University Interscholastic League

Computer Science Competition

Number 103 (District 1 - 2007)

General Directions (Please read carefully!):

1) DO NOT OPEN EXAM UNTIL TOLD TO DO SO.

2) **NO CALCULATORS 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. You may 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 2 packages and classes (e.g. .util, System, Math, Double, 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 BA_{16} and AB_{16}?

A. 156_{16} B. CC_{16} C. FF_{16} D. 266_{16} E. 165_{16}

QUESTION 2

What is output by the code to the right?

A. 38.5 B. 70 C. 40

D. 20 E. 38

```
int x = 3;
int y = x + 2 * 4;
int z = y * x + y / 2;
System.out.print( z );
```

QUESTION 3

How many *'s are output by the code to the right?

A. 11 B. 12 C. 10

D. 13 E. 22

```
int limit = 11;
for(int count = 0; count <= limit; count++)
    System.out.print( "*" );
```

QUESTION 4

What is output by the code to the right?

A. 1020 B. 1525 C. 105

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

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

```
int[] list = new int[5];
for(int i = 0; i < list.length; i++)
    list[i] = list.length * i;
System.out.print( list[2] );
System.out.print( list[ list.length - 1] );
```

QUESTION 5

What is output by the code to the right?

A. 313251

B. 94261

C. 913261

D. 913271

E. 01234

```
String name = "cade";
int[] data = {7, 13, 23, 5};
for(int i = 0; i < data.length; i++){
  if( i % 2 == 0 ){
    if( name.charAt(i) < 'c' )
      data[i] /= 3;
    else
      data[i] += name.charAt(i) - 'a';
  } else {
      data[i] -= name.charAt(i) - 'a';
  }
}
for(int i : data )
  System.out.print( i );
```

QUESTION 6

What replaces **<*1>** in the code to the right so that method `test` always returns `false`?

A. ^ B. :: C. ||

D. && E. !

```
public boolean test(int x){
    return ( x < 12 ) <*1> ( x > 20 );
}
```

QUESTION 7

What is output by the code to the right?

A. 369

B. 5811

C. 2712

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

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

```
int x = 2;
int[][] mat = new int[3][4];
for(int r = 0; r < mat.length; r++){
  for(int c = 0; c < mat[0].length; c++){
    mat[r][c] = x;
    x++;
  }
}
int c = mat.length;
for(int r = 0; r < mat.length; r++){
  System.out.print( mat[r][c] );
  c--;
}
```

QUESTION 8

What is output by the code to the right?

A. din B. dina C. ina

D. inal E. "ina"

```
String team = "cardinals";
System.out.print( team.substring(3,6) );
```

QUESTION 9

What is output by the code to the right?

A. 11 B. 22 C. 21

D. 12 E. 121

```
int y = 15;
int x = 10;
if( x * y > x * x )
  System.out.print( "1");
else
  System.out.print( "2");
if( y * x != x * y )
  System.out.print( "1");
else
  System.out.print( "2");
```

QUESTION 10

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

A. [1, 1, 1, 1, 1]

B. [1, 4, 1, 2, 3]

C. f

D. [3, 2, 1, 4, 1]

E. [0, 0, 0, 0, 0]

QUESTION 11

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

A. [1, 1, 1, 1, 1]

B. [1, 4, 1, 2, 3]

C. f

D. [3, 2, 1, 4, 1]

E. [0, 0, 0, 0, 0]

```
int[] data1 = {3, 2, 1, 4, 1};
ArrayList<Integer> f =
                  new ArrayList<Integer>();

for(int i : data1)
  f.add(0, i);

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

System.out.println();

for(int i = 0; i < 3; i++){
  f.set(i, f.set(5 - i - 1, f.get(i) ) );
}

System.out.print( f ); // line 2
```

QUESTION 12

What replaces **<*1>** in the code to the right so that when the default constructor in the `Pair` class is called the resulting `Pair` object's instance variable `val` is equal to `0` and the instance variable `s` refers to a `String` equal to `"A"` ?

