University Interscholastic League

Computer Science Competition

Number 135 (Regional - 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.

What does $F9E_{16}$ minus 110011110001_2 equal?

A. $34D_{16}$ B. $1D8F_{16}$ C. 109_{10} D. $2AD_{16}$ E. $24F_{16}$

QUESTION 2

What is output by the code to the right?

A. 8   B. 108   C. 195

D. 895   E. 995

```
int x = 895;
int y = 100;
int z = x % y + y % x;
System.out.print(z);
```

QUESTION 3

What is output by the code to the right?

A. 16   B. 21   C. 23

D. 26   E. 28

```
int val = -5;
for(int i = val; i <= 8; i++){
  val++;
  ++val;
}
System.out.print(val);
```

QUESTION 4

What is output by the code to the right?

A. 20   B. 12   C. 9

D. 8   E. 6

```
String c1 = "#Yoo*";
String c2 = c1.toLowerCase();
c2 += c1 + c2 + c1;
System.out.print(c2.length());
```

QUESTION 5

What is output by the code to the right?

A. null5   B. 5   C. 4

D. There is no output due to a syntax error.

E. There is no output due to a runtime error.

```
String[] st = new String[5];
System.out.print(st[3] + st.length);
```

QUESTION 6

What is output by the code to the right?

A. 2.0   B. 2.125   C. 5.125

D. There is no output due to a syntax error.

E. There is no output due to a runtime error.

```
double a1 = 52.125;
a1 %= 10;
System.out.print(a1);
```

QUESTION 7

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

```
!((p < q) || !(q >= r))
```

A. `(p < q) || (q >= r)`   B. `(p >= q) && (q >=r)`   C. `!(p < q) && !(q >= r)`

D. `p <= r`   E. `!(p != q) && (q < r)`

What is output by the code to the right?

A. 12   B. 23

C. 24   D. 14

E. There is no output due to a syntax error.

```
int x1 = 7;
if(x1 * 2 > 10)
  System.out.print(1);
else
  System.out.print(2);
if(x1 == 14)
  System.out.print(3);
else
  System.out.print(4);
```

What is output by statement marked `// line 1` in the client code to the right?

A. 3 1503

B. 1500 4503

C. 0 0

D. 3 1500

E. 3 1800

```
public class School {
  private int numStudents, cls;

  public School(int ns, int c) {
    numStudents = ns;
    cls = c;
  }

  public void newYear() {
    numStudents += cls * 100;
  }

  public String toString() {
    return cls + " " + numStudents;
  }
}

public class BigSchool extends School {
  public BigSchool(int ns, int c) {
    super(ns * 2, c);
  }

  public void newYear() {
    super.newYear();
    super.newYear();
  }
}

// client code
School sc1 = new School(1500, 3);
sc1.newYear();
System.out.print(sc1); // line 1
School sc2 = new BigSchool(100, 2);
sc2.newYear();
System.out.print(sc2); // line 2
```

What is output by statement marked `// line 2` in the client code to the right?

A. 2 300

B. 2 400

C. 2 600

D. 2 800

E. There is no output due to a runtime error.

What is output by the code to the right?

A. 54   B. 47   C. 43

D. 35   E. 1

```
int m = 35;
int n = 40;
int o = 19;
System.out.print(m & o | n);
```

The code to the right contains a syntax error. Which of the following best describes the cause of the syntax error?

A.   The `++` operator is not defined for variables of type `double`.

B.   The expression `++m1` must be rewritten as `m1++`.

C.   Variables of type `double` are not legal arguments for the `Math.round` method.

D.   Expressions that result in `doubles` may not be assigned to variables of type `int`.

E.   The `round` method must be called via an object of type `Math`, not the class name.

```
double m1 = -125;
int n1 = Math.round(++m1);
System.out.print(n1);
```

What is output by the code to the right?

A.   "one
    two

B.   "one"two"

C.   "onetwo

D.   \t\onetwo

E.   There is no output due to a syntax error.

```
System.out.print("\t\"one");
System.out.println("two");
```

What is output by the code to the right?

A.   100000000   B.   000256

C.   000006   D.   000400

E.   000000400

```
int tk = 256;
System.out.printf("%06o", tk);
```

What is returned by the method call `change(7471020)`?

A.   0   B.   2   C.   21

D.   747102   E.   247123

```
public int change(int x) {
  if(x <= 0)
    return x;
  else
    return change(x / 10) + x % 10;
}
```

What is output by the code to the right?

A.   36   B.   37   C.   55

D.   63   E.   64

```
String stars = "*";
for(int i = 3; i < 12; i++)
  for(int j = 0; j < i; j++)
    stars += "*";
System.out.print(stars.length());
```

What is output by the code to the right?

A.　[0, 1, 2]　　B.　[0.0, 1.0, 2.0]

C.　[0, 0, 0]　　D.　3 [0, 1, 2]

E.　The output will vary from one run of the program to the next.

```
int[] values = {0, 1, 2};
System.out.print(values);
```

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

A.　0　　　　B.　1　　　　C.　7

D.　8　　　　E.　15

```
boolean p, q, r, s;

// code to initialize p, q, r, and s

boolean t = !p && q && r && !s;
```

What is output by statement marked `// line 1` in the client code to the right?

