University Interscholastic League

Computer Science Competition

Number 104 (District 2 - 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 DE_{16} and 22_{16}?

A. FF_{16} B. 100_{16} C. $F0_{16}$ D. $A00_{16}$ E. BC_{16}

QUESTION 2

What is output by the code to the right?

A. 6 B. -6 C. 0

D. -12 E. -9

```
int x = -3;
int y = x + 2 * x;
int z = y + x / -1;
System.out.print( z );
```

QUESTION 3

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

A. 11 B. 9 C. 0

D. 10 E. 5

```
int limit = 10;
for(int count = 1; count <= limit; count++)
    System.out.print( "*" );
```

QUESTION 4

What is output by the code to the right?

A. 64 B. 02 C. 0-2

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[6];
for(int i = 0; i < list.length; i++)
    list[i] = list.length - i * 2;
System.out.print( list[3] );
System.out.print( list[list.length - 2] );
```

QUESTION 5

What is output by the code to the right?

A. 21166

B. abcd

C. 20175

D. 231212

E. 71166

```
String name = "abcd";
int[] data = {7, 2, 14, 9};
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 `true`?

A. && B. ! C. >>

D. || E. ^

```
public boolean test(int x){
    return ( x > 0 ) <*1> ( x < 100 );
}
```

QUESTION 7

What is output by the code to the right?

A. 12963

B. 876

C. 131074

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 = 14;
int[][] mat = new int[4][3];
for(int r = 0; r < mat.length; r++){
  for(int c = 0; c < mat[0].length; c++){
    mat[r][c] = x;
    x--;
  }
}
int c = x;
for(int r = 0; r < mat.length; r++){
  System.out.print( mat[r][c] );
}
```

QUESTION 8

What is output by the code to the right?

A. ineers B. n C. e

D. neers E. engineers

```
String team = "engineers";
System.out.print( team.substring(4) );
```

QUESTION 9

What is output by the code to the right?

A. 22 B. 11 C. 12

D. 21 E. 221

```
int x = 15;
int y = 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, 2, 3, 4, 5]

B. [2, 4, 3, 1, 5]

C. [0, 0, 0, 0, 0]

D. [5, 4, 3, 2, 1]

E. [5, 1, 3, 4, 2]

QUESTION 11

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

A. [2, 3, 4, 1, 5]

B. [2, 4, 3, 1, 5]

C. [5, 1, 3, 4, 2]

D. [5, 2, 4, 1, 3]

E. [2, 5, 3, 1, 4]

```
int[] data1 = {5, 1, 3, 4, 2};
ArrayList<Integer> f =
                    new ArrayList<Integer>();

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

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

System.out.println();

for(int i = 0; i < 3; i++){
  f.add(i, f.set(5 - i - 2, f.remove(i) ) );
}

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

QUESTION 12

What replaces **<*1>** in the code to the right so that the when the two integer constructor in the `Complex` class is called the resulting `Complex` object's instance variables are initialized to store the same values as the parameters `real` and `imag` ?

I.
```
this.real = real;
this.imag = imag;
```

II.
```
real = real;
imag = imag;
```

III.
```
Complex.real = real;
Complex.imag = imag;
```

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

D. I and II E. I and III

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

QUESTION 13

What replaces **<*2>** in the code to the right to declare a variable of type `Complex` named `c1` and makes `c1` refer to a new `Complex` object with both instance variables initialized to `0`?

A. `Complex c1 = new Complex();`

B. `Complex c1 = new Complex;`

C. `Complex c1 = Complex(0, 0);`

D. `Complex c1 = new Complex(0, 0);`

E. More than one of these.

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. `0`

B. `0_0`

C. `0_0i`

D. `_i`

E. `0, 0`

QUESTION 15

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

A. `1_0i`

B. `1`

C. `0_-2i`

D. `0_-1i`

E. `-2i`

