University Interscholastic League

Computer Science Competition

Number 102 (Invitational B - 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.

9) 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 7643_8 and 3556_8?

A. 11199_8 B. 12311_8 C. 13421_8 D. 12310_8 E. $FFFF_{16}$

QUESTION 2

What is output by the code to the right?

A. 17 B. 10 C. 5

D. 22 E. 22.5

```
int x = 5;
int y = 3;
int z = 2;
x = y * x + x / z;
System.out.print(x);
```

QUESTION 3

What is output by the code to the right?

A. 20 B. 2 C. 11

D. 10 E. 22

```
int total = 0;
for(int i = 0; i <= 10; i++)
  total += 2;
System.out.println(total);
```

QUESTION 4

What is output by the code to the right?

A. Alan Turing

B. AlanTuring

C. Alan_Turing

D. TuringAlan

E. s3

```
String s1 = "Turing";
String s2 = "Alan";
String s3 = s2 + s1;
System.out.print(s3);
```

QUESTION 5

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

A. uilS B. uil C. UIL3

D. s5 E. uil3

QUESTION 6

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

A. uilS B. uil C. UIL3

D. uil# E. uil3

```
String s4 = "UIL3";
String s5 = s4.toLowerCase();
System.out.print( s5 ); //line 1
System.out.print( s4 ); //line 2
```

QUESTION 7

What is output by the code to the right?

A. `CDAAaAB` B. `BAaAACD` C. `CDaaaAB`

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

```
String s6 = "A";
String[] sList = {"B", s6,
         s6.toLowerCase(), s6 + s6, "CD"};
s6 = "";
for(String s : sList)
      s6 = s + s6;
System.out.println( s6 );
```

QUESTION 8

What is output by the code to the right?

A. `null`

B. `NULL`

C. There is no output because `st` is the empty `String`.

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

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

```
String[] names = new String[10];
String st = names[5].toUpperCase();
System.out.println( st );
```

QUESTION 9

What is output by the code to the right?

A. `34` B. `19` C. `20`

D. `14` E. `12`

```
int[][] mat = {{2,7,5},
               {2,1,3},
               {8,4,2}};
int tot = 0;
for(int r = 0; r < mat.length; r++)
  for(int c = r; c < mat[0].length; c++)
    tot += mat[r][c];
System.out.print(tot);
```

QUESTION 10

What is output by the code to the right?

A. `210-1` B. `-1012` C. `-2-101`

D. `-101` E. `2345`

```
int[][] mat1 = new int[4][4];
for(int i = 0; i < 4; i++)
  for(int j = 0; j < 4; j++)
    mat1[j][i] = i - j;

for(int i = 0; i < 4; i++)
  System.out.print( mat1[2][i]);
```

QUESTION 11

What is output by the code to the right?

A. `16` B. `16.0` C. `-16.0`

D. `-16` E. There is no output due to a syntax error in the code.

```
System.out.print(
 Math.pow(Math.min(-4,-2),Math.abs(-2)) );
```

QUESTION 12

What is output by the code to the right?

A. `86420` B. `8642` C. `1086420`

D. `97531` E. `9876543210`

```
// IntStack implements the traditional
// stack operations for ints
IntStack s = new IntStack();
for(int i = 0; i < 10; i += 2)
  s.push(i);
while( !s.isEmpty() )
  System.out.print( s.pop() );
```

QUESTION 13

Which of the following statements are syntactically correct?

