

# University Interscholastic League

## Computer Science Competition

### UTCS UIL Open - 2011

General Directions (Please read carefully!):

- 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  $713_{16}$  and  $79A_{16}$ ?

- A.  $EAD_{16}$       B.  $F00_{16}$       C.  $F04_{16}$       D.  $FB4_{16}$       E.  $EB4_{16}$

**QUESTION 2**

What is output by the code to the right?

- A. 6 15      B. 5 15      C. 5 18  
D. 7 15      E. 6 18

```
int x = 5;
int y = 3 * x;
x++;
System.out.print(x + " " + y);
```

**QUESTION 3**

What is output by the code to the right?

- A. 5 5      B. 10      C. 6 5  
D. 6      E. 11

```
int total = 0;
int i = 1;
for(; i <= 5; i++)
    ++total;
System.out.print(total + i);
```

**QUESTION 4**

What is output by the code to the right?

- A. Cal      B. vinLin      C. Lin  
D. lvi      E. lvinLin

```
String name = "CalvinLin";
name = name.substring(3);
System.out.println(name);
```

**QUESTION 5**

What is output by the code to the right?

- A. easyBDF      B. ABCABC  
C. easyABCABC      D. easyABC  
E. easyABCeasyABC

```
String lets = "ABC";
System.out.print( "easy" + lets + lets);
```

**QUESTION 6**

What is output by the code to the right?

- A. 7.0      B. 7.125      C. 3.125  
D. 5.125      E. 5.0

```
double a2 = 35.125;
double b2 = a2 % 10 + 2;
System.out.print(b2);
```