```
public class Complex{
  private int real;
  private int imag;

  public Complex(int real, int imag){
    <*1>
  }

  public String toString(){
    return real + "_" + imag + "i";
  }

  public void alter(){
    real++;
  }
}

-------------------------------------

// in a class other than Complex
public void utep(){
  <*2>
  System.out.print( c1 ); // line 1
  Complex c2 = rice(c1);
  System.out.println();
  System.out.print( c2 ); // line 2
}

public Complex rice(Complex c){
  c.alter();
  c = new Complex( -1, -2 );
  c.alter();
  return c;
}
```

QUESTION 16

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

A. 2 B. 6 C. 3

D. 9 E. 7

QUESTION 17

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

A. 13 B. 27 C. 30

D. 12 E. 3011

QUESTION 18

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

A. 0 B. 2 C. 4

D. 1 E. 3

```
public int tt(int x, int y){
    x = x * 2;
    --y;
    int z = x % y;
    return z + 1;
}

public int aam(int z){
    z++;
    int x = z + 2;
    int y = tt(z, x);
    x += z;
    return x - y + z;
}

public void hsu(){
    System.out.print( tt(13, 11) );
}

public void ut(){
    int x = 12;
    int y = aam(x);
    System.out.print( x );
}

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

QUESTION 19

What is returned by `eval(new int[] {3,0,1,5,4,1,7} ) ?`

A. 21 B. 0 C. 24

D. 25 E. 3015417

```
public int eval(int[] org){
  int a;
  int t = 0;
  for(int i : org){
    a = i % 2;
    t += (a == 1) ? i : org[i];
  }
  return t;
}
```

QUESTION 20

What is output by the code to the right?

A. dithering

B. 1dith\ter\ting

C. 1dithterting

D. 3dithering

E. 2dithering

```
String start = "dith\ter\ting";
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. 2.3

B. 1.8

C. 1.3

D. -0.7

E. 37.3

```
String nums = "-0.5 0.3 A 1A  -.5   2";
double sum = 0;
Scanner s = new Scanner(nums);
while( s.hasNext() ){
    if( s.hasNextDouble() )
        sum += s.nextDouble();
    else
        s.next();
}
System.out.print( sum );
```

QUESTION 22

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

A. 13125807

B. 58121307

C. 13128507

D. 05781213

E. 05812137

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

If the value of the parameter `b` is `false`, what is the expected running time of method `sort` on an array containing `N` unique items in descending order? Choose the most restrictive correct answer.

A. $O(N^2)$ B. $O(N)$ C. $O(N^3)$

D. $O(N \log N)$ E. $O(\log N)$

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

public void sort(int[] list, boolean b){
  int temp, j;
  for(int i = 1; i < list.length; i++){
    temp = list[i];
    j = i;
    while( j > 0 && temp < list[j - 1]){
      swap(list, j, j - 1);
      j--;
    }

    if( b && i == 4 ){
      for(int k : list){
        System.out.print(k);
      }
    }

  }
}

public void go(){
  int[] data = {13, 12, 5, 8, 0, 7};
  sort(data, true);
}
```

QUESTION 25

What is output by the code to the right?

A. 0 B. 3 C. 2

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 = 201;
double div = 100;
double res = val / div;
System.out.print( (int)res );
```

QUESTION 26

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

A. `36`

B. `8`

C. `16`

D. `0`

E. `1`

QUESTION 27

What argument to method `utpb` will cause the method to return the `value 3` ?

A. `"aa"` B. `"bba"` C. `"abb"`

D. `"d"` E. More than one of these.

QUESTION 28

What could replace the statement
`res = res * res;`
in `case 'c'` so that method `utpb` functions exactly the same?

A. `res = res * 2;`

B. `res = res ^ 2;`

C. `res *= res;`

D. `Math.pow(2, res);`

E. `res = res >> 2;`

