

University Interscholastic League

Computer Science Competition

Number 141 (Regional - 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 $101101_2 + 1101011_2$?

- A. 98_{16} B. 152_{16} C. $8E_{16}$ D. 88_{16} E. 58_{16}

QUESTION 2

What is output by the code to the right?

- A. 1-1-1 B. 200 C. 2-20
D. -1 E. 2

```
int x = 1;
int y = 2;
int z = -1;
y = ++x * z++;
System.out.print(""+x+y+z);
```

QUESTION 3

What is output by the code to the right?

- A. 6 B. 8 C. 10
D. 12 E. 20

QUESTION 4

Which code segment can replace the `for` loop to the right without changing the output of the code to the right?

- I. `for(int i = 0; i < 10; i++) {
 i++;
 s += 2;
}`
II. `int i = 0;
while(i < 10) {
 s += 2;
 i++;
}`
III. `for(int i = 0; i < 20; i += 2)
 s += 2;`

- A. I only B. II only C. III only
D. I and II E. II and III

```
int s = 0;
for(int i = 0; i < 10; i++) {
    s += 2;
    i++;
}
System.out.print(s);
```

QUESTION 5

What is output by the code to the right?

- A. 535 B. 29 C. 929
D. 25 E. 35

```
int x = 3;
int y = 5;
if((x -= 1) > 2 && (y += 4) == 9)
    System.out.print(y);
System.out.print(x+" "+y);
```

QUESTION 6

What is output by the code to the right?

- A. 1 B. 2
C. 3 D. 4
E. There is no output due to a runtime error.

```
int[] a = {1, 3, 2, 4, 5};
System.out.print(a[a[1]]);
```

QUESTION 7

What is output by the code to the right?

- A. 1101 B. 13
- C. 2202 D. 11011101
- E. There is no output due to a compilation error.

```
System.out.print(Integer.parseInt("1101",
2));
```

QUESTION 8

What is output by the code to the right?

- A. 1 B. 2 C. 3
- D. 123 E. 12

```
int x = 8;
int y = 5;
int z = 1;
String s = "583";
if(x%y >= x-y) System.out.print("1");
if(x/y <= z) System.out.print("2");
if(s.indexOf("5") >= z)
    System.out.print("3");
```

QUESTION 9

What is output by the code to the right?

- A. 16 B. 38 C. 48
- D. 78 E. 768

```
String x = "hat";
for(int i = 0; i < 10; i += 3) {
    x += "x";
    x += x;
}
System.out.print(x.length());
```

QUESTION 10

What is output by line 1 in the client code to the right?

- A. -3
- B. 0
- C. 1
- D. 3
- E. 6

```
public static int mu(int x, int y) {
    x = y + 3;
    y = x + 1;
    return y-x;
}
```

```
// Client code
System.out.print(mu(4, 5)); // line 1
int z = mu(mu(1, 2), mu(3, 4));
System.out.print(z); // line 2
```

QUESTION 11

What is output by line 2 in the client code to the right?

- A. -6
- B. -3
- C. -2
- D. 0
- E. 1

QUESTION 12

Which of the following expressions are logically equivalent to $p \&& (\neg q \mid\mid \neg p) \&& (\neg(\neg p \&& \neg r) \mid\mid \neg r)$, for boolean variables p, q and r?

- A. $\neg(\neg p \mid\mid q)$
- B. $\neg q \mid\mid \neg p$
- C. $p \mid\mid r$
- D. $\neg r$
- E. $\neg(q \&& \neg r) \&& p$

