

University Interscholastic League

Computer Science Competition

Number 133 (District 1 - 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 757_8 and 540_8 ?

- A. 1317_8 B. 1317_{10} C. 1297_{10} D. 217_8 E. 1517_8

QUESTION 2

What is output by the code to the right?

- A. 1.0 B. 1.75 C. 2.15
D. 2.55 E. 2.75

```
double a = 3.5;
double b = 4 / 5 + a / 2;
System.out.print(b);
```

QUESTION 3

What is output by the code to the right?

- A. 20 B. 40 C. 42
D. 60 E. 63

```
int val = 0;
for(int i = 0; i < 20; i++){
    val++;
    val += 2;
}
System.out.print(val);
```

QUESTION 4

What is output by the code to the right?

- A. ibe B. v205 C. v_1
D. Be E. iBe

```
String c1 = "Tyler_Brownsville";
String c2 = "" + c1.charAt(12);
c2 += c1.charAt(5) + "" + c1.charAt(15);
System.out.print(c2);
```

QUESTION 5

What is output by the code to the right?

- A. false false 6 B. false true 5
C. true false 5 D. true true 6
E. The output will vary from one run of the program to the next.

```
boolean[] st = new boolean[5];
System.out.print(st[3] + " " + !st[0]);
System.out.print(" " + st.length);
```

QUESTION 6

What is output by the code to the right?

- A. -5.0 5.99 B. -10.0 5.99
C. -10 5.0 D. -5.0 5.0
E. 10.0 5.0

```
double a1 = 5.99;
double b1 = -1.25;
double c1 = ((int) a1) * ((int) b1);
System.out.print(c1 + " " + a1);
```

QUESTION 7

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

`!(p && !q)`

- A. `!p || q` B. `!p && q` C. `!p && !q`
D. `p || q` E. `p || !q`

<p>QUESTION 8</p> <p>What is output by the code to the right?</p> <p>A. 1 B. 2 C. 13</p> <p>D. 23 E. 123</p>	<pre>int x2 = 10; if(x2 * x2 > x2 + x2) if(x2 > 0) System.out.print(1); else System.out.print(2); System.out.print(3);</pre>
<p>QUESTION 9</p> <p>Which of the following can replace <*1> so that the class College to the right compiles without syntax error?</p> <p>A. super(s) B. this(s)</p> <p>C. mascot = s D. School(s)</p> <p>E. More than one of A through D is correct.</p>	<pre>public class School { private String mascot; public School(String m) {mascot = m;} public void rah() {mascot += "!";} public String toString() {return mascot;} }</pre>
<p>Assume <*1> is filled in correctly.</p>	
<p>QUESTION 10</p> <p>What is output by the client code to the right?</p> <p>A. Raiders B. !!</p> <p>C. !!Raiders D. Raiders!!</p> <p>E. There is no output due to a syntax error in the client code.</p>	<pre>public class College extends School { public College(String s) { <*1>; } } // client code College tt = new College("Raiders"); tt.rah(); tt.rah(); System.out.print(tt);</pre>
<p>QUESTION 11</p> <p>What is output by the code to the right?</p> <p>A. 282475249 B. 10000000 C. 15</p> <p>D. 17 E. 13</p>	<pre>int m = 7; int n = 10; System.out.print(m ^ n);</pre>
<p>QUESTION 12</p> <p>What is output by the code to the right?</p> <p>A. 3125 B. 625 C. 625.0</p> <p>D. 256 E. 125</p>	<pre>int m1 = 4; int n1 = (int) Math.pow(m1 + 1, m1 - 1); System.out.print(n1);</pre>
<p>QUESTION 13</p> <p>What is output by the code to the right?</p> <p>A. 1\23\4 B. 1 23 4</p> <p>C. 1t23t4 D. 1 2</p> <p>E. 1 2 3 4</p>	<pre>System.out.print("1\t2"); System.out.print("3\t4");</pre>
<p>QUESTION 14</p> <p>What is output by the code to the right?</p> <p>A. 0045.70 B. 045.7 C. 45.70</p> <p>D. +45.7 E. 045.70</p>	<pre>double tk = 45.7; System.out.printf("%05.2f", tk);</pre>

