cannot be determined until runtime.

**QUESTION 35**

What is output by the following client code?

```
Structure s2 = new Structure();
s2.add(2);
s2.add(7);
s2.add(5);
while( !s2.isEmpty() )
    System.out.print( s2.remove() + " " );
```

- A. 2 5 7
- B. 7 5 2
- C. 2 7 5
- D. 5 7 2
- E. 7 2 5

**QUESTION 36**

What type of data structure does the Structure class implement?

- A. A list
- B. A queue
- C. A stack
- D. A max heap
- E. A priority queue

```
public class Structure{
    public static final int CAP = 10;

    private Object[] con;
    private int f;
    private int b;
    private int size;

    public Structure(){
        con = new Object[CAP];
        b = -1;
    }

    public void add(Object obj){
        size++;
        if( size == con.length )
            resize();
        b = (b + 1) % con.length;
        con[b] = obj;
    }

    public Object get(){
        return con[f];
    }

    public Object remove(){
        size--;
        Object result = con[f];
        f = (f + 1) % con.length;
        return result;
    }

    public boolean isEmpty(){
        return size == 0;
    }

    private void resize(){
        Object[] temp = new Object[size * 2];
        int org = f;
        for(int i = 0; i < size; i++){
            temp[i] = con[org];
            org = (org + 1) % con.length;
        }
        f = 0;
        b = size - 1;
        con = temp;
    }
}
```

**QUESTION 37**

Assume the method `sample(int[] data)` is  $O(N^2)$  where  $N = \text{data.length}$ . When the method `sample` is passed an array with  $\text{length} = 2,000$  it takes 1 second for method `sample` to complete. If method `sample` is then passed an array with  $\text{length} = 8,000$  what is the expected time it will take method `sample` to complete?

- A. 1 second
- B. 2 seconds
- C. 4 seconds
- D. 8 seconds
- E. 16 seconds

**QUESTION 38**

What replaces <\*1> and <\*2> in the code to the right so that it compiles with no syntax errors?

- | <*1>                          | <*2>         |
|-------------------------------|--------------|
| A. ListIterator               | iterator     |
| B. Iterator                   | iterator     |
| C. ListIterator               | listIterator |
| D. Iterator                   | listIterator |
| E. None of these are correct. |              |

```
public void check(ArrayList<String> arr) {
    <*1><String> it;
    it = arr.<*2>();
    String temp;
    while( it.hasNext() ){
        temp = it.next();
        if( temp.length() > 5 )
            it.set( temp.toUpperCase() );
    }
}
```

**QUESTION 39**

What is output by the code to the right when method trace is called?

- |  |           |
|--|-----------|
| A. 1 8 4                                     | B. 1 8 3  |
| C. 0 8 4                                     | D. 0 16 4 |
| E. There is no output due to a syntax error. |           |

```
public void trace(){
    int x = 10;
    int y = 1;
    for(int i = 0; i < 3; i++){
        x /= 2;
        y *= 2;
    }
    System.out.print( x + " " + y + " " + i);
}
```

**QUESTION 40**

How many \* are output by the code to the right?

- |        |        |      |
|--------|--------|------|
| A. 0   | B. 1   | C. 3 |
| D. 150 | E. 165 |      |

```
for(int i = 1; i <= 10; i++)
    for(int j = 0; j < i; j++)
        for(int k = 0; k < 3; k++)
            System.out.print('*');
```