QUESTION 13 What is output by the code to the right? A. 0 B. 1 C. 3 D. 7 E. 21436846	<pre>int m = 7 >>> 34; System.out.print(m);</pre>
QUESTION 14 What is output by the code to the right? A. true B. 3 C. 4 D. 15 E. There is no output due to a compilation error.	<pre>int m = 15; int n = 3; int k = 4; int t = m/k > n ? m : m%k > n ? n : k; System.out.print(t);</pre>
QUESTION 15 Which choice for <*1> allows the code to the right to compile without error? I. e[0][0]+e[1][1]+e[2][2] II. e.arr[0][0]+e.arr[1][1]+e.arr[2][2] III. e[0].arr[0]+e[1].arr[1]+e[2].arr[2] A. I only B. II only C. III only D. I and III only E. I, II and III	<pre>public class Ex { int[] arr = {0, 1, 2}; public static void main(String[] args) { Ex[] e = new Ex[3]; e[0] = new Ex(); e[1] = new Ex(); e[2] = e[0]; System.out.print(<*1>); } }</pre>
Assume that <*1> was replaced correctly.	
QUESTION 16 What is the output by the code to the right? A. 0 B. 000 C. 012 D. 3 E. null	

QUESTION 17

Which of the following choices for α in the code to the right produces code that compiles correctly?

- I. Comparable
- II. String
- III. Nothing is needed - leave the space containing α blank

- A. I only
- B. II only
- C. III only
- D. II and III
- E. I and II

Assume that α was replaced correctly.

QUESTION 18

What is output by the code to the right?

- A. hi 3
- B. hi 4
- C. bye 3
- D. bye 4
- E. hello 4

QUESTION 19

What is output by the code to the right?

- A. oneonetwo
- B. onetwotwo
- C. twotwotwo
- D. twoonetwo
- E. There is no output due to a compilation error.

```
List<String> list = new ArrayList< $\alpha$ >();
list.add("hello");
list.add("hi");
list.add("bye");
list.add("hi");
String s = list.get(2);
System.out.print(s + " " + list.size());
```

```
public class One {
    private static String c = "one";
    public String mu() {return c;}
}

public class Two extends One {
    private static String c = "two";
    public void printIt(One k) {
        String s = k.mu() + (new Two()).mu() + c;
        System.out.print(s);
    }
}

public class Test {
    public static void main(String[] args) {
        One on = new One();
        Two tw = new Two();

        tw.printIt(on);
    }
}
```

QUESTION 20

The file `a.txt` does not exist, and the file `b.txt` contains the following text:

Hello World

What is output by the code to the right?

- A. 1
- B. 12
- C. 125He2
- D. 124HelloWorld2
- E. There is no output due to a compilation error.

QUESTION 21

In the line marked line 1, replace the expression

```
catch(IOException | NullPointerException e)
```

with

```
catch(IOException e)
```

What is output by the code to the right after that change?

- A. 1
- B. 12
- C. 125He2
- D. 124HelloWorld2
- E. There is no output due to a compilation error.

```
public class C {
    public static void main(String[] args) {
        String[] files = {"a.txt", "b.txt"};
        pi(files[0]);
        pi(files[1]);
    }

    public static void pi(String fi) {
        BufferedReader b;
        try {
            FileReader x = new FileReader(fi);
            b = new BufferedReader(x);
            int l = fi.length();
            System.out.print(l);
            System.out.print((char)b.read());
            System.out.print((char)b.read());
        } catch(IOException |
NullPointerException e) { // line 1
            System.out.print("1");
        }
        finally {
            System.out.print("2");
        }
    }
}
```

QUESTION 22

What is output by the code to the right?

- A. 1
- B. 2
- C. 12
- D. 23
- E. 123

```
LinkedList<String> s;
s = new LinkedList<String>();
s.add("Hello");
if(s instanceof Object)
    System.out.print("1");
if(s instanceof List)
    System.out.print("2");
if(s instanceof Collection)
    System.out.print("3");
```

QUESTION 23

What is output by the code to the right?

- | | | |
|-------|-------|-------|
| A. 0 | B. 16 | C. 42 |
| D. 60 | E. 84 | |

```
int a = 0;
int i = 0;
while(i < 10) {
    int j = 10;
    while(j > i) {
        a += i+j;
        j -= 4;
    }
    i += 4;
}
System.out.print(a);
```

QUESTION 24

What is output by the code to the right?