A.　0　　　　B.　13　　　　C.　15

D.　18　　　　E.　26

```
public int tinker(int[] data) {
  data[0] += data[2];
  data[1] -= data[1] * 3;
  int t = 0;
  for(int i : data)
    t += i;
  data = new int[4];
  data[0] = 15;
  return t;
}

// client code
int[] readings = {12, 5, 7, 2};
int ans = tinker(readings);
System.out.print(ans); // line 1
ans = 0;
for(int i : readings)
  ans += i;
System.out.print(ans); // line 2
```

What is output by statement marked `// line 2` in the client code to the right?

A.　0　　　　B.　15　　　　C.　18

D.　26　　　　E.　48

Which of the following can replace `<*1>` in the code to the right so that the code segment compiles without error?

I.　byte
II.　short
III.　float

A.　I only　　　　B.　II only　　C.　III only

D.　I and II only　　E.　I, II, and III

```
double value = 48.125627;
<*1> var = (<*1>) value;
```

Which of the following can replace **<*1>** in method `work` so that the method compiles without error?

A. new   B. work   C. true

D. finally   E. 22_$

```
public int work(int <*1>, int y) {
  int z = <*1> + y;
  <*1>++;
  y++;
  System.out.print(z + " ");
  return z + <*1> + y;
}
```

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

What is output by the client code to the right?

A. 1 5 3 -6   B. 0 4 2 -6

C. 5 1 3 -5   D. 1 5 3 -4

E. 4 0 2 -4

```
// client code
int x = 4;
int y = -5;
System.out.print(x++ + " "
            + work(x++, y) + " " + --y);
```

What is output by the code to the right?

A. 2false

B. 1false

C. 1true

D. The output will vary from one run of the program to the next.

E. There is no output due to a syntax error in the code.

```
boolean p = true;
if(p = false)
  System.out.print(1);
else
  System.out.print(2);
System.out.print(p);
```

What is the largest possible value the code to the right will output?

A. 990   B. 999   C. 1000

D. 1089   E. 1100

```
int tot = 0;
int lim = ((int) (Math.random() * 10)) + 1;
for(int i = 0; i < lim; i++) {
  int temp = (int) (Math.random() * 100);
  tot += temp;
}
System.out.print(tot);
```

Which of the following can replace **<*1>** in the code to the right so that the output is 6?

A. Character.isLowerCase(ch)

B. !Character.isLowerCase(ch)

C. Character.isLetter(ch)

D. !Character.isLetter(ch)

E. Character.isLetterOrDigit(ch)

```
String uni = "Texas-Tech-2011";
int total = 0;
for(int i = 0; i < uni.length(); i++) {
  char ch = uni.charAt(i);
  if( <*1> )
    total++;
}
System.out.print(total);
```

What replaces **<*1>** in the code to the right so that when the `while` loop is complete `stck.size()` returns 0?

A. `stck.pop()`   B. `stck.isEmpty()`

C. `!stck`   D. `!stck == 0`

E. `!stck.isEmpty()`

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

What is output by the code to the right?

A. `1010-5`   B. `-510`

C. `-51010`   D. `10-5`

E. `10-5-5`

```
Stack<Integer> stck = new Stack<Integer>();
stck.push(-5);
stck.push(10);
if(stck.peek() > 0)
  stck.push(stck.peek());
while( <*1> )
  System.out.print(stck.pop());
```

What is output by the statement to the right marked `// line 1`?

A. `false`   B. `true`   C. `-50`

D. There is no output due to a syntax error.

E. There is no output due to a runtime error.

```
Comparable c1 = "Baylor";
Comparable c2 = "tcu";
boolean b3 = c1.compareTo(c2) > 0;

System.out.print(b3); // line 1

System.out.print(c1.equals(c2)); // line 2
```

What is output by the statement to the right marked `// line 2`?

A. `false`   B. `true`   C. `50`

D. There is no output due to a syntax error.

E. There is no output due to a runtime error.

What is output by the code to the right?

A. `false false`

B. `false true`

C. `true false`

D. `true true`

E. The output will vary from one run of the program to the next.

```
TreeMap<Integer, String> tm;
tm = new TreeMap<Integer, String>();
tm.put(0, "A");
tm.put(12, "B");
tm.put(0, "C");
HashMap<Integer, String> hm;
hm = new HashMap<Integer, String>();
hm.put(0, "C");
hm.put(12, "" + 'B');
System.out.print(tm instanceof Collection);
System.out.print( " " + tm.equals(hm));
```

QUESTION 32

What is returned by the method call `test(7)`?

A.　−2　　　B.　19　　　C.　20

D.　30　　　E.　38

```
public int test(int x) {
  if(x <= 2)
    return x * 2;
  return x * 2 + test(x - 2) + test(x - 4);
}
```

QUESTION 33

What is the worst case order (Big O) of method `slide` to the right? N = `d1.length` and M = `d2.length`. Pick the most restrictive correct answer.

