

# University Interscholastic League

## Computer Science Competition

Number 139 (District 1 - 2013)

### General Directions:

- 1) **DO NOT OPEN EXAM UNTIL TOLD TO DO SO.**
- 2) **NO CALCULATOR OF ANY KIND MAY BE USED.**
- 3) There are 40 questions on this contest exam. You have 45 minutes to complete this contest. If you are in the process of actually writing an answer when the signal to stop is given, you may finish writing that answer.
- 4) Papers may not be turned in until 45 minutes have elapsed. If you finish the test before the end of the allotted time, remain at your seat and retain your paper until told to do otherwise. Use this time to check your answers.
- 5) All answers must be written on the answer sheet/Scantron card provided. Indicate your answers in the appropriate blanks provided on the answer sheet or on the Scantron card. Clean erasures are necessary for accurate Scantron grading.
- 6) You may place as many notations as you desire anywhere on the test paper, but not on the answer sheet or Scantron card which are reserved for answers only.
- 7) You may use additional scratch paper provided by the contest director.
- 8) All questions have ONE and only ONE correct (BEST) answer. There is a penalty for all incorrect answers. **All provided code segments are intended to be syntactically correct, unless otherwise stated. Ignore any typographical errors and assume any undefined variables are defined as used.**
- 9) A reference to commonly used Java classes is provided at the end of the test, and you may use this reference sheet during the contest. You may detach the reference sheets from the test booklet, but **DO NOT DO SO UNTIL THE CONTEST BEGINS.**
- 10) Assume that any necessary import statements for standard Java packages and classes (e.g. `.util`, `ArrayList`, etc.) are included in any programs or code segments that refer to methods from these classes and packages.

### Scoring:

- 1) All questions will receive 6 points if answered correctly; no points will be given or subtracted if unanswered; 2 points will be deducted for an incorrect answer.

**QUESTION 1**

What is  $A39_{16}$  when this value is converted to base 8?

- A.  $2624_8$       B.  $2617_8$       C.  $5071_8$       D.  $5100_8$       E.  $5107_8$

**QUESTION 2**

What is output by the code to the right?

- A. 2      B. 2.0      C. 42  
D. 12      E. There is no output.

```
int x = 42;
int y = 5;
int z = 3;
System.out.print(x/y/z);
```

**QUESTION 3**

What is output by the code to the right?

- A. 2187      B. 729      C. 33  
D. 315      E. 0

```
int m = 3;
for(int i = 0; i < 8; i += 2) {
    m += m*i;
}
System.out.print(m);
```

**QUESTION 4**

What output by the code to the right?

- A. 6      B. 7      C. 8  
D. 11      E. There is no output due to a runtime error.

```
String s = "JohnSteinbeck";
String t = s.substring(2, s.length()-4);
System.out.print(t.length());
```

**QUESTION 5**

What replaces `<*1>` in the code to the right so that the output is 5?

- A. {0, 0, 0, 0, 0}  
B. new r[5]  
C. new [5]  
D. new double[5]  
E. Both A and D

```
double[] r = <*1>;
System.out.print(r.length);
```

**QUESTION 6**

What is output by the code to the right?

- A. 0      B. 1  
C. -1      D. -0.5  
E. 11

```
double x = 56/4%5-2.5;
int y = (int) x;
System.out.print(y);
```

<p><b>QUESTION 7</b></p> <p>How many combinations of truth values for p, q and r make this expression to the right true?</p> <p>A. 1                      B. 4</p> <p>C. 15                     D. 7</p> <p>E. 8</p>	<p><math>(p \ \&amp;\&amp; \ !q) \    \ (q \    \ !r)</math></p>
<p><b>QUESTION 8</b></p> <p>What is output by the code to the right?</p> <p>A. 10                      B. 4050                      C. 5</p> <p>D. 50                      E. 110</p>	<pre>String s = ""; int x = 50; if(x % 2 == 0) {     if(x % 3 == 0) {         x /= 5;     }     else {         s += x-10;     } } else {     s += 1;     x %= 5; } System.out.print(s + x);</pre>
<p><b>QUESTION 9</b></p> <p>What is the value of the Java expression to the right?</p> <p>A. 2                      B. 8                      C. 35</p> <p>D. 43                     E. 55</p>	<p><math>43^{25} \&amp; 14</math></p>
<p><b>QUESTION 10</b></p> <p>For int variables x and y, when is the boolean expression true?</p> <p>I. x and y are both positive.</p> <p>II. x and y are both even.</p> <p>III. x and y are both odd.</p> <p>IV. One of x and y is even and the other is odd.</p> <p>A. I only</p> <p>B. II only</p> <p>C. III only</p> <p>D. IV only</p> <p>E. II and III</p>	<p><math>x\%2 \ != \ y\%2</math></p>
<p><b>QUESTION 11</b></p> <p>What is <math>3B6_{16} + 54C_{16}</math>?</p> <p>A. <math>800_{16}</math>                      B. <math>900_{16}</math>                      C. <math>902_{16}</math>                      D. <math>968_{16}</math>                      E. <math>A02_{16}</math></p>	