- | | | |
|-------|-------|------|
| A. 2 | B. 3 | C. 6 |
| D. 26 | E. 52 | |

```
System.out.print(26 >> 2);
```

QUESTION 25**Question omitted****QUESTION 26**

What is output by the code to the right when it is executed with the command

`java Ex hope david length divided`

- A. david26
- B. length36
- C. david7
- D. divided7
- E. length25

QUESTION 27

Let the array that method mat is called on be MxN. What is the run time of mat? Choose the most restrictive correct answer.

- A. $O(N)$
- B. $O(M)$
- C. $O(MN)$
- D. $O(M+N)$
- E. $O(N^{1/2})$

Question omitted

```
public class Ex{
    public static void main(String[] args) {
        Stack<String> s = new Stack<String>();
        for(int i = 0; i < args.length; i++)
            s.push(args[i]);
        s.peek();
        s.pop();
        String x = s.pop();
        x += s.size()+" "+s.pop().length();
        System.out.print(x);
    }
}
```

```
public static int mat(int[][] a) {
    int k = 0;
    for(int i = 0; i < a.length; i+=2) {
        int m = Math.max(0, a.length-2);
        for(int j = m; j < a.length; j++)
            k++;
    }
    return k;
}
```

QUESTION 28

What is output by the print statement labeled line1 when the code to the right is run with the following command line arguments?

- cat Dog elk Elephant rabbit
- A. 4 B. Hello C. fate
 D. Pop E. help

QUESTION 29

What is output by the print statement labeled line2 when the code to the right is run with the following command line arguments?

cat Dog elk Elephant rabbit

- A. Dog
 B. elk
 C. Elephant
 D. rabbit
 E. cat

```
public class G<T extends Comparable<T>> {
    public static <T extends Comparable<T>> T
        mu(List<T> list, int j, int k) {
            T m = list.get(j);
            int c;
            for(int i = j+1; i <= k; i++) {
                c = m.compareTo(list.get(i));
                if(c < 0) m = list.get(i);
            }
            return m;
        }

    public static void main(String[] args) {
        G<String> t = new G<String>();
        LinkedList<String> L;
        L = new LinkedList<String>();
        L.add("Hello");
        L.add("Pop");
        L.add("fate");
        L.add("help");
        System.out.print(mu(L, 0, 2)); //line1

        List<String> L2;
        L2 = new LinkedList<String>();
        for(String e: args) L2.add(e);
        System.out.print(mu(L2, 1, 4)); //line2
    }
}
```

QUESTION 30

Insert the following integers (in order from left to right) in a binary search tree.

15 20 3 1 5 7 30 12

What is the height of the resulting tree? The height of a tree is the number of edges in the longest path from the root to a leaf.

- A. 3
 B. 4
 C. 5
 D. 6
 E. 8

QUESTION 31

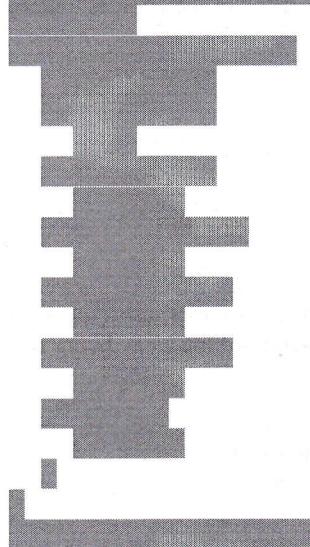
What value is returned by the call tau(25) ?

- A. 80 B. 95 C. 110
 D. 195 E. 220

```
public static int tau(int n) {
    if(n <= 10) return 3*n;
    return n + tau(n-5) + tau(n-10);
}
```

QUESTION 32

Question omitted

**Question omitted****QUESTION 33**

What is output by the code to the right?