I. `Plan p1 = new Plan();`

II. `Plan p2 = new CallingPlan(1, 5);`

III. `CallingPlan p3 = new CallingPlan();`

A. I only

B. III only

C. I and II only

D. II and III only

E. I, II, and III

QUESTION 14

What is output by the following client code?

```
CallingPlan p4 = new CallingPlan();
System.out.println( p4.cost(10) );
```

A. 10 B. 20 C. 30

D. 120 E. 0

QUESTION 15

What is output by the following client code?

```
CallingPlan p5 = new CallingPlan();
CallingPlan p6 = new CallingPlan();
System.out.print( p5==p6 );
```

A. 0 B. p5==p6 C. 1

D. true E. false

QUESTION 16

What is output by the following client code?

```
WithBaseMin w1 =
            new WithBaseMin(1, 5, 10);
System.out.print( w1.cost(5) );
```

A. 15 B. 5 C. 25

D. 50 E. 10

QUESTION 17

What is output by the following client code?

```
WithBaseMin w2 =
            new WithBaseMin(2, 10, 20);
System.out.print( w2.cost(30) );
```

A. 70 B. 10 C. 30

D. 20 E. 120

```
public interface Plan{
  public int cost(int used);

  public int baseCost();
}
```

```
public class CallingPlan implements Plan{
  private int cpm;
  private int base;

  public CallingPlan(){
    this(2, 10);
  }

  public CallingPlan(int c, int b){
    cpm = c;
    base = b;
  }

  public int cost(int used){
    return base + cpm * used;
  }

  public int baseCost(){
    return base;
  }

  public void priceIncrease(){
    cpm++;
  }
}
```

```
public class WithBaseMin
                    extends CallingPlan{

  private int baseMin;

  public WithBaseMin (int c, int b, int m){
    super(c, b);
    baseMin = m;
  }

  public int cost(int used){
    int result = 0;
    if( used <= baseMin )
      result = baseCost();
    else
      result = super.cost(used - baseMin);
    return result;
  }
}
```

Questions 18 through 22 refer to the interface `Plan` and classes `CallingPlan` and `WithBaseMin` on page 4.

QUESTION 18

What is output when method `jg24` is called?

A. `30` B. `130` C. `0`

D. `40` E. `10`

```
public void jg24(){
  CallingPlan c1 = new CallingPlan();
  jj48(c1);
  System.out.print( c1.cost(10) );
}

public void jj48(CallingPlan c){
  c.priceIncrease();
}
```

QUESTION 19

What is output when method `de8` is called?

A. `25` B. `2525` C. `2530`

D. `3030` E. `30`

```
public void de8(){
  CallingPlan c1 = new CallingPlan(1,20);
  mw99(c1);
  System.out.print(c1.cost(10));
}

public void mw99(CallingPlan c){
  c = new CallingPlan(2,5);
  System.out.print( c.cost(10) );
}
```

QUESTION 20

What is output by the code to the right?

A. `true`

B. `false`

C. `b@12`

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

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

```
Plan p1;
WithBaseMin m1 = new WithBaseMin(1,10,10);
p1 = m1;
boolean b = m1.equals(p1);
System.out.print( b );
```

QUESTION 21

What is output when method `k9` is called?

A. `2550`

B. `2540`

C. `2045`

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

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

```
public void k9(){
  CallingPlan[] pList = new CallingPlan[2];
  pList[0] = new CallingPlan(1, 5);
  pList[1] = new WithBaseMin(2, 10, 5);
  be9( pList );
}

public void be9(CallingPlan[] ps){
  for(int i = 0; i < ps.length; i++)
    System.out.print( ps[i].cost(20) );
}
```

QUESTION 22

What must be done to the class to the right so that it will compile?

A. Nothing, the class will compile as is.

B. The class must have a constructor.

C. The class must be declared `abstract`.

D. The class must have an instance variable for the cost per minute.

E. The `cost` method must make use of the parameter named `used`.

```
public class SimplePlan implements Plan{

  public int cost(int used){
    return 20;
  }

}
```

QUESTION 23

What is output when method `show` is called?

A. `-1 1 5 10 14`

B. `-1 1 14 10 5`

C. `14 10 5 1 -1`

D. `14 1 -1 10 5`

E. `1 5 -1 10 14`

QUESTION 24

Method `sort` attempts to implement the selection sort algorithm. The method is designed to sort the elements of `data` into increasing order, but the method does not always work as intended. What change should be made so the method always works as intended?