**QUESTION 7**

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

- A. 8      B. 7      C. 3  
D. 1      E. 0

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

boolean s = p || q || r;
```

<p><b>QUESTION 8</b></p> <p>What is output by the code to the right?</p> <p>A. BC                      B. AC                      C. BD</p> <p>D. AD                      E. There is no output.</p>	<pre>int x3 = 7; if(x3 != 5    x3 != 7)     System.out.print("A"); else     System.out.print("B"); if(x3 != 5 &amp;&amp; x3 != 7)     System.out.print("C"); else     System.out.print("D");</pre>
<p><b>QUESTION 9</b></p> <p>What is output by the client code to the right marked //line 1?</p> <p>A. 3</p> <p>B. 2</p> <p>C. 1</p> <p>D. 0</p> <p>E. true</p>	<pre>public class Critter{     public static final int NORTH = 0;     public static final int EAST = 1;     public static final int SOUTH = 2;     public static final int WEST = 3;      private int dir;      public int move(){         dir = dir == 0 ? WEST : NORTH;         return dir;     } }</pre>
<p><b>QUESTION 10</b></p> <p>What is output by the client code to the right marked //line 2?</p> <p>A. 0</p> <p>B. 3</p> <p>C. b10</p> <p>D. b13</p> <p>E. null0</p>	<pre>public class Badger extends Critter{     private String name;      public Badger(String s){ name = s; }      public String toString(){         return name;     } }  // client code Critter c1 = new Critter(); Badger b1 = new Badger("b1"); c1.move(); System.out.print(c1.move()); // line 1  String stc = b1.toString() + b1.move(); System.out.println(stc); // line 2</pre>
<p><b>QUESTION 11</b></p> <p>What is output by the code to the right?</p> <p>A. 0                      B. 40                      C. 125</p> <p>D. 625                      E. 32768</p>	<pre>int m = 5 &lt;&lt; 3; System.out.print(m);</pre>
<p><b>QUESTION 12</b></p> <p>What is the maximum possible number of '*'s the code to the right will print when run?</p> <p>A. 0                      B. 1                      C. 7</p> <p>D. 8                      E. 9</p>	<pre>double limit = Math.random() * 8; for(int i = 0; i &lt;= limit; i++)     System.out.print('*');</pre>

<p><b>QUESTION 13</b></p> <p>What is output by the code to the right?</p> <p>A. X1X2Y1                      B. "X1\"X2\"Y1"</p> <p>C. X1"X2"Y1                  D. "X1""\"X2\"""Y1"</p> <p>E. X1\"X2\"Y1</p>	<pre>System.out.print("X1"); System.out.print("\"X2\""); System.out.println("Y1");</pre>
<p><b>QUESTION 14</b></p> <p>What is output by the code to the right?</p> <p>A. 009.10      B. 9.109382      C. 9.10</p> <p>D. 009.11      E. 9.11</p>	<pre>int x = 2; String f = "%" + (x+x) + "." + x + "f"; System.out.printf(f, 9.109382);</pre>
<p><b>QUESTION 15</b></p> <p>What is returned by the method call manip(5)?</p> <p>A. 17                      B. 11.5                  C. 11</p> <p>D. 9.5                    E. 9</p>	<pre>public int manip(int x){     int y = x + 2;     x /= 2;     return y + x; }</pre>
<p><b>QUESTION 16</b></p> <p>What is output by the code to the right?</p> <p>A. 0                      B. 10                    C. 11</p> <p>D. 18                    E. 20</p>	<pre>String stars = ""; for(int i = 0; i &lt; 10; i++)     stars += "*"; for(int i = 0; i &lt; 10; i++)     stars += "*"; System.out.print(stars.length());</pre>
<p><b>QUESTION 17</b></p> <p>What replaces <b>&lt;*1&gt;</b> in the code to the right to indicate method start does not return a value?</p> <p>A. static      B. class      C. final</p> <p>D. void        E. null</p>	<pre>public int other(int x, int y) {     x--;     y++;     return x * y; }</pre>
<p>Assume <b>&lt;*1&gt;</b> is filled in correctly.</p>	<pre>public int other(int x) {     x++;     int y = other(x, x);     x++;     return x * y; }</pre> <pre>public <b>&lt;*1&gt;</b> start() {     System.out.print(other(3) + other(3,4)); }</pre>
<p><b>QUESTION 18</b></p> <p>What is output by the code to the right when method start is called?</p> <p>A. 85                      B. 135</p> <p>C. 256                    D. 266</p> <p>E. There is no output due to a runtime error.</p>	

<p><b>QUESTION 19</b></p> <p>What is output by the code to the right?</p> <p>A. TexasOrange</p> <p>B. Texas7911497110103101</p> <p>C. The output will vary from one run of the program to the next.</p> <p>D. There is no output due to a syntax error.</p> <p>E. There is no output due to a runtime error.</p>	<pre>String st5 = "Texas"; Object ob5 = "Orange"; System.out.print(st5.toString()); System.out.print(ob5.toString());</pre>