- A. 3-4
- B. -42
- C. -48
- D. 28
- E. There is no output due to a runtime error.

```
List<Integer> L = new ArrayList<Integer>();  
L.add(5);  
L.add(7);  
L.add(-4);  
L.add(8);  
L.add(2, 3);  
System.out.print(L.get(2)+" "+L.get(3));
```

QUESTION 34

What is returned by the call go(35)?

- A. 10
- B. 19
- C. 25
- D. 31
- E. 7

QUESTION 35

What is the runtime of go(n)? Choose the most restrictive correct answer.

- A. O(log n)
- B. O(n)
- C. O(n^{1/2})
- D. O(n log n)
- E. O(n²)

```
public static int go(int n) {  
    if(n <= 0) return 1;  
    return 3 + go(n/2);  
}
```

QUESTION 36

What is output by the code to the right? In the choices below, a blank space is represented by `\b`.

- A. 04,0003.825
- B. 04,+003.825
- C. \b4,\b\b+3.825
- D. 04,+0003.825
- E. 24,+0003.825

```
System.out.printf("%02d,%+08.3f", 4,
3.8245);
```

QUESTION 37

Consider the sorting algorithms quicksort, mergesort, heapsort, and insertion sort. Which of these sorting algorithms are $O(n\log n)$ in the worst case? The length of the array being sorted is n .

- A. quicksort only
- B. quicksort and mergesort
- C. quicksort and insertion sort
- D. mergesort and heapsort
- E. heapsort only

QUESTION 38

What is output by the code to the right? Assume that the file `data.txt` contains:

- | | | |
|-------|--|--------|
| A. 3 | bye | |
| A. A3 | B. A1 | C. A12 |
| D. A2 | E. There is no output due to a syntax error. | |

```
public class One {
    public void set(String f) throws
FileNotFoundException {
        Scanner sc = new Scanner(new File(f));
        System.out.print(sc.next());
    }
}
public class Two extends One{
    public void set(String f) throws
IOException {
        Scanner sc = new Scanner(new File(f));
        System.out.print(sc.nextInt());
    }
}
public class Test {
    public static void main(String[] args) {
        try{
            One a = new One();
            Two b = new Two();
            a.set("data.txt");
            b.set("data.txt");
        }
        catch(IOException e) {
            System.out.print("1");
        }
        catch(FileNotFoundException e) {
            System.out.print("2");
        }
    }
}
```

QUESTION 39

What is output by the code to the right?

- | | | |
|--------|--|-------|
| A. 352 | B. 351 | C. 81 |
| D. 82 | E. There is no output due to a syntax error. | |

```
int k = 3;
String s = "hello";
System.out.print(s.length() + k + "" +
s.indexOf('e'));
```

QUESTION 40

What is output by the client code to the right?

- A. 3631
- B. 3136
- C. 4947
- D. 88
- E. 5264

```
public class matrix {  
    public static void main(String[] args) {  
        int[][] one = {{1, 4, 7, -2, 6}, {2, 3,  
0}, {1, 2, 3, 4, 5, 6}, {2, 2}, {1, 0, 1,  
0, 1, 0}};  
        int[][] two = {{0, 1}, {3, 1, 5, 3, 1},  
{3, 1, 5}, {4}, {0, 1}, {2, 1, 1, 1}};  
        int x = met(one, two);  
        int y = met(two, one);  
        System.out.print(x + " " + y);  
    }  
  
    public static int met(int[][] a, int[][]  
b) {  
        int n = Math.max(a.length, b.length);  
        int val = 0;  
        for(int i = 0; i < n; i += 1) {  
            if(a.length > i && b.length > i) {  
                int r = a[i][a[i].length-1];  
                val += a.length + b[i].length + r;  
            }  
            else if(a.length>i && a[i].length>i)  
                val += 1;  
            else if(b.length>i && b[i].length>i)  
                val += 2;  
        }  
        return val;  
    }  
}
```

Computer Science Answer Key

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

Notes:

Questions 27 and 35: 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.

Questions 20, 21, and 32: The answers to these questions reflect features introduced with Java 7.