University Interscholastic League

Computer Science Competition

Number 140 (District 2 - 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 the value of $101101_2 - 11001_2$?

A. 1010_2 B. 10100_2 C. 1100_2 D. 100_2 E. 1000_2

QUESTION 2

What is output by the code to the right?

A. 3 B. 4 C. 3.0

D. 4.0 E. 3.5

```
System.out.print(Math.round(3.5));
```

QUESTION 3

What is output by the code to the right?

A. cruel B. crue C. re

D. cu E. cul

```
String x = "cruel";
String y = "";
for(int i = 0; i < x.length(); i += 2)
   y += x.charAt(i);
System.out.print(y);
```

QUESTION 4

Which expression can replace **<*1>** so that the code to the right outputs 3.0?

I. 15/4
II. (double) 15/4
III. (double) 15/(double)4
IV. (double)(15/4)

A. I only B. II only C. III only

D. IV only E. II and IV

```
System.out.print(<*1>);
```

QUESTION 5

What is output when mu(43210) is called?

A. 3210210 B. 43210 C. 21010

D. 210 E. 100

```
public static void mu(int n) {
   int j = n% 1000;
   int k = j % 100;
   System.out.print(j + "" + k);
}
```

QUESTION 6

What is output by the code to the right?

A. 2345 B. 41

C. 365 D. 239

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

```
String s = "34";
System.out.print(2 + Integer.parseInt(s) +
"5");
```

QUESTION 7

What is output by the code to the right?

A. 0 B. 4

C. 42 D. 43

E. 43.2

```
int x = 9;
int y = 14;
System.out.print(x * y % 8 * 4 / 5);
```

QUESTION 8

What is output by the code to the right?

A. 0 B. 1 C. 2

D. 3 E. 3.5

```
int n = 7;
String s = "Presley";
if(s.length() % 2 == 0) {
  if(n > 0) System.out.print(1);
  else System.out.print(2);
}
else if(s.indexOf("r") > 0)
   System.out.print(n/2);
else System.out.print(0);
```

QUESTION 9

What is output by the code to the right?

A. 1055 B. 5510 C. 5555

D. 1010 E. There is no output due to a runtime error.

```
int x = 5;
String s = "5";
System.out.print(x + x + s + s);
```

QUESTION 10

What is returned by the call `mu(arr)` when `arr` is the array `{1, 2, 3, 4, 5}`?

A. 1234

B. 1113

C. 1313

D. 111313

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

```
public static String mu(int[] a) {
  String s = "";
  for(int i = 0; i < a.length; i++) {
    for(int j = 0; j < i; j += 2)
      s += a[j];
  }
  return s;
}
```

QUESTION 11

Let n = `a.length`. What is the runtime of `mu`? Give the most restrictive correct answer.

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

QUESTION 12

Convert $BA25_{16}$ to base 10.

A. 4389 B. 11025 C. 47397 D. 47653 E. 762448

QUESTION 13

Assume `int n` has been initialized to a positive integer. What is the value of `s` after the code to the right is executed?

A. `n` B. `2n` C. n^2

D. `n(n+1)/2` E. `(n+1)(n+2)/2`

```
int s = 0;
for(int j = n; j >= 0; j--)
   for(int i = j; i >= 0; i--)
      s++;
```

QUESTION 14

What is output by the code to the right?

A. 9 B. 23 C. 26

D. 67 E. There is no output due to a compilation error.

```
int s = 0;
int[][] arr = {{3, 1, 5}, {2, 8, 6}, {10,
11, 12}};
for(int[] r : arr) {
  for(int x : r) {
    x++;
  }
}
for(int i = 0; i < arr.length; i++)
  s += arr[i][i];
System.out.print(s);
```

QUESTION 15

What code can replace **<*1>** so that the output from `line 1` in the client code is `22`?

I. `SCHOOL_ID`

II. `this.SCHOOL_ID`

III. `Student.SCHOOL_ID`

A. I only B. II only

C. III only D. I and III

E. I, II and III

Assume that **<*1>** was replaced correctly.