I. `s = "A"`
II. `Pair(0, "A")`
III. `this(0, "A")`

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

D. I and II E. I and III

```
public class Pair{
  private int val;
  private String s;

  public Pair(){
    <*1>;
  }

  public Pair(int v, String st){
    val = v;
    s = st;
  }

  public String toString(){
    return s + val;
  }

  public void eoy(){
    val += 2;
  }
}
```

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

QUESTION 13

What replaces **<*2>** in the code to the right to declare a variable of type `Pair` named `p1` and makes `p1` refer to a new `Pair` object with `val` initialized to `5` and `s` initialized to `"BA"` ?

A. `Pair p1 = Pair(5, "BA");`

B. `Pair p1 = new Pair(5, "BA");`

C. `Pair p1 = new Pair();`

D. `Pair p1 = Pair("BA");`

E.
```
Pair p1 = new Pair();
p1.val = 5;
p1.s = new String( "BA" );
```

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

QUESTION 14

When method `utep` is called, what is output by the line marked `// line 1` in the code to the right?

A. `BA5`

B. `BA7`

C. `BA76`

D. `6BA7`

E. `A2`

QUESTION 15

When method `utep` is called, what is output by the line marked `// line 2` in the code to the right?

A. `BA76`

B. `A2`

C. `A0`

D. `BA7`

E. `BA5`

```
// in a class other than Pair
public void utep(){
  <*2>
  Pair p2 = rice( p1 );
  System.out.print( p1 ); // line 1
  System.out.println();
  System.out.print( p2 ); // line 2
}

public Pair rice(Pair p){
  p.eoy();
  p = new Pair( 4, p.toString() );
  p.eoy();
  return p;
}
```

QUESTION 16

What is output by the code to the right when method `hsu` is called?

A. -3 B. 5 C. 0

D. 1 E. -2

QUESTION 17

What is output by the code to the right when method `ut` is called?

A. 822 B. 726 C. 228

D. 257 E. 2626

QUESTION 18

What is output by the code to the right when method `ts` is called?

A. 24724 B. 247 C. 24024

D. 24013 E. 24725

```
public int tt(int x, int y){
    x = x % 3;
    y++;
    int z = x * y;
    return z - 3;
}

public int aam(int z){
    int x = z;
    int y = tt(z, x);
    x += z;
    return x + y + z;
}

public void hsu(){
    System.out.print( tt(2, 3) );
}

public void ut(){
    int x = 7;
    int y = aam(x);
    System.out.print("" + x + y);
}

public void ts(){
    int x = 2;
    int y = 4;
    System.out.print("" + x + y);
    int a = tt(y, x);
    System.out.print("" + a + x + y);
}
```

QUESTION 19

What is returned by
`eval(new int[] {1,0,1,3,2,4,7} )` ?

A. 15 B. 18 C. 33

D. 21 E. 7

```
public int eval(int[] org){
  int a, b;
  int t = 0;
  for(int i : org){
    a = i % 2;
    b = i % 3;
    t += (a==0) ? i : (b==0) ? org[i] : (a+b);
  }
  return t;
}
```

QUESTION 20

What is output by the code to the right?

A. 9an ti j a gg\nies

B. 9antijaggies

C. 6an ti j a gg ies

D. 6antijaggies

E. 5antijaggnies

```
String start = "an ti j a gg\nies";
String[] chop = start.split("\\s+");
System.out.print( chop.length );
for(String s : chop)
    System.out.print( s );
```

QUESTION 21

What is output by the code to the right?

A. 35

B. 8

C. 3

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

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

```
String nums = "-3 9 ST -5 2 32a";
int sum = 0;
Scanner s = new Scanner(nums);
while( s.hasNext() ){
    if( s.hasNextInt() )
        sum += s.nextInt();
    else
        s.next();
}
System.out.print( sum );
```

QUESTION 22

What is output by the code to the right when method `show` is called?