<p>QUESTION 15</p> <p>What is returned by the method call <code>pick("universityTexas")</code> ?</p> <p>A. nvriyea B. unvi</p> <p>C. niet D. unvis</p> <p>E. There is no output due to an infinite loop.</p>	<pre>public String pick(String n) { String result = ""; int lim = n.length(); for(int i = 1; i <= lim; i *= 2) result += n.charAt(i); return result; }</pre>
<p>QUESTION 16</p> <p>What is output by the code to the right?</p> <p>A. 3 B. 10 C. 30</p> <p>D. 54 E. 75</p>	<pre>String stars = ""; for(int i = 0; i < 5; i++) for(int j = 0; j < 5; j++) stars += "****"; System.out.print(stars.length());</pre>
<p>QUESTION 17</p> <p>What is output by the line marked <code>// line 1</code> in the client code to the right?</p> <p>A. null B. 200 C. 10 20</p> <p>D. There is no output due to a syntax error in the client code.</p> <p>E. The output will vary from one run of the program to the next.</p>	<pre>public class GasTank { private int cap; private int mpg; public GasTank(int c, int m) { cap = c; mpg = m; } public int range() { return cap * mpg; } }</pre>
<p>QUESTION 18</p> <p>What is output by the line marked <code>// line 2</code> in the client code to the right?</p> <p>A. false false</p> <p>B. false true</p> <p>C. There is no output due to a syntax error in the client code.</p> <p>D. There is no output due to a runtime error.</p> <p>E. The output will vary from one run of the program to the next.</p>	<pre>// client code GasTank g1 = new GasTank(10, 20); System.out.print(g1); // line 1 GasTank g2 = new GasTank(20, 15); GasTank g3 = new GasTank(20, 15); boolean b1 = g2 == g3; boolean b2 = g3.equals(g2); System.out.print(b1 + " " + b2); // line 2</pre>
<p>QUESTION 19</p> <p>Which of the following Java expressions is equivalent to the formula to the right? <code>a</code> and <code>t</code> are variables of type <code>double</code>.</p> <p>A. <code>0.5 * a * t * t</code></p> <p>B. <code>a * t ^ 2 / 2</code></p> <p>C. <code>a * t * t * 2</code></p> <p>D. <code>(a * t * t) / 0.5</code></p> <p>E. <code>a * t ^^ 2 * 0.5</code></p>	$\frac{1}{2}at^2$

<p>QUESTION 20</p> <p>What is output by the code to the right?</p> <p>A. 0 B. 3 C. 5</p> <p>D. 15 E. null</p>	<pre>int[][] table = new int[5][3]; System.out.print(table[0].length);</pre>
<p>QUESTION 21</p> <p>What is output by the code to the right?</p> <p>A. 1.0 B. -1.0 C. -2.0</p> <p>D. 2 E. 2.0</p>	<pre>double a3 = 17.02 * -0.1; System.out.print(Math.floor(a3));</pre>
<p>QUESTION 22</p> <p>What is output by the code to the right?</p> <p>A. c84k c84k B. C*\$K c84k</p> <p>C. c*\$K c*\$K D. C84K c84k</p> <p>E. c84k C84K</p>	<pre>String an1 = "C84K"; String an2 = an1.toLowerCase(); System.out.print(an1 + " " + an2);</pre>
<p>QUESTION 23</p> <p>What is output by the code to the right?</p> <p>A. [C, X, D] B. [X, X, D]</p> <p>C. [C, X, X] D. [C, X, C]</p> <p>E. There is no output due to a syntax error in the code.</p>	<pre>List<String> list; list = new ArrayList<String>(); list.add("C"); list.add("D"); list.add(1, "X"); list.set(2, list.get(1)); System.out.print(list);</pre>
<p>QUESTION 24</p> <p>What is output by the client code to the right?</p> <p>A. 48 6 24</p> <p>B. 48 12 24</p> <p>C. 48 6 12</p> <p>D. 24 6 24</p> <p>E. 48 6 48</p>	<pre>public int mystery(int x, int y) { x *= 2; y /= 3; return x * y; } // client code int x = 6; int y = 12; System.out.print(mystery(x, y)); y = mystery(y, x); System.out.print(" " + x + " " + y);</pre>
<p>QUESTION 25</p> <p>Which of the following can replace <*1> in the following line of code so that it compiles without error?</p> <p>double <*1> = 0.0;</p> <p>A. 37_ B. Big C. final D. int E. None of A through D are correct.</p>	