A.　O(NM)　　　　B.　O(NlogM)

C.　O(N)　　　　D.　O(MlogN)

E.　O(N²)

```
public int slide(int[] d1, int[] d2) {
  int res = 0;
  for(int i = 0; i < d1.length; i++)
    for(int j = i; j < i + 10; j++)
      if(j >= d2.length)
        break;
      else if(d2[j] > d1[i])
        res += d2[j];
  return res;
}
```

QUESTION 34

What is output by method `sort` when the following client code is executed?

```
int[] tst = {37, 52, 16, 8, 21, 53};
sort(tst);
```

A.　[21, 16, 8][53, 52, 37]

B.　[16, 8][37, 21, 53, 52]

C.　[37, 21, 53, 52, 16][8]

D.　[8, 37][21, 53, 52, 16]

E.　[53, 52, 37, 21, 16, 8][]

```
// pre: all values in data > 0
public void sort(int[] data) {
  ArrayList<Integer>[] t =
   (ArrayList<Integer>[]) new ArrayList[2];
  t[0] = new ArrayList<Integer>();
  t[1] = new ArrayList<Integer>();
  int b = 1;
  for(int i = 0; i < 31; i++) {
    for(int j = 0; j < data.length; j++)
      t[(data[j] & b) / b].add(data[j]);
    b = b << 1;
    int j = 0;
    for(int x : t[1])
      data[j++] = x;
    for(int x : t[0])
      data[j++] = x;
    if(i == 4)
      System.out.print(t[0] + "" + t[1]);
    t[0].clear();
    t[1].clear();
  }
}
```

QUESTION 35

What sorting algorithm does method `sort` implement?

A.　selection sort

B.　insertion sort

C.　quicksort

D.　merge sort

E.　radix sort

QUESTION 36

Assume method `regional(int[] data)` is O(2ᴺ) where N = `data.length`. When method `regional` is passed an array with `length` = 200 it takes 3 seconds for method `regional` to complete. If method `regional` is then passed an array with `length` = 207 what is the expected time it will take method `regional` to complete?

A.　3.1 seconds　　　B.　128 seconds　　　C.　384 seconds　　　D.　1,024 seconds　　　E.　3,072 seconds

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

```
int[] fs = {0, 8, 4, 12, 2, 10, 6, 14,
                            1, 9, 5, 13};

for(int i : prc(fs))
  System.out.print(i + " ");
```

A.   1 2 1 2 1 2 1 2 1 2 1 2

B.   1 2 2 3 2 3 3 4 3 4 4 6

C.   0 8 4 12 2 10 6 14 1 9 5 13

D.   1 2 2 3 2 3 3 4 2 4 3 5

E.   1 2 2 4 2 4 4 8 2 6 5 11

```
public int[] prc(int[] data) {
  int[] f = new int[data.length];
  for(int i = 0; i < data.length; i++) {
    int m = 0;
    for(int j = 0; j < i; j++)
      if(data[i] > data[j] && f[j] > m)
        m = f[j];
    f[i] = m + 1;
  }
  return f;
}
```

Method `wrong` to the right has a syntax error. Which of
the following best describes the syntax error?

A.   `_` is not a valid identifier.

B.   `C` is not a valid identifier for a variable.

C.   The expression `C = 4` must be changed to
`C == 4`.

D.   The parameter `t` may not be declared to be `final`.

E.   More than one of A through E is correct.

```
public void wrong(int[] _, final int t) {
  int C = 0;
  for(int wrong : _) {
    if(_[wrong] == t) {
      _[wrong]++;
      C++;
    }
    if(C = 4)
      return;
  }
}
```

GO ON TO THE NEXT PAGE.

What is output by the following client code?

```
Structure st = new Structure();
st.add(0, "A");
st.add(0, 12);
st.add(1, 0.5);
st.add(st.size(), "B");
for(int i = 0; i < st.size(); i++)
  System.out.print(st.get(i) + " ");
```

A.   12 0.5 B

B.   A 0.5 12 B

C.   12 0.5 A B

D.   There is no output due to a syntax error in the client code.

E.   There is no output due to a runtime error.

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

A.   An array based list

B.   A linked list

C.   A stack

D.   A queue

E.   A graph

```
public class Structure<E> {
  private N<E> st = new N<E>(null, null);
  private int s;

  public void add(int i, E v) {
    N<E> n = new N<E>(v, g(i));
    g(i - 1).n = n;
    s++;
  }

  public E get(int i) { return g(i).d; }

  public void remove(int i) {
    g(i - 1).n = g(i).n;
    s--;
  }

  public int size() { return s; }

  private N<E> g(int i) {
    N<E> t = st;
    for(int j = -1; j < i; j++, t = t.n);
    return t;
  }

  private static class N<E> {
    private E d;
    private N<E> n;

    private N(E d1, N<E> n1) {
      d = d1;
      n = n1;
    }
  }
}
```