A. -401366

B. 6-40163

C. 013466

D. 6310-4

E. 66310-4

QUESTION 23

Which sorting algorithm is implemented by method `sort`?

A. Insertion sort

B. Bubble sort

C. Quick sort

D. Selection sort

E. Merge sort

QUESTION 24

What is the expected running time of method `sort` on an array containing `N` items? Choose the most restrictive correct answer.

A. O(1) B. O(logN) C. O(N)

D. O(NlogN) E. $O(N^2)$

```
public void move(int[] data, int i, int j){
  int t = data[i];
  data[i] = data[j];
  data[j] = t;
}

public void sort(int[] d){
  int m;
  for(int i = 0; i < d.length; i++){
    m = i;
    for(int j = i + 1; j < d.length; j++){
      if( d[m] < d[j] )
        m = j;
    }
    move(d, m, i);
  }
}

public void show(){
  int[] data = {6, -4, 0, 1, 6, 3};
  sort(data);
  for(int i : data)
    System.out.print( i );
}
```

QUESTION 25

What is output by the code to the right?

A. 1 B. 2 C. 0

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

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

```
double val = 1999.0;
double div = 1000;
double res = val / div;
System.out.print( (int)res );
```

QUESTION 26

What is returned by the method call `utpb(15138)` ?

A. `CABAAAAA`

B. `AAAABAC`

C. `AAAAABAC`

D. `CBAAAAA`

E. `AAAAABC`

QUESTION 27

What argument to method `utpb` will cause the method to return the `String "AACBA"` ?

A. `523` B. `1123` C. `2225`

D. Either A or B E. None of these.

QUESTION 28

What could replace the statement `res += "AA";` in `case 5` so that method `utpb` functions exactly the same?

A.
```
res += "A";
val = val * 10 + 5;
```

B.
```
res += "A";
val += val * 10 + 1;
```

C.
```
val = val * 10 + 2;
```

D.
```
val = ((val * 10) + 1) * 10 + 1;
```

E. More than one of these.

```
public String utpb(int val){
  String res = "";
  while( val > 0 ){
    int d = val % 10;
    val = val / 10;
    switch (d) {
      case 1: res += "A"; break;
      case 3: res += "BA"; break;
      case 5: res += "AA"; break;
      default:
        res += "C";
        val = val * 10 + 1;
    }
  }
  return res;
}
```

QUESTION 29

What is output by the code to the right?

A. `-1` B. `0` C. `1`

D. An integer less than -1.

E. An integer greater than 1.

```
String name1 = "Marvin_Minsky";
String name2 = "Marvin_The_Martian";
System.out.print( name2.compareTo(name1) );
```

QUESTION 30

What is returned by `uhcl(50)` ?

A. `9` B. `11` C. `8`

D. `2` E. `5`

```
public int uhcl(int n){
    int result = 0;
    if( n >= 200 )
        result = 2;
    else
        result = 3 + uhcl( n * 2 );
    return result;
}
```

QUESTION 31

What replaces **<*1>** in the code to the right to throw an `IllegalArgumentException` if the precondition of method `acc` is not met?

A.
```
if( ln == data.length )
  throw new IllegalArgumentException();
```

B.
```
if( ln <= data.length )
  throw new Exception();
```

C.
```
if( !( ln > data.length ) )
  throw new IllegalArgumentException();
```

D.
```
if( !( ln <= data.length ) )
  throw new IllegalArgumentException();
```

E. More than one of these.

```
//pre: ln <= data.length
public void acc(int ln, int[] data){
    <*1>
    // rest of method not shown
}
```

QUESTION 32

What is output by the following code segment?

```
int[] d = {0, 5, 1, 3, 2, 1, 3, 1, 2};
System.out.print( wiley(6, 3, d) );
```

A. 2

B. 3

C. 4

D. 5

E. 6

```
//pre: num <= list.length
public int wiley(int gt, int num,
                              int[] list){
  int rt = 0;
  int n = 0;
  int lim = list.length;
  for(int i = 0; i < num - 1; i++)
    rt += list[i];
  for(int i = num - 1; i < lim; i++){
    rt += list[i];
    if( rt == gt )
      n++;
    rt -= list[i - num + 1];
  }
  return n;
}
```

QUESTION 33

What is returned by `tlu("alanturing", "johnmccarthy")` ?