<p><b>QUESTION 20</b></p> <p>What is output by the code to the right?</p> <p>A. BC                      B. 12A</p> <p>C. C15                      D. 14C</p> <p>E. There is no output due to a runtime error.</p>	<pre>String sd; sd = "12 A 13 B 14 C 15"; Scanner sc2 = new Scanner(sd); for(int i = 0; i &lt; 4; i++)     sc2.next(); System.out.print(sc2.next()); System.out.print(sc2.next());</pre>
<p><b>QUESTION 21</b></p> <p>What is output by the code to the right?</p> <p>A. 452100      B. 4521      C. 452</p> <p>D. 4521.00      E. 21</p>	<pre>int qq = 4521; int zz = qq % 100; System.out.print(zz);</pre>
<p><b>QUESTION 22</b></p> <p>What is output by the code to the right?</p> <p>A. 23              B. 19              C. 8</p> <p>D. 4              E. -1</p>	<pre>String s = "ABAaaBBAAbAAaBAabbbaa"; int val = s.toLowerCase().indexOf("abbbaa"); System.out.print(val);</pre>
<p><b>QUESTION 23</b></p> <p>What is output by the code to the right?</p> <p>A. [.3, .2, .1]      B. [0.3, 0.1, 0.2]</p> <p>C. [0.3, 0.1]      D. [0.1, 0.2, 0.3]</p> <p>E. [0.1, 0.3]</p>	<pre>ArrayList&lt;Double&gt; ds; ds = new ArrayList&lt;Double&gt;(); ds.add(.1); ds.add(.2); ds.set(1, .3); System.out.print(ds);</pre>
<p><b>QUESTION 24</b></p> <p>What is output by the code to the right?</p> <p>A. afzAA      B. AAafz      C. afzA</p> <p>D. afz      E. Aafz</p>	<pre>char[] lets = {'z', 'A', 'f', 'a', 'A'}; Arrays.sort(lets); String res = ""; for(char ch : lets)     res += ch; System.out.print(res);</pre>
<p><b>QUESTION 25</b></p> <p>What is output by the code to the right?</p> <p>A. "ceboo"      B. ceboo      C. cebook</p> <p>D. cebo      E. ebo</p>	<pre>String tc = "Facebook"; String part = tc.substring(2, 6); System.out.print(part);</pre>

<p><b>QUESTION 26</b></p> <p>What replaces <b>&lt;*1&gt;</b> in the code to the right to initialize the variable <code>total</code> to zero?</p> <p>A. <code>null</code>      B. <code>false</code>      C. <code>pts</code></p> <p>D. <code>0</code>      E. More than one of the answers A through D is correct.</p>	<pre>int[] pts = {12, 5, 15, 10, 12, 7}; int total = &lt;*1&gt;; for(int it : pts) {     int temp = it / 5;     switch (temp) {         case 0 : total += 1; break;         case 1 : total += 2; break;         case 2 : total += 4; break;         default : total += 8;     } } System.out.print(total);</pre>
<p>Assume <b>&lt;*1&gt;</b> is filled in correctly.</p>	
<p><b>QUESTION 27</b></p> <p>What is output by the code to the right?</p> <p>A. <code>4</code>      B. <code>8</code>      C. <code>11</code></p> <p>D. <code>24</code>      E. <code>42</code></p>	
<p><b>QUESTION 28</b></p> <p>What is output by the code to the right?</p> <p>A. <code>[4, 2, 5]</code>      B. <code>[2, 5, 6]</code></p> <p>C. <code>[6, 5, 4]</code>      D. <code>[3, 5, 7]</code></p> <p>E. <code>[2, 5, 4]</code></p>	<pre>int[] ref1 = {2, 5, 4}; int[] ref2 = {3, 2, 1}; ref2[1]++; ref2 = ref1; ref2[2] += ref1[0]; System.out.print(Arrays.toString(ref1));</pre>
<p><b>QUESTION 29</b></p> <p>What is output by the code to the right?</p> <p>A. <code>[0, 1]</code>      B. <code>[1, 0]</code></p> <p>C. <code>[12, 13]</code>      D. <code>[13, 12]</code></p> <p>E. There is no output due to a syntax error in the code.</p>	<pre>ArrayList&lt;Double&gt; reals; reals = new ArrayList&lt;Double&gt;(); reals.add(0, 12); reals.add(1, 13); System.out.print(reals);</pre>
<p><b>QUESTION 30</b></p> <p>What is output by the code to the right?</p> <p>A. <code>2</code>      B. <code>8</code>      C. <code>10</code></p> <p>D. <code>256</code>      E. <code>true</code></p>	<pre>int val2 = 2; int val3 = 8; int val4 = val2 ^ val3; System.out.println(val4);</pre>
<p><b>QUESTION 31</b></p> <p>Which sorting algorithm does not compare the elements being sorted to each other if the maximum value of the elements being sorted is already known?</p> <p>A. Selection sort      B. Insertion sort      C. Radix sort      D. Heap sort      E. Quicksort</p>	

**QUESTION 32**

What replaces **<\*1>** in the code to the right so that the instance variable `x` can be accessed by code in all classes?

- A. `final`      B. `private`      C. `public`  
D. `void`      E. `protected`

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

**QUESTION 33**

What is output by the client code to the right?

- A. 0      B. 1      C. 2  
D. There is no output due to a syntax error in the `Sample` class.  
E. There is no output due to a runtime error.