QUESTION 26

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

```
int[] data3 = {12, 14, -10, 4, 5, -10};
System.out.print(calc(data3));
```

- A. 0 B. 2 C. 5
D. 10 E. 26

```
public int calc(int[] list) {
    int total = 0;
    int count = 0;
    for(int i = 0; i < list.length; i++)
        if(list[i] % 2 == 0) {
            total += list[i];
            count++;
        }
    return total / count;
}
```

QUESTION 27

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

```
int[] data4 = {3, 1, 11, -3, 15, 1};
System.out.print(calc(data4));
```

- A. NaN B. 0 C. 4
D. There is no output due to a syntax error in the client code
E. There is no output due to a runtime error.

QUESTION 28

What is output by the code to the right?

- A. [A, B, aa, a] B. [aa, a, A, B]
C. [a, A, aa, B] D. [A, B, a, aa]
E. [A, a, aa, B]

```
String[] sts = {"A", "a", "aa", "B"};
Arrays.sort(sts);
System.out.print(Arrays.toString(sts));
```

QUESTION 29

What is output by the code to the right?

- A. 03025 B. 01234 C. 12345
D. 10 E. 250

```
int[] data = {0, 3, 0, 2, 5};
String all = "";
for(int xv : data)
    all += xv;
System.out.print(all);
```

QUESTION 30

What is output by the code to the right?

- A. {-4=aa, 0=A, 3=A,B, 5=null}
B. {-4=aa, 3=B, 5=null}
C. {-4=aa, 0=A, 3=B, 5=null}
D. There is no output due to a syntax error.
E. There is no output due to a runtime error.

```
TreeMap<Integer, String> samp;
samp = new TreeMap<Integer, String>();
samp.put(3, "A");
samp.put(0, "A");
samp.put(3, "B");
samp.put(-4, "aa");
samp.put(5, samp.get(-1));
System.out.print(samp);
```

QUESTION 31

A method is $O(N^3)$. When $N = 200,000$ the method takes 3 seconds to complete. What is the expected runtime for the method when $N = 800,000$?

- A. 12 seconds B. 48 seconds C. 192 seconds D. 384 seconds E. 576 seconds

QUESTION 32

Given method `sort` to the right what is output when the following client code is executed.

```
int[] us = {12, 17, 5, -5, 15, 0, -3};
sort(us);
```

- A. [-5, 5, 12, 15, 17, 0, -3]
- B. [-5, 0, -3, 5, 12, 15, 17]
- C. [-5, -3, 0, 5, 12, 15, 17]
- D. [12, 17, 5, -5, 15, 0, -3]
- E. None of A through D are correct.

```
public void sort(int[] lt) {
    int temp, j;
    for(int i = 1; i < lt.length; i++) {
        temp = lt[i];
        j = i;
        while( j > 0 && temp < lt[j - 1]) {
            lt[j] = lt[j - 1];
            lt[j - 1] = temp;
            j--;
        }
        if(i == 4)
            System.out.print(Arrays.toString(lt));
    }
}
```

QUESTION 33

Which sorting algorithm does method `sort` implement?