<p><b>QUESTION 12</b></p> <p>Assume <code>int x</code> has been initialized to a positive even integer, and that <code>int y</code> has been initialized to a positive odd integer. What is the value of <code>k</code> after the code to the right is executed?</p> <p>A. 0                      B. <math>2x + y</math>                      C. <math>x + y</math></p> <p>D. <math>x * y</math>                      E. <math>(x*y)/2</math></p>	<pre>int k = 0; for(int i = 0; i &lt; x; i += 2) {     for(int j = 0; j &lt; y; j++) {         k++;     } }</pre>
<p><b>QUESTION 13</b></p> <p>What is output by the code to the right?</p> <p>A. 0                      B. 6                      C. 9</p> <p>D. 12                      E. 25</p>	<pre>int y = 0; int x = 641275; while(x &gt; 0) {     switch(x%10) {         case 0: case 2: case 4: case 6:         case 8:             y++;             break;         case 1: case 3: case 5: case 7:         case 9:             y += 2;             break;     }     x = x/10; } System.out.print(y);</pre>
<p><b>QUESTION 14</b></p> <p>What code can replace <code>&lt;*1&gt;</code> so that instance variable <code>x</code> and instance variable <code>y</code> are both assigned the value 1?</p> <p>I. <code>x = 1; y = 1;</code></p> <p>II. <code>this();</code></p> <p>III. <code>this.x = 1; this.y = 1;</code></p> <p>A. I only                      B. II only</p> <p>C. III only                      D. I, II and III</p> <p>E. II and III</p> <p>Assume that <code>&lt;*1&gt;</code> was replaced correctly.</p>	<pre>public class Example {     private int x;     private int y;      public Example() {         x = 1;         y = 1;     }      public Example(int x, int y) {         &lt;*1&gt;     }      public void change(int n) {         x = n;     }      public String toString() {         return x + " " + y;     } }</pre>
<p><b>QUESTION 15</b></p> <p>Assume that the client code to the right is in some class other than the <code>Example</code> class. What code can replace <code>&lt;*2&gt;</code> so that the output from the client code is 2 1?</p> <p>A. None - no code is needed to replace <code>&lt;*2&gt;</code>.</p> <p>B. <code>change(2);</code></p> <p>C. <code>e.change(2);</code></p> <p>D. <code>e.x = 2;</code></p> <p>E. <code>x = 2;</code></p>	<pre>// Client code in another class Example e = new Example(2, 1); &lt;*2&gt; System.out.print(e);</pre>

**QUESTION 16**

What value is printed by the client code below?

```
int[] a = {6, 2, 4, 8, 1, 5};
```

```
System.out.print(mu(a));
```

- A. 0                      B. 5                      C. 6  
D. 9                      E. 11

**QUESTION 17**

Let  $n = r.length$ . what is the run time of method mu?  
Give the most restrictive correct answer.

- A.  $O(1)$                       B.  $O(\log n)$                       C.  $O(n)$   
D.  $O(n \log n)$                       E.  $O(n^2)$

```
// pre: r != null and r.length >= 1
public static int mu(int[] r) {
    int pos = r.length - 1;
    int k = r[pos];
    int sum = 0;
    while(pos > 0) {
        sum += k;
        pos = pos/2;
        k = r[pos];
    }
    return sum;
}
```

**QUESTION 18**

What is output by the code to the right?

- A. 0002                      B. 00-12                      C. 0001  
D. 1101                      E. 11-12

```
int x = 1;
int y = 1;
int z = --x - 1;
int t = (y--) + 1;
System.out.print("" + x + y + z + t);
```