```
public int utpb(String val){
  int res = 1;
  for(int i = 0; i < val.length(); i += 2){
    char c = val.charAt(i);
    switch (c) {
      case 'b': res *= 2; break;
      case 'd': res += 2; break;
      case 'c': res = res * res; break;
      case 'a': res++; break;
      default:
        res = res / 3;
    }
  }
  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 = "Manuel_Blum";
String name2 = "Manuel_Mann";
int r = name1.compareTo(name2.toLowerCase());
System.out.print( r );
```

QUESTION 30

What is returned by `uhcl(100)` ?

A. `19` B. `15` C. `0`

D. `12` E. `11`

```
public int uhcl(int n){
    if( n < 20 )
        return n;
    else
        return uhcl( (n + 10) / 2 );
}
```

QUESTION 31

What is output by method `acc` when it is invoked via the call `acc(-2)` ?

A. -2

B. 5

C. 6

D. 8

E. None of these.

```
//pre: x > 0
public void acc(int x){
  if( !(x > 0) )
    throw new IllegalArgumentException();
  x = x * x;
  x++;
  System.out.println( x );
}
```

QUESTION 32

What is output by the following code segment?

```
int[] d = {0, 3, 1, 4, 1, 5, 1, 1, 2};
System.out.print( wiley(3, d) );
```

A. 10

B. 4

C. 7

D. 42

E. 8

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

QUESTION 33

What is returned by
`tlu("alanperlis", "richhamming")` ?

A. -1 B. 21 C. 19

D. 15 E. 1

```
public int tlu(String s1, String s2){
  int r = 0;
  for(int i = 0; i < s1.length(); i++){
    r += s2.indexOf( s1.charAt(i) );
  }
  return r;
}
```

QUESTION 34

What is output by the code to the right?

A. 5 B. 44 C. 4

D. 32 E. 12

```
int k = 200;
int n = 2;
int tot = 0;
while( k > n ){
  k /= 2;
  n *= 2;
  tot++;
}
System.out.print( tot );
```

QUESTION 35

What replaces **<*1>** in the code to the right so that the instance variable `data` and the `parameter val can` refer to objects of any type?

A. `E`

B. `AnyType`

C. `Object`

D. `Node`

E. `String`

```
public class Node{

  public <*1>  data;
  public Node next;

}
```

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

QUESTION 36

What is output by the following code segment?

```
GList s1 = new GList();
s1.insert("A");
s1.insert("C");
s1.insert("B");
s1.insert("A");
System.out.print( s1 );
```

A. `ACBA`

B. `AABC`

C. `CBAA`

D. `ABCA`

E. `ACB`

QUESTION 37

What is output by the following code segment?

```
GList s2 = new GList();
ArrayList<String> a2
              = new ArrayList<String>();
s2.insert("A");
a2.add("A");
a2.add("C");
a2.add("B");
s2.insert(a2);
System.out.print( s2 );
```

A. `[A, C, B]A`

B. `ACBA`

C. `ABCA`

D. `ABC`

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

```
public class GList{

  private Node head;

  public GList(){
    head = null;
  }

  public void insert(<*1> val){
    if( head == null ){
      head = new Node();
      head.data = val;
    }
    else {
      Node n = new Node();
      n.data = val;
      n.next = head;
      head = n;
    }
  }

  public String toString(){
    String result = "";
    Node t = head;
    while( t != null ){
      result += t.data.toString();
      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 && a && b && !b;`

B. `c = !a && !b;`

C. `c = !a || !b;`

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

E. `c = !ab;`

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

QUESTION 39

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

A. 9

B. 18

C. 45

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

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

```
public int calc(int[] list){
  int total = 0;
  int n = list.length;
  int lim = list.length * list.length;
  for(int i = 0; i < lim; i++){
    total += list[i % n];
  }
  return total;
}

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

QUESTION 40

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

A. $O(N^2)$ B. $O(N)$ C. $O(1)$

D. $O(N^3)$ E. $O(NlogN)$

Computer Science Answer Key
UIL Invitational District 2 - 2007

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

Notes:

13. Automatic default constructor removed if other constructors exist in a class.

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.

27. Choices B and D both cause 3 to be returned.