QUESTION 16

What is the output from line 2 in the client code?

A. `Jen Doe12`

B. `Jen DoeG12`

C. `Jen DoeGS12`

D. `Jen Doe`

E. There is no output because line 2 produces a runtime error.

```
public class Student {
  public static final int SCHOOL_ID = 22;
  private String name;
  private int IDNum;

  public Student(String s, int ID1) {
    name = s;
    IDNum = ID1;

    if(this instanceof Grad)
      name += "G";
    if(this instanceof Student)
      name += "S";
  }

  public int getSchNum() {
    return <*1>;
  }

  public String toString(){
    return name + IDNum;
  }

}

public class Grad extends Student {
  public Grad(String n, int one){
    super(n, one);
  }
}

// Client code
Student s = new Student("Jane Doe", 5);
Grad g = new Grad("Jen Doe", 12);
System.out.print(s.getSchNum()); // line 1
System.out.print(g.toString());  // line 2
```

QUESTION 17

What value is returned by the call `tau(10)`?

A. 5 B. 10 C. 20

D. 40 E. 80

QUESTION 18

What is the runtime of `tau(n)`? Give the most restrictive correct answer.

A. O(1) B. O(logn) C. O(n)

D. O(nlogn) E. $O(n^2)$

```
// pre: n > 0
public static int tau(int n) {
  if(n <= 2) return 5;
  return 2 * tau(n-2);
}
```

QUESTION 19

Which of the following replace **<*1>** in the code below to produce the same array as the code to the right?

```
int n = 0;
int[] a = new int[10];
<*1>
```

I.
```
for(int i = 0; i < 10; i++)
  a[i]++;
```

II.
```
for(int x : a)
  x++;
```

III.
```
do{
  a[n]++;
  n++;
} while(n < 10);
```

A. I only B. II only C. III only

D. I and III E. I, II and III

```
int n = 0;
int[] a = new int[10];
while(n < 10){
  a[n]++;
  n++;
}
```

GO ON TO THE NEXT PAGE.

QUESTION 20

Which of the following statements could replace `line 1` in the code to the right? The code should still compile after the change, and the output from the client code should remain the same.

I. `ID = String.valueOf(n);`
II. `ID = Integer.parseInt(n);`
III. `ID = Integer.toString(n);`

A. I only B. II only

C. III only D. I and II

E. I and III

```
public class A {
  private String ID;
  public A(int n) {
    ID = "" + n; // line 1
  }
  public String go() {
    return ID;
  }
  public String getID() {
    return ID;
  }
}

public class B extends A {
  public B(int n) {
    super(2*n);
  }
  public String go() {
    return getID();
  }
}
public class C extends B {
  public C(int n) {
    super(4*n);
  }
}
// Client code
A[] arr = {new A(1), new B(1), new C(1)};
System.out.print(arr[0].go() + arr[1].go()
+ arr[2].go());
```

QUESTION 21

What is the output from the client code to the right?

A. `128` B. `111`

C. `122` D. `2416`

E. `222`

QUESTION 22

What is output by the code to the right?

A. `Amy Jack`

B. `Amy Amos`

C. `Jack Henry`

D. `Amos Henry`

E. `Jack Amos`

```
TreeSet<String> t = new TreeSet<String>();
t.add("Amy");
t.add("Amos");
t.add("Evelyn");
t.add("Henry");
t.add("Jack");
System.out.print(t.first() + " ");
System.out.print(t.higher("Evelyn"));
```

QUESTION 23

What is output by the code to the right?

A. `0` B. `1` C. `4`

D. `24` E. `32`

```
System.out.print(~30 & 42);
```

QUESTION 24

What is output by the code to the right?

A. `+66.53` B. `+5.2` C. `66.525`

D. `+66.52` E. `66.52`

```
System.out.printf("%+5.2f", 66.525);
```

QUESTION 25

For which of the following strings `s` is the output from the code to the right `true`?