```
public class Sample {
    <*1> int x;

    public static void bar(int x) {
        foo();
        x++;
    }

    public void foo() {x++;}
}
```

```
// client code
Sample st = new Sample();
st.bar(st.x);
System.out.print(st.x);
```

**QUESTION 34**

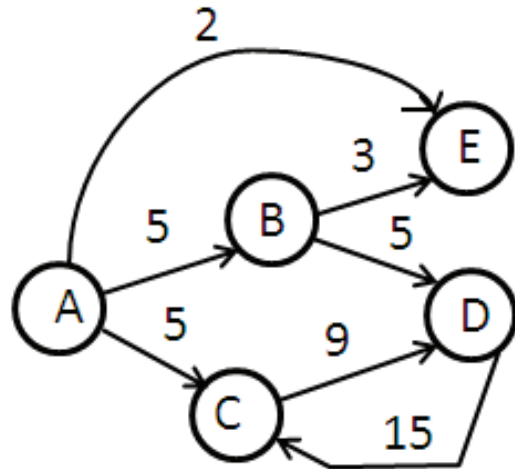
What kind of graph does the picture to the right represent?

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

**QUESTION 35**

What is the cost of the lowest cost path from vertex D to vertex A?

- A. 5      B. 10  
C. 14      D. 20  
E. There is no path from vertex D to vertex A.



**Go on to the next page.**

**QUESTION 36**

What replaces **<\*1>** and **<\*2>** in the code to the right to set the constant LIM1 to the number of rows in `t` and the constant LIM2 to the number of columns in `t`?

**<\*1>****<\*2>**

- |                                 |                              |
|---------------------------------|------------------------------|
| A. <code>t.length</code>        | <code>t.length.length</code> |
| B. <code>t.length.length</code> | <code>t.length</code>        |
| C. <code>t.length</code>        | <code>t[0].length</code>     |
| D. <code>t[0].length</code>     | <code>t[1].length</code>     |
| E. <code>t[0].length</code>     | <code>t.length</code>        |

Assume **<\*1>** and **<\*2>** are filled in correctly.

**QUESTION 37**

What is returned by method `handle` if `t` is the 2d array shown below?

1	8	0	9	1	6
0	1	5	4	0	4
2	2	7	1	13	2
11	5	13	13	4	20
0	1	5	4	0	4

- A. 44                      B. 59
- C. 94                      D. 137
- E. There is no output due to an infinite loop that occurs when the method is called with the 2d array shown above.

```
// pre: t != null, t refers to a
// rectangular matrix, t.length > 0
```

```
public int handle(int[][] t) {
    int total = 0;
    final int LIM1 = <*1>;
    final int LIM2 = <*1>;

    for(int r = 0; r < LIM1; r++) {
        int temp1 = LIM2 / 2;
        int temp2 = 0;
        int temp3 = LIM1 * 2;
        int c = 0;
        while(temp2 < temp3 && c < temp1) {
            temp2 += t[r][c];
            temp2 += t[r][LIM2 - 1 - c++];
        }
        total += temp2;
    }
    return total;
}
```

**Go on to the next page.**



**QUESTION 38**

What is the best case order (Big O) and worst case order of the insert method in the Structure class to the right given the Structure already contains N elements? Pick the most restrictive set of correct answers.

Best case	Worst Case
A. $O(1)$	$O(1)$
B. $O(1)$	$O(N)$
C. $O(N)$	$O(N)$
D. $O(N)$	$O(N^2)$
E. $O(N^2)$	$O(N^2)$

**QUESTION 39**

What is output by the following client code?

```
Structure st = new Structure();
System.out.print(st.size());
st.add(4);
st.add(8);
st.add(6);
for(int i = 0; i < st.size(); i++)
    System.out.print(st.get(i));
System.out.print(st.size());
```

- A. 104863
- B. 04863
- C. 06843
- D. 10486310
- E. There is no output due to a runtime error caused by the client code.

**QUESTION 40**

What kind of data structure does the Structure class implement?

- A. a stack
- B. an array based list
- C. a queue
- D. a linked list
- E. a heap

```
public class Structure {
    private Object[] con;
    private int size;

    public Structure() {
        con = new Object[10];
        size = 0;
    }

    public void add(Object x) {
        insert(size, x);
    }

    public Object get(int pos) {
        return con[pos];
    }
}
```

```
public void insert(int pos, Object obj) {
    ensureCapacity();
    for(int i = size; i > pos; i--)
        con[i] = con[i - 1];
    con[pos] = obj;
    size++;
}
```

```
public Object remove(int pos) {
    Object removedValue = con[pos];
    for(int i = pos; i < size - 1; i++)
        con[i] = con[i + 1];
    con[size - 1] = null;
    size--;
    return removedValue;
}
```

```
public int size() {
    return size;
}
```

```
private void ensureCapacity() {
    if(size == con.length)
        resize();
}
```

```
private void resize() {
    Object[] temp;
    temp = new Object[con.length * 2];
    for(int i = 0; i < con.length; i++)
        temp[i] = con[i];
    con = temp;
}
```