

# University Interscholastic League

## Computer Science Competition

Number 134 (District 2 - 2012)

### 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 the sum of  $D0A_{16}$  and  $238_{16}$ ?

- A.  $F42_{16}$       B.  $AD2_{16}$       C.  $E48_{16}$       D.  $F48_{16}$       E.  $E56_{16}$

**QUESTION 2**

What is output by the code to the right?

- A. 4      B. 28      C. 56  
D. 77      E. 84

```
int x = 4;
int y = x + 3 * (4 + x);
System.out.print(y);
```

**QUESTION 3**

What is output by the code to the right?

- A. 0      B. 9      C. 10  
D. 24      E. 27

```
int val = 0;
for(int i = 10; i > 1; i--)
    val += 3;
System.out.print(val);
```

**QUESTION 4**

What is output by the code to the right?

- A. 13      B. 12      C. 7  
D. 6      E. -1

```
String c1 = "AABABBAABBBAAABB";
int res = c1.indexOf("AAA", 8);
System.out.print(res);
```

**QUESTION 5**

What is output by the code to the right?

- A. 1 2      B. 3 2      C. 65 12  
D. 2 1      E. 2 3

```
String[] st = {"AB", "A", "DAD", "12"};
System.out.print(st[3].length());
System.out.print(" " + st[1].length());
```

**QUESTION 6**

What is output by the code to the right?

- A. 158      B. 96      C. 64  
D. 32      E. 19

```
int x1 = 13;
int y1 = 19;
int z1 = 2 * x1 - y1 + 2 * y1 - x1;
System.out.print(z1);
```

**QUESTION 7**

How many combinations of values for the boolean variables  $p$ ,  $q$ , and  $r$  will result in  $s$  being set to true?

- A. 1      B. 2      C. 3  
D. 4      E. 7

```
boolean p, q, r;
//code to initialize p, q, and r

boolean s = (p || q) && (!r && !q);
```

<p><b>QUESTION 8</b></p> <p>What is output by the code to the right?</p> <p>A. 43.85                      B. 13.85</p> <p>C. 47.7                        D. 17.7</p> <p>E. There is no output due to a syntax error.</p>	<pre>double a3 = 7.7; if(a3 / 2 &gt; 3)     System.out.print(1); else     System.out.print(4); System.out.print(a3);</pre>
<p><b>QUESTION 9</b></p> <p>Given the Student and Block classes to the right, what is output by the following client code?</p> <pre>Student st1 = new Student(10); st1.goodYear(); System.out.print(st1);</pre> <p>A. credits: 6      B. 10</p> <p>C. credits: 16    D. 6</p> <p>E. credits: credits</p>	<pre>public class Student {     private int credits;      public Student(int c) {credits = c;}      public void goodYear() {credits += 6;}      public String toString() {         return "credits: " + credits;     }      public void setCredits(int c) {         credits = c;     } }</pre>
<p><b>QUESTION 10</b></p> <p>Given the Student and Block classes to the right, what is output by the following client code?</p> <pre>Student st2 = new Block(10, 4); st2.goodYear(); System.out.print(st2);</pre> <p>A. credits: 16    B. credits: 14</p> <p>C. credits: 10    D. credits: 12</p> <p>E. There is no output due to a syntax error in the client code.</p>	<pre>public class Block extends Student {     private int ccs;      public Block (int c, int ex) {         super(c);         ccs = ex;     }      public void goodYear() {         setCredits(ccs + 8);     } }</pre>
<p><b>QUESTION 11</b></p> <p>What is output by the code to the right?</p> <p>A. 189                      B. 127                      C. 62</p> <p>D. 31                        E. 0</p>	<pre>int m = 127; int n = 62; System.out.print(m &amp; n);</pre>
<p><b>QUESTION 12</b></p> <p>What is output by the code to the right?</p> <p>A. 6.0                      B. 5.0                      C. 4.825</p> <p>D. 4.0                        E. 3.15</p>	<pre>double m2 = 3.15; double n2 = m2 / 2; double o2 = Math.floor(n2) + Math.ceil(m2); System.out.print(o2);</pre>