- A. radix sort
- B. selection sort
- C. insertion sort
- D. heap sort
- E. None of A through D are correct.

QUESTION 34

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

```
ArrayList w = new ArrayList();
gen(w, 0, "eerily");
System.out.print(w.size());
```

- A. 0
- B. 14
- C. 64
- D. 128
- E. There is no output due to a runtime error.

```
public void gen(ArrayList pats,
                int pos, String cur) {
    if(pos == cur.length())
        pats.add(cur);
    else {
        gen(pats, pos + 1, cur);
        String temp = cur.substring(0, pos) +
            'e' + cur.substring(pos + 1);
        gen(pats, pos + 1, temp);
    }
}
```

QUESTION 35

What is output by the code to the right?

- A. 35.216
- B. 16.804
- C. 4.402
- D. 2.201
- E. There is no output due to a syntax error.

```
double a5 = 8.804;
double b5 = a5 >> 2;
System.out.print(a5 + " " + b5);
```

QUESTION 36

Method `min` to the right contains a logic error. Which of the following changes is required so that method `min` always meets its post condition?

- A. Change `int min = 0` to `int min = lt[0]`.
- B. Change every occurrence of the identifier `min` to `m`.
- C. Change `int min = 0` to `int min = Integer.MAX_VALUE`.
- D. Change `int i` to `int x`.
- E. More than one of A through D is correct.

```
// pre: lt != null, lt.length > 0
// post: return the minimum value in lt
public int min(int lt[]) {
    int min = 0;
    for(int i : lt)
        min = min > i ? i : min;
    return min;
}
```

QUESTION 37

What is returned by method `h(t, 1, 0, -10)` if `t` is the matrix shown below?

1	4	0	22	25	6
0	-1	5	20	47	50
2	3	7	17	10	52
11	5	13	15	4	20

- A. 5 B. 8 C. 12
D. 14 E. 2000

```
public int h(int[][] t, int i, int j,
            int d) {
    if(i == -1 || i == t.length)
        return 1000;
    if(j == t[0].length)
        return 0;
    if(t[i][j] <= d)
        return 2000;
    int m1 = 1 + h(t, i - 1, j, t[i][j]);
    int m2 = 2 + h(t, i, j + 1, t[i][j]);
    int m3 = 1 + h(t, i + 1, j, t[i][j]);
    return Math.min(Math.min(m1, m2), m3);
}
```

QUESTION 38

Given class `N` below, what is output by the client code to the right?

```
public class N {
    public Object d;
    public N n;
    public N(Object d1, N n1) {
        d = d1; n = n1; }
}
```

- A. 401 B. 302 C. 321
D. There is no output due to a runtime error.
E. The output will vary from one run of the program to the next.

```
// client code
N n1 = new N(0, null);
n1.n = new N(1, new N(2, new N(3, n1)));
N n2 = new N(n1, new N(4, n1.n));
n2.n.n = n1.n.n.n;
N t = n2;
for(int i = 1; i < 11; i++) {
    if(i % 3 == 0)
        System.out.print(t.d);
    t = t.n;
}
```

QUESTION 39

Given the `Structure` class to the right what is output by the following client code?

```
Structure st = new Structure();
st.add(24);
st.add(36);
st.add(24);
st.add(8);
while(!st.isEmpty())
    System.out.print(st.remove());
```

- A. 36824 B. 82436
C. 8243624 D. 2436248
E. The code runs without error, but there is no output.

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

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

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

    public E get() {
        return con.get(con.size() - 1);
    }

    public E remove() {
        return con.remove(con.size() - 1);
    }

    public boolean isEmpty() {
        return con.isEmpty();
    }
}
```

QUESTION 40

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

- A. a graph B. a heap C. a stack
D. a queue E. a list