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<p><b>QUESTION 19</b></p> <p>To produce the correct output, which expression should replace <code>&lt;*1&gt;</code> in the code to the right? You will need to replace both <code>&lt;*1&gt;</code> and <code>&lt;*2&gt;</code> to get the desired output.</p> <p>A. <code>j &lt; i</code>      B. <code>j &lt; 7</code></p> <p>C. <code>j &lt; 7-i</code>    D. <code>j &lt; 6-i</code></p> <p>E. <code>j &lt; 6</code></p>	<pre>for(int i = 1; i &lt; 7; i++) {     for(int j = 1; &lt;*1&gt;; j++) {         System.out.print("0");     }     for(int j = 0; &lt;*2&gt;; j++) {         System.out.print("1");     }     System.out.println(); }</pre> <p>Desired Output from above code:</p> <pre>000001 000011 000111 001111 011111 111111</pre>
<p><b>QUESTION 20</b></p> <p>To produce the correct output, which expression should replace <code>&lt;*2&gt;</code> in the code to the right?</p> <p>A. <code>j &lt; i</code>      B. <code>j &lt; 7</code></p> <p>C. <code>j &lt; 7-i</code>    D. <code>j &lt; 6-i</code></p> <p>E. <code>j &lt; 6</code></p>	
<p><b>QUESTION 21</b></p> <p>What is output by the code to the right? In the Strings below, <code> </code> represents a blank space.</p> <p>A. <code> Ford  13</code></p> <p>B. <code>Ford     13</code></p> <p>C. <code> Ford00013</code></p> <p>D. <code>Ford  00013</code></p> <p>E. <code> Ford13  </code></p>	<pre>System.out.printf("%-6s%05d", "Ford", 13);</pre>
<p><b>QUESTION 22</b></p> <p>What is output by the code to the right?</p> <p>A. 2hello      B. 3bye      C. 0null</p> <p>D. 4hello      E. 4bye</p>	<pre>String[] arr = {"hello", "hi", "bye", "hi"}; TreeSet&lt;String&gt; s = new TreeSet&lt;String&gt;(); for(String i : arr)     s.add(i); s.remove("hi"); System.out.print(s.size()); System.out.print(s.last());</pre>
<p><b>QUESTION 23</b></p> <p>What is output by the code to the right?</p> <p>A. <code>atJa</code>      B. <code>etJe</code>      C. <code>PatJa</code></p> <p>D. <code>etJef</code>      E. <code>atJaf</code></p>	<pre>String s = "Jefferson"; String t; t = "Pat".concat(s).replace('a', 'e'); t = t.substring(1, 5); System.out.print(t);</pre>

<p><b>QUESTION 24</b></p> <p>What is output by the code to the right?</p> <p>A. true&gt;true</p> <p>B. true&gt;false</p> <p>C. false&gt;true</p> <p>D. false&gt;false</p> <p>E. There is no output due to a compilation error.</p>	<pre>Integer y = new Integer(13); int x = y; String s = "13"; String r = ""+x; int z = Integer.parseInt(s); System.out.print(""+s.equals(r) + (y==z));</pre>
<p><b>QUESTION 25</b></p> <p>What is the value of the expression to the right?</p> <p>A. "12buckle my shoe34"</p> <p>B. "3buckle my shoe7"</p> <p>C. "12buckle my shoe7"</p> <p>D. "3buckle my shoe34"</p> <p>E. This is not a valid Java expression.</p>	<pre>1 + 2 + "buckle my shoe" + 3 + 4</pre>
<p><b>QUESTION 26</b></p> <p>What is returned by the method call <code>rec("abcdef")</code>?</p> <p>A. "f"            B. "fdb"            C. "fcba"</p> <p>D. "eca"            E. "fca"</p>	<pre>public static String rec(String s) {     if(s == null    s.length() == 0)         return "";     return s.charAt(s.length()-1) +         rec(s.substring(0, s.length()/2)); }</pre>

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# QUESTION 27

The client code to the right appears in some class other than Sub or Sup. Which choice for <\*1> will produce the output Batman 3 from the statement labeled line 1?

- I. s = t;
- II. sup(t);
- III. super(t);

- A. I only      B. II only      C. III only
- D. I and III      E. I and II

```
public class Sup {
    private String s;

    public Sup() {
        s = "Superman";
    }
    public Sup(String t) {
        s = t;
    }
    public void change(String t) {
        s = t;
    }
    public String getS(){
        return s;
    }
}
```

Assume <\*1\*> is filled in correctly.

# QUESTION 28

Which choice for <\*2> will produce the output Ironman 1 from the statement labeled line 2?

- I. s = "Ironman";
- II. change("Ironman");
- III. super.change("Ironman");

- A. I only      B. II only      C. III only
- D. I and III      E. II and III

```
public class Sub extends Sup {
    private int cat;

    public Sub(String t, int c) {
        <*1>
        cat = c;
    }
    public void change(String t) {
        <*2>
        cat = 1;
    }
    public int getCat() {
        return cat;
    }
}

// Client code
Sub x = new Sub("Batman", 3);
System.out.print(x.getS() + " " +
x.getCat()); // line 1
x.change("Ironman");
System.out.print(x.getS() + " " +
x.getCat()); // line 2
```

# QUESTION 29

Which of the following creates an int array arr that contains three zeros?

- I. int[] arr = new int[3];
- II. int[] arr = {0, 0, 0};
- III. int[] arr = new 3[0];

- A. I only      B. II only      C. III only      D. I and II      E. I, II and III

# QUESTION 30

What is the value of k after the code to the right has been executed?