A. `"1aB#"`

B. `"AzBB"`

C. `"AzbBa"`

D. `"1p2q"`

E. `"3rrss"`

```
String t = "[1A][a-z][^A-Z][^0-9]";
System.out.print(s.matches(t));
```

QUESTION 26

What is output by the code to the right?

A. `3dig`

B. `2fish`

C. `3dig`

D. `2dog`

E. `2cat`

```
LinkedList<String> L = new
LinkedList<String>();
L.add("cat");
L.add(1, "dog");
L.addLast("fish");
L.add("dig");
L.peek();
L.remove();
L.pop();
System.out.print("" + L.size() +
L.getFirst());
```

QUESTION 27

What is output by the client code to the right?

A. `aba` B. `aaba` C. `aaa`

D. `ab` E. `bbb`

```
public static String rep(String s) {
  if(s == null || s.length() < 3)
    return "";
  if(s.length() % 2 == 0)
    return "a" + rep(s.substring(1,
s.length()-1));
  return "b" + rep(s.substring(2,
s.length()));
}

// Client code
String s = "elephant";
System.out.print(rep(s));
```

GO ON TO THE NEXT PAGE.

QUESTION 28

What is output by the client code to the right?

A. 6 B. 7 C. 8

D. 10 E. 12

QUESTION 29

Which algorithm is implemented by the `met` method?

A. bubble sort
B. shell sort
C. insertion sort
D. radix sort
E. selection sort

```
public static void met(int[] a) {
  int count = 0;
  for(int i = 0; i < a.length-1; i++) {
    int s = i;
    for(int j = i+1; j < a.length; j++){
      if(a[j] < a[s]) s = j;
    }
    int temp = a[i];
    a[i] = a[s];
    a[s] = temp;
    count++;
  }
  System.out.println(count);
}

// Client code
int[] arr = {3, -5, 0, 10, 6, 15, 2, 18,
24};
met(arr);
```

QUESTION 30

Consider that a sorting algorithm, when called on an array of integers, may move an array entry from one position or index in the array to another. When sorted in decreasing order using insertion sort, which of the following arrays will involve the smallest number of such position changes for array entries?

A. {4, 6, 1, 8, 9, 3}
B. {9, 4, 1, 8, 6, 3}
C. {4, 3, 8, 9, 6, 1}
D. {1, 9, 3, 6, 4, 8}
E. {3, 4, 1, 6, 9, 8}

QUESTION 31

What is output by the code to the right?

A. 0 B. 3 C. 5

D. 8 E. 13

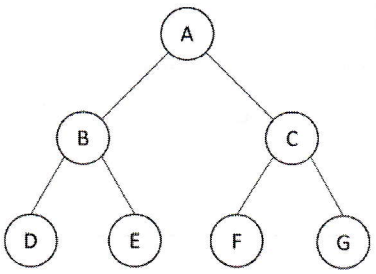
```
int s = 0;
int x = 30;
while(x > 0) {
  x += 5;
  s += x % 10;
  x = x / 10;
}
System.out.print(s);
```

QUESTION 32

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

A. ABDECFG B. DBEAFCG C. DEBFGCA

D. DEFGBCA E. ABCDEFG



QUESTION 33

The code to the right produces either a compilation or runtime error. Which of the following statements best explains the error?

A. `line 1` produces a compilation error.
B. `line 1` produces a runtime error.
C. `line 3` produces a runtime error.
D. `line 4` produces a runtime error.
E. `line 2` produces a compilation error.

```
int i;
int[][] arr = new int[10][]; // line 1
for(i = 0; i < arr.length; i++) // line 2
  arr[i] = new int[arr.length]; // line 3
System.out.print(arr[i][i]); // line 4
```

QUESTION 34

Which statement best describes the error that occurs when we attempt to compile and run the code to the right?