<p><b>QUESTION 13</b></p> <p>What is output by the code to the right?</p> <p>A.   bigtallthin    B.   bigtall\nthin</p> <p>C.   big tall\nthin        D.   big tall\nthin</p> <p>E.   big tall thin</p>	<pre>System.out.print("big"); System.out.println(); System.out.print("tall\nthin");</pre>
<p><b>QUESTION 14</b></p> <p>What is output by the code to the right?</p> <p>A.   671.5        B.   +671.4       C.   671.4</p> <p>D.   (671.0)     E.   +671.5</p>	<pre>double t5 = 671.45; System.out.printf("%+6.1f", t5);</pre>
<p><b>QUESTION 15</b></p> <p>What is returned by the method call <code>calc(-2, -1.5)</code>?</p> <p>A.   -31.5        B.   -21.0        C.   -15.0</p> <p>D.   -13.5        E.   3.5</p>	<pre>public double calc(int x, double a) {     x--;     a -= 2 * x;     return a * x; }</pre>
<p><b>QUESTION 16</b></p> <p>What is output by the code to the right?</p> <p>A.   16            B.   15            C.   11</p> <p>D.   10            E.   0</p>	<pre>String stars = ""; for(int i = 0; i &lt; 5; i++)     stars += "*"; stars += "*"; for(int i = 0; i &lt; 10; i++)     stars += "*"; System.out.print(stars.length());</pre>
<p><b>QUESTION 17</b></p> <p>What is output by the code to the right?</p> <p>A.   2             B.   2.0           C.   4.0</p> <p>D.   4             E.   5.0</p>	<pre>double[] as = {0.5, -1.78, 2.21, 4.5000}; System.out.print( (int) as[3] );</pre>
<p><b>QUESTION 18</b></p> <p>What is output by the code to the right?</p> <p>A.   0             B.   25            C.   25.0</p> <p>D.   32            E.   32.0</p>	<pre>int r = 0; r += Math.pow(2, 5); System.out.print(r);</pre>
<p><b>QUESTION 19</b></p> <p>Which of the following Java statements is equivalent to the formula to the right? BMI, ma, and in are variables of type double.</p> <p>A.   BMI = 703 * ma / (in * in);</p> <p>B.   BMI = 703 * m * a / in / 2;</p> <p>C.   BMI = 703.0 * ma / (in ^ 2);</p> <p>D.   BMI = 703.0 * ma / in * 2;</p> <p>E.   BMI = 703 * m * a &gt;&gt; in &gt;&gt; in;</p>	$BMI = \frac{703ma}{in^2}$

<div>QUESTION 20</div> <div>What is the minimum value the code to the right will print out?</div> <div><div>A. 0.0</div><div>B. 1.0</div><div>C. 2.0</div><div>D. 3.0</div><div>E. None of A through D are correct.</div></div>	<pre>double mys = 0.0; double t = 0; do {     t = Math.random();     mys++; } while(t &lt; 0.2); System.out.print(mys);</pre>
<div>QUESTION 21</div> <div>What is output by the code to the right?</div> <div><div>A. true true</div><div>B. false true</div><div>C. false false</div><div>D. There is no output due to a syntax error.</div><div>E. There is no output due to a runtime error.</div></div>	<pre>Object obj1 = new ArrayList&lt;String&gt;(); Object obj2 = obj1.toString(); System.out.print(obj1 == obj2); System.out.print(" " + obj1.equals(obj2));</pre>
<div>QUESTION 22</div> <div>Which of the following boolean expressions replaces <b>&lt;*1&gt;</b> in method <code>sort</code> so that the body of the <code>if</code> statement is executed if the <code>String</code> at index <code>m</code> is greater than the <code>String</code> at index <code>j</code>?</div> <div><div>A. <code>w[m].compareTo(w[j]) &gt; 0</code></div><div>B. <code>w[m] &gt; w[j]</code></div><div>C. <code>w[m] &lt; w[j]</code></div><div>D. <code>w[m].compareTo(w[j]) &lt; 0</code></div><div>E. <code>Comparable.compareTo(w[m], w[j]) &gt; 0</code></div></div>	<pre>public void sort(String[] w) {     for(int i = 0; i &lt; w.length - 1; i++) {         int m = i;         for(int j = i + 1; j &lt; w.length; j++)             if( <b>&lt;*1&gt;</b> )                 m = j;         if(m != i) {             String t = w[i];             w[i] = w[m];             w[m] = t;         }         if(i == 4)             System.out.print(Arrays.toString(w));     } }  // client code String[] ds = {"Z", "a", "MY", "Z", "b",                "p", "BE"}; sort(ds);</pre>
<div>Assume <b>&lt;*1&gt;</b> is filled in correctly.</div>	
<div>QUESTION 23</div> <div>What is output when the client code to the right is executed?</div> <div><div>A. [Z, a, MY, Z, b, p, BE]</div><div>B. [BE, MY, Z, Z, a, b, p]</div><div>C. [BE, MY, Z, Z, a, p, b]</div><div>D. [Z, Z, BE, MY, b, p, a]</div><div>E. [BE, MY, Z, Z, b, p, a]</div></div>	
<div>QUESTION 24</div> <div>Which sorting algorithm does method <code>sort</code> implement?</div> <div><div>A. insertion sort</div><div>B. selection sort</div><div>C. radix sort</div><div>D. quicksort</div><div>E. heap sort</div></div>	
<div>QUESTION 25</div> <div>Which of the following is a valid Java identifier?</div> <div><div>A. +12</div><div>B. 5x</div><div>C. (val)</div><div>D. x_y12</div><div>E. More than one of A through D is correct.</div></div>	