A. `//line 1` should be changed to `index = 0;`

B. `//line 2` should be changed to `m = -1;`

C. `//line 2` should be changed to `m = data[i];`

D. `//line 3` should be changed to `index = i;`

E. `//line 4` should be changed to `m = j;`

Assume the logic error in `sort` has been corrected.

QUESTION 25

Let `N = data.length` from method `sort`. What will the variable `count` equal at the line marked `// line 5` ?

A. `N!`

B. N^2

C. `(N + 1) * N / 2`

D. `N * (N + 1) * (N + 2)`

E. `N / 3 + N / 2`

QUESTION 26

Let `N = data.length` from method `sort`. What is the minimum number of times the statement at the line marked `// line 4` will be executed?

A. `0` B. `1` C. `N / 2`

D. $\log_2 N$ E. `N`

```
public static void sort(int[] data){
  int m;
  int index;
  int temp;
  int count = 0;

  for(int i = 0; i < data.length; i++){
    index = i; // line 1
    m = 0; // line 2

    for(int j = i; j < data.length; j++){
      count++;

      if( data[j] < m){
        index = j; // line 3
        m = data[j]; // line 4
      }
    }

    temp = data[i];
    data[i] = data[index];
    data[index] = temp;
  }
  // line 5
}

public static void show(){
  int[] d2 = {14, 1, -1, 10, 5};
  sort(d2);

  for(int i = 0; i < d2.length; i++)
    System.out.print( d2[i] + " ");
}
```

QUESTION 27

What replaces **<*1>** in the code to the right to subtract 1 from `total` only if element `w[row][col]` is equal to 1?

A.
```
if( w[row][col] == 1 )
  total -= 1;
```
B.
```
if( w[r][c] == 1 )
  total -= 1;
```
C.
```
if( w[row][col] )
  total -= 1;
```
D.
```
if( w[row][col] != 2 )
  total--;
```
E. More than one of these.

Assume **<*1>** has been filled in correctly.

QUESTION 28

Assuming `w` is a square matrix with `N` rows and `N` columns, what is the running time of method `numNeigh`? Choose the most restrictive correct answer.

A. $O(1/N)$ B. $O(1)$ C. $O(N)$

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

QUESTION 29

Assuming `w` is a square matrix with `N` rows and `N` columns, what is the running time of method `next`? Choose the most restrictive correct answer.

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

D. $O(N^8)$ E. $O(N^4)$

QUESTION 30

What is output by the following client code?

```
int[][] m = {{1,1,1,0},
             {0,0,0,1}};
Game g = new Game(m);
g.next();
System.out.print(g);
```

A.
```
0110
0110
```
B.
```
***.
...*
```
C.
```
....
....
```
D.
```
***.
.***
```
E.
```
.**.
.**.
```

```
class Game {
  private int[][] w;

  public Game(int[][] init){
    int r = init.length;
    int c = init[0].length;
    w = new int[r][c];
    for(int i = 0; i < r; i++)
      for(int j = 0; j < c; j++)
        w[i][j] = init[i][j];
  }

  public void next(){
    int[][] gen1 = new int[w.length][w[0].length];
    int n;
    for(int r = 0; r< w.length; r++)
      for(int c = 0; c < w[0].length; c++){
        n = numNeigh(r, c);
        if( w[r][c] == 1 && (n == 2 || n == 3) )
          gen1[r][c] = 1;
        else if( n == 3 )
          gen1[r][c] = 1;
      }
    w = gen1;
  }

  private int numNeigh(int row, int col){
    int total = 0;
    for(int r = row -1; r <= row + 1; r++)
      for(int c = col - 1; c <= col + 1; c++)
        if(inbounds(r,c,w) && w[r][c] == 1)
          total++;
    <*1>
    return total;
  }

  private boolean inbounds(int row,
                           int col, int[][] mat){
    return row >= 0 && row < mat.length
           && col >= 0 && col < mat[row].length;
  }

  public String toString(){
    String result = "";
    for(int r = 0; r < w.length; r++){
      for(int c = 0; c < w[0].length; c++)
        result += ( w[r][c] == 1 ) ? "*" : ".";
      result += "\n";
    }
    return result;
  }

}
```

QUESTION 31

What is output by the code to the right?