A. 5 B. 6 C. 7

D. 8 E. 9

```
public int tlu(String s1, String s2){
   int r = 0;
   String s3;
   for(int i = 0; i < s1.length(); i++){
      s3 = s1.substring(i, i+1);
      if( s2.contains( s3 )){
         r++;
      }
   }
   return r;
}
```

QUESTION 34

What is output by the code to the right?

A. 3 B. 2 C. 4

D. 5 E. 7

```
int k = 73;
int n = 31;
int tot = 0;
while( k > n ){
  k /= 3;
  n /= 2;
  tot++;
}
System.out.print( tot );
```

QUESTION 35

What replaces **<*1>** in the code to the right so that the data type of `next` is a `Node` that contains the same type of data as this `Node` ?

A. `Node<this.E>`

B. `Node<E>`

C. `Object<E>`

D. `LinkedList<E>`

E. `Node<Object>`

```
public class Node<E>{

  public E data;
  public <*1> next;

}
```

Assume **<*1>** from Question 35 is filled in correctly

QUESTION 36

What is output by the following code segment?

```
SList<String> s = new SList<String>();
s.insert("A");
s.insert("C");
s.insert("B");
s.insert("A");
System.out.print( s );
```

A. `ABCA`

B. `datadatadat`

C. `ACBA`

D. `ACB`

E. `BCA`

QUESTION 37

What is output by the following code segment?

```
SList<String> s1 = new SList<String>();
ArrayList<String> a2
                = new ArrayList<String>();
s1.insert("A");
a2.add("A");
a2.add("C");
a2.add("B");
s1.insert(a2);
System.out.print( s1 );
```

A. `AACB`

B. `ACBA`

C. `ACB`

D. `BCA`

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

```
public class SList<E>{

  private Node<E> head;

  public SList(){
    head = new Node<E>();
  }

  public void insert(E data){
    Node<E> t;
    for( t = head; t.next != null;
                                t = t.next);
    t.next = new Node<E>();
    t.next.data = data;
  }

  public String toString(){
    String result = "";
    Node<E> t = head.next;
    while( t != null ){
      result += t.data;
      t = t.next;
    }
    return result;
  }

}
```

QUESTION 38

Which statement below represents the truth table to the right? `a`, `b`, and `c` are all variables of type `boolean` .

A. `c = (a || b) && !(a || b);`

B. `c = (a && b) || !(a && b);`

C. `c = (a || b) && (a || !b);`

D. `c = (a || b) && !(a && b);`

E. `c = a ~ b;`

a	b	c
false	false	false
false	true	true
true	false	true
true	true	false

QUESTION 39

What is output by the code to the right when method `sted` is called?

A. 16

B. 15

C. 13

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

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

```
//pre: list.length >= 6
public int middleVals(int[] list){
  int total = 0;
  int start = list.length / 2 - 3;
  int stop = list.length /2 + 2;
  for(int i = start; i <= stop; i++){
    total += list[i];
  }
  return total;
}

public void sted(){
  int[] vals = {2, 2, 3, 4, 3, 2, 1, 3, 5};
  System.out.print( middleVals(vals) );
}
```

QUESTION 40

What is the running time of method `middleVals` for an array containing `N` items? Choose the most restrictive correct answer.

A. `O(1)` B. `O(N)` C. `O(logN)`

D. `O(NlogN)` E. $O(N^2)$

Computer Science Answer Key
UIL Invitational District 1 - 2007

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

Notes:

24 and 40. 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.

40. A. Always sums the middle 6 elements regardless of the size of the array.