<p><b>QUESTION 26</b></p> <p>What replaces <b>&lt;*1&gt;</b> in the method <code>search</code> to the right so that the output of the client code to the right is [0, 2, 4, 8]?</p> <p>A. <code>m[i] = t</code>      B. <code>m[i].equals(t)</code></p> <p>C. <code>m[i] == t</code>      D. <code>m[i].compareTo(t)</code></p> <p>E. More than one of A through D is correct.</p> <p>Assume <b>&lt;*1&gt;</b> is filled in correctly.</p>	<pre>public ArrayList&lt;Integer&gt; search(     String[] m, String t) {     ArrayList&lt;Integer&gt; r;     r = new ArrayList&lt;Integer&gt;();     for(int i = 0; i &lt; m.length; i++)         if(&lt;*1&gt;)             r.add(i);     return r; }</pre>
<p><b>QUESTION 27</b></p> <p>Which searching algorithm does method <code>search</code> implement?</p> <p>A. binary      B. heap</p> <p>C. radix      D. sequential</p> <p>E. insertion</p>	<pre>// client code String[] n = {"A", "N", "A", "J", "A",              "M", "AA", "AAA", "A"}; String sch = n[6].substring(1); System.out.print(search(n, sch));</pre>
<p><b>QUESTION 28</b></p> <p>Which of the following can replace <b>&lt;*1&gt;</b> in the code to the right so that the code segment compiles without error?</p> <p>I. <code>Collection&lt;Integer&gt;</code>  II. <code>List&lt;Integer&gt;</code>  III. <code>Object</code></p> <p>A. I only      B. II only      C. III only</p> <p>D. I and II only      E. I, II, and III</p>	<pre>&lt;*1&gt; list = new LinkedList&lt;Integer&gt;(); System.out.print(list.toString()); System.out.print(list.size());</pre>
<p><b>QUESTION 29</b></p> <p>What replaces <b>&lt;*1&gt;</b> in method <code>mystery</code> to the right to obtain the remainder of the integer division of <code>x</code> by <code>i</code>?</p> <p>A. <code>rem</code>      B. <code>~</code>      C. <code>!</code></p> <p>D. <code>/</code>      E. <code>%</code></p> <p>Assume <b>&lt;*1&gt;</b> is filled in correctly.</p>	<pre>public int mystery(int x) {     int num = 0;     for(int i = 1; i &lt;= x; i++)         if( x &lt;*1&gt; i == 0 )             num++;     return num; }</pre>
<p><b>QUESTION 30</b></p> <p>What is output by the client code to the right?</p> <p>A. 2 12      B. 13 72      C. 1 11</p> <p>D. 1 7      E. 0 10</p>	<pre>// client code System.out.print(mystery(13)); System.out.print(" " + mystery(72));</pre>
<p><b>QUESTION 31</b></p> <p>What is output by the code to the right?</p> <p>A. 10001100      B. 01110011      C. 00000000</p> <p>D. 11110011      E. 11111111</p>	<pre>byte b1 = 12; byte b2 = (byte) ~b1; String bits = Integer.toBinaryString(b2); bits = bits.substring(bits.length() - 8); System.out.print(bits);</pre>

**QUESTION 32**

What is the average case order (Big O) of method `find` shown to the right, given the following kinds of Maps? `m.size() = N` and `can.length = M`. Pick the most restrictive correct set of answers.