A. A compilation error is produced by `line 1`, since line 1 attempts to declare a variable in an interface.
B. A compilation error is produced by `line 2`, since the keyword `abstract` should not appear in this method declaration.
C. A compilation error is produced by `line 4`, since `line 4` contains an illegal assignment to a final variable.
D. The code compiles, but a runtime error occurs.
E. `Lines 3` and `4` cause a compilation error, since those lines attempt to reference the variable `x` as if it was static.

```
public interface P { // line 0
  public int x = 2; // line 1
  public abstract int getX(); // line 2
}

public class Pclass {
  public static void main(String[] args){
    System.out.print(P.x); // line 3
    P.x = 3;  // line 4
  }
}
```

In `line 0`, replace `interface` with `abstract class`.

QUESTION 35

Which statement best describes the error that occurs when we attempt to compile and run the code to the right?

A. A compilation error is produced by `line 1`, since line 1 attempts to declare a variable in an interface.
B. A compilation error is produced by `line 2`, since the keyword `abstract` should not appear in this method declaration.
C. A compilation error is produced by `line 4`, since `line 4` contains an illegal assignment to a final variable.
D. The code compiles, but a runtime error occurs.
E. `Lines 3` and `4` cause a compilation error, since those lines attempt to reference the variable `x` as if it was static.

QUESTION 36

What is output by the code to the right?

A. 24 B. 72 C. 128

D. 216 E. 432

```
String s = "";
for(int i = 0; i < 8; i += 2)
  s += "s";
for(int j = 0; j < 5; j++)
  s = s + s;
System.out.print(s.length());
```

QUESTION 37

Which of the following boolean expression evaluates to true if and only if P and Q are both false?

A. `!P && (!P || Q) && (!Q || P)`

B. `!P || !Q || (P && Q)`

C. `P && (!P || Q)`

D. `!P || (P && !Q)`

E. `P || Q || !P`

QUESTION 38

What is output by the code to the right?

A. 345 B. 415 C. 815

D. 824 E. There is no output due to a runtime error.

```
ArrayList<Integer> L = new
ArrayList<Integer>();
L.add(2);
L.add(4);
L.add(8);
L.add(3);
L.add(3, 1);
System.out.print(""+L.get(1) + L.get(3) +
L.size());
```

QUESTION 39

What is output when the code to the right is executed with the following command line arguments?

```
ant bird elephant donkey fish elk
```

A. 3

B. 7

C. 15

D. 21

E. 28

```
public class Q39 {
  public static void main(String[] args) {
    int k = 0;
    for(int i = 0; i < args.length; i++){
      k += args[i].length();
      if(args[i].compareTo("cinnamon") > 0)
        break;
    }
    print k;
  }
}
```

QUESTION 40

What is output by the client code to the right?

A. 10

B. 16

C. 22

D. 53

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

```
public static int mat(int[][] b) {
  int s = 0;
  for(int i = 0; i < b.length; i += 2)
    for(int j = 1; j < b[i].length; j+= 2)
      s += b[i][j];
  return s;
}

// Client code
int[][] a = {{1, 8, 9, 2, -4}, {11, 16, -6,
7}, {1, 2, 3, 4, 5, 6}, {-4, 7, 2, 1}};
System.out.print(mat(a));
```

Computer Science Answer Key
UIL District 2-2013

1. B	11. D	21. A	31. E
2. B	12. D	22. D	32. B
3. E	13. E	23. E	33. D
4. D	14. B	24. A	34. C
5. C	15. E	25. D	35. E
6. C	16. C	26. B	36. C
7. B	17. E	27. C	37. A
8. D	18. C	28. C	38. B
9. A	19. D	29. E	39. C
10. D	20. E	30. B	40. C

Notes:

Questions 11 and 18: The clause "Choose the most restrictive correct answer." is necessary because per the formal definition of Big O, an algorithm that is $O(n^2)$ is also $O(n^3)$, $O(n^4)$, and so forth.