- A. 10      B. 45      C. 50
- D. 90      E. 1000

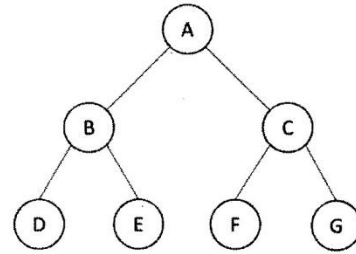
```
int k = 0;
for(int i = 0; i < 10; i++) {
    for(int j = 0; j < i; j++)
        k++;
}
```



QUESTION 31

Which of the following lists the nodes of the tree in the order that they would be visited in a preorder traversal?

- A. ABDECFG B. DBEAFCG C. DEBFGCA  
D. DEFGBCA E. ABCDEFG



QUESTION 32

What is arr after the code to the right is executed?

- A. {"Hello", "hi", "Bye"}  
B. {"Hello-", "hi?", "Bye"}  
C. {"Hello", "-hi", "?Bye"}  
D. {"Hello", "hi"}  
E. null

```
String s = "Hello-hi?Bye";
String[] arr = s.split("\\?|-");
```

QUESTION 33

Which of the following can replace **<\*1>** in the code to the right so that the method returns the sum of the last entries in each row of matrix r? For example, for

```
int[][] a = {{1, 2, 3}, {4, 5}, {6}};
```

the call mat(a) should return 14.

- I. r[i].length-1  
II. r[0].length-1  
III. r[].length-1

- A. I only B. II only C. III only  
D. I and II E. I, II and III

The parameter r can be a jagged array for questions 33 and 34.

QUESTION 34

Suppose you want to modify the mat method so that it returns the sum of all elements in r that have an odd column index. Which of the following could be the body of the loop in the code to the right, replacing line 1?

- I. for(int j = 0; j < r[0].length; j++)  
    if(j % 2 == 1) s += r[i][j];  
II. for(int j = 1; j < r[0].length; j += 2)  
    s += r[i][j];  
III. for(int j = 1; j < r[i].length; j += 2)  
    s += r[i][j];

- A. I only B. II only C. III only  
D. I and II E. I, II and III

```
public static int mat(int[][] r) {
    int s = 0;
    for(int i = 0; i < r.length; i++){
        s += r[i][<*1>]; // line 1
    }
    return s;
}
```

<p><b>QUESTION 35</b></p> <p>What is output by the code to the right?</p> <p>A. 2 2                      B. 1 2                      C. 1 1</p> <p>D. 2 3                      E. 1 3</p>	<pre>Stack&lt;Integer&gt; st = new Stack&lt;Integer&gt;(); st.push(1); st.push(2); st.push(3); int i = st.search(2); System.out.print(i); System.out.println(" " + st.pop());</pre>
<p><b>QUESTION 36</b></p> <p>On an int array of length n, the best case run time of insertion sort is which of the following? Choose the most restrictive correct answer.</p> <p>A. <math>O(1)</math></p> <p>B. <math>O(\log n)</math></p> <p>C. <math>O((\log n)^2)</math></p> <p>D. <math>O(n)</math></p> <p>E. <math>O(n^2)</math></p>	
<p><b>QUESTION 37</b></p> <p>What is output by the code to the right?</p> <p>A. \                      B. \n                      C. \\n</p> <p>\a//                      \a//                      \\a/</p> <p>D. \\n\n\\a/                      E. \\n\n\\a//</p>	<pre>System.out.print("\\n\n\\a//");</pre>
<p><b>QUESTION 38</b></p> <p>This program (contained in file Q38.java) is compiled and then executed from a command line prompt as follows:</p> <pre>java Q38 2 elephants fly</pre> <p>What is the output?</p> <p>A. 1</p> <p>B. 3</p> <p>C. 13</p> <p>D. 15</p> <p>E. There is no output due to a run time error.</p>	<pre>public class Q38 {     public static void main(String[] args) {         int j = 0;         for(int i = 0; i &lt; args.length; i++)             j += args[i].length();         System.out.print(j);     } }</pre>

**QUESTION 39**

What value is returned by the call `tau("1234")`?

- A. 34224
- B. 34124
- C. 343424
- D. 234124
- E. 234224

```
public String tau(String s) {  
    String a = s.substring(s.length()/2);  
    if(s.length() <= 2)  
        return a + s.charAt(0);  
    return a + tau(s.substring(1,  
s.length()-2)) + s.charAt(s.length()-1);  
}
```

**QUESTION 40**

What is output by the code to the right?

- A. 53687                      B. 47535
- C. 36424                      D. 23451
- E. 37654

```
int[] a = {0, 1, 2, 3, 4, 5};  
for(int i = 0; i < 4; i++)  
    a[i] = a[3*a[i+1]%5] + 2;  
a[4] = a[3*a[0]%5] + 2;  
for(int i = 0; i < 5; i++)  
    System.out.print(a[i]);
```