A. 26521 B. 3210 C. 02683

D. 83620 E. 621

```
ArrayList<Integer> dr =
                    new ArrayList<Integer>();
for(int i = 1; i < 40; i = 1 + i * i)
      dr.add(i);
for(int i = dr.size()-1; i >= 0; i--)
      System.out.print( dr.get(i) );
```

QUESTION 32

What is output by the code to the right?

A. A&MM1M

B. 1

C. A&M

D. 1M

E. M

```
String res = "";
try{
  String col = "A&M";
  for(int i = 2; i < 6; i++)
    res += col.charAt(i);
  System.out.print(col);
  System.out.print(res);
}
catch(Exception e){
  System.out.print(res.length());
}
finally{
  System.out.print(res);
}
```

QUESTION 33

What is output by the code to the right?

A. 2HC3

B. 2HC

C. 1HC

D. 1HC3

E. 3

```
double len = 13.6;
double inc = 8.6;
if( len > 10 ){
  if( inc < 6.5  )
    System.out.print(1);
  else
    System.out.print(2);
  if( inc > 7 && len > 10)
    System.out.print("HC");
}
else
  System.out.print(3);
```

QUESTION 34

What is output by the code to the right?

A. 63 B. 19 C. 44

D. 18 E. 1

```
int d = 31;
int f = 51;
System.out.print( d & f );
```

QUESTION 35

What is output by the code to the right?

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

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

C. all

D. true

E. false

```
String tag = "/TaB";
boolean all = true;
char c;
for(int i=0; i < tag.length() && all; i++){
  c = tag.charAt(i);
  all = Character.isLetter(c)
            && Character.isUpperCase(c);
}
System.out.print(all);
```

QUESTION 36

What is output by the code to the right?

A. 0
B. 1
C. ut
D. same
E. tech

```
String n1 = "TexasTech";
String n2 = "TexasLonghorns";
if( n1.compareTo(n2) > 0 )
  System.out.print("tech");
else if( n1.compareTo(n2) < 0 )
  System.out.print("ut");
else
  System.out.print("same");
```

QUESTION 37

What is output by the code to the right?

A. 10
B. 9
C. 13
D. 0
E. 2436

```
String d3 = "acbbeab";
int t = 0;
for(int i = 0; i < d3.length(); i++){
   switch( d3.charAt(i) ){
   case 'a' :
      t++;
      break;
   case 'b' :
      t += 2;
      break;
   case 'c' :
      t *= 3;
   }
}
System.out.print(t);
```

QUESTION 38

What is output by the code to the right?

A. ngs B. ngs m C. m
D. n E. There is no output.

```
String nm = "mustangs miners";
String[] tok = nm.split("[aeiou]");
System.out.print( tok[2]);
```

QUESTION 39

What is output by the code to the right?

A. fghnors
B. fghnoorrs
C. sronhgf
D. hornfgs
E. hornfrogs

```
TreeSet<Character> set =
                  new TreeSet<Character>();
String mas = "hornfrogs";

for(int i = 0; i < mas.length(); i++)
  set.add(mas.charAt(i));

for(Character ch : set)
  System.out.print(ch);
```

QUESTION 40

What is output by the code to the right?

A. runners
B. falcons
C. true
D. false
E. There is no output.

```
String r = "falcons";
boolean obj = r instanceof Object;
boolean str = r instanceof String;
if( obj &&  str )
      r = "runners";
System.out.print( r );
```

There are no questions on this page.

Computer Science Answer Key
UIL Invitational B 2007

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