	TreeMap	HashMap
A.	$O(NM)$	$O(NM)$
B.	$O(N \log M)$	$O(NM)$
C.	$O(MN^2)$	$O(N)$
D.	$O(M^N)$	$O(M)$
E.	$O(M \log N)$	$O(M)$

```
public int find(Map<String, Integer> m,
               String[] can) {
    int res = 0;
    for(String k : can)
        if(m.containsKey(k))
            res++;
    return res;
}
```

**QUESTION 33**

What is output by the code to the right?

- A. 4 56      B. 11 5      C. 9 5  
D. 13      E. 6 56

```
String gar = "56+=78-412**32^";
String[] rs = gar.split("\\D");
System.out.print(rs.length + " " + rs[0]);
```

**QUESTION 34**

The following values are inserted in the order shown into a binary search tree using the traditional, naive insertion algorithm. What is the result of post order traversal of the resulting tree?

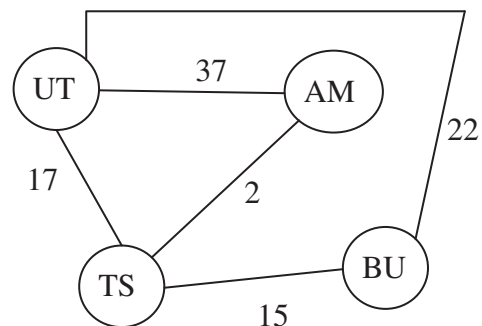
11, 3, 7, 8, 3, 6, 9, 11, 12

- A. 12 11 9 8 7 6 3      B. 3 6 7 8 9 11 12      C. 11 3 7 6 8 9 11 12  
D. 6 9 8 7 3 12 11      E. 11 3 7 6 8 9 12

**QUESTION 35**

What kind of graph does the picture to the right represent?

- A. a directed unweighted graph  
B. a directed weighted graph  
C. an undirected unweighted graph  
D. a undirected weighted graph  
E. a binary search tree

**QUESTION 36**

What is output by the code to the right?

- A. true true true  
B. false false true  
C. false false false  
D. true false true  
E. There is no output due to a runtime error.

```
String[] gds = {"A", "", null, "C", "D"};
System.out.print(gds instanceof Object);
System.out.print(gds[2] instanceof Object);
System.out.print(gds[1] instanceof String);
```

**QUESTION 37**

Given method `process` to the right, what is output by the following client code?

```
int[] p1 = process(9);
System.out.print(p1[4]);
```

- A. 90                      B. 9                      C. 3  
D. 2                      E. 1

```
public int[] process(int max) {
    int[] cs = {1, 3, 5};
    int[] ms = new int[max];
    Arrays.fill(ms, max * 10);
    ms[0] = 0;
    for(int i = 1; i < ms.length; i++)
        for(int j = 0; j < cs.length; j++)
            if(cs[j] <= i) {
                int t = ms[i - cs[j]] + 1;
                if(t < ms[i])
                    ms[i] = t;
            }
    return ms;
}
```

**QUESTION 38**

Given method `process` to the right, what is output by the following client code?

```
int[] p2 = process(15);
int tot = 0;
for(int i : p2)
    tot += i;
System.out.print(tot);
```

- A. 105                      B. 36                      C. 33  
D. 27                      E. 14

**QUESTION 39**

What is output by the client code to the right?

- A. 36912151821  
B. 3612  
C. 369121518  
D. 181512963  
E. 36120000000

```
public class Structure<E> {
    private ArrayList<E> con;

    public Structure() {
        con = new ArrayList<E>(10);
    }

    public void add(E v) { con.add(v); }

    public E remove() {
        return con.remove(0);
    }

    public E peek() { return con.get(0); }

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

// client code
Structure<Integer> str;
str = new Structure<Integer>();
for(int i = 3; i < 20; i += i)
    str.add(i);
while(!str.isEmpty())
    System.out.print(str.remove());
```

**QUESTION 40**

What type of data structure does the `Structure` class implement?

- A. An array based list  
B. A stack  
C. A set  
D. A min heap  
E. A queue