University Interscholastic League

Computer Science Competition

Number 86 (District 2 - 2004)

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) 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.

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 $101110_2 + 100001_2$?

A. 1001111_2 B. 1111111_2 C. 201111_2 D. 0_2 E. None of these

QUESTION 2

What is output by the code to the right if `int i` is 4?

A. Nothing B. `**`
C. `***` D. `****`
E. None of these

```
for (int j=0; j<i; ++j)
  System.out.print('*');
```

QUESTION 3

What is output by the code to the right if `int i` is -2?

A. Nothing B. `*`
C. More than 5 `*`'s D. `**`
E. None of these

QUESTION 4

Which of the following are valid types for x in the code to the right?

A. `int` B. `char`
C. `boolean` D. Both A and B
E. A, B, and C

```
switch(x) {
case '0': // do something
case '1': // do something else
}
```

QUESTION 5

Which of the following must be included at the end of the list of statements for the `'0'` case so that the code for the `'1'` case is not also executed?

A. `continue;` B. `break;`
C. `stop;` D. `default;`
E. None of these

QUESTION 6

What is output by the code to the right?

A. Nothing
B. `UIL District Test`
C. `District`
D. `Dist`
E. None of these

```
String s = "UIL District Test";

System.out.print(s.substring(4,8));
```

QUESTION 7

Which of the following could be used in another class to declare variable h to be a Horse and intialize h to be a horse named Seabiscuit?

A.
```
Horse h(Seabiscuit,null,null);
```

B.
```
Horse h = new Horse(
                  name = "Seabiscuit");
```

C.
```
Horse h = new Horse("Seabiscuit");
```

D.
```
Horse h = new Horse();
h.name = "Seabiscuit";
```

E. More than one of these

QUESTION 8

When a Horse is created by the constructor, what is the data member father initialized to?

A. 0 B. The Horse being created

C. null D. Not initialized

E. None of these

QUESTION 9

Suppose h is a Horse named Seabiscut with father named Hard Tack and mother named Swing On. Neither Hard Tack nor Swing On have had their setMother() or setFather() methods called. What is output by h.printFamily()?

A.
```
Seabiscuit sired by Hard Tack and Swing On
Hard Tack sired by and
Swing On sired by and
```

B.
```
Seabiscuit sired by Hard Tack and Swing On
Hard Tack sired by unknown and unknown
Swing On sired by unknown and unknown
```

C.
```
Seabiscuit sired by Hard Tack and Swing On
```

D.
```
Seabiscuit sired by Hard Tack and Swing On
Hard Tack sired by unknown and unknown
null sired by unknown and unknown
null sired by unknown and unknown
Swing On sired by unknown and unknown
null sired by unknown and unknown
null sired by unknown and unknown
```

E. More than one of these

```
public class Horse {
  public Horse(String s) {
    name = s;
  }

  public void setMother(Horse h) {
    mother = h;
  }

  public void setFather(Horse h) {
    father = h;
  }

  public void printFamily() {
    System.out.println(name +
       " sired by " +
       ((father==null)?"unknown":
                       father.name) +
       " and " +
       ((mother==null)?"unknown":
                       mother.name));
    if (father!=null)
      father.printFamily();
    if (mother!=null)
      mother.printFamily();
  }

  private String name;
  private Horse mother, father;
}
```

QUESTION 10

If a and b have type `int` and c and d have type `double`, which of the following is a valid call of static method `f()`?

A. `f(a+b, (int)c+(int)d)`

B. `f(c+d, a+b)`

C. `f(a+c, b+(int)d)`

D. All of these

E. None of these

```
public static int f(double x, int y) {
  return (int)(x+y);
}
```

QUESTION 11

What is returned by the call `f(1.7,0)`?

A. 1 B. 2

C. 3 D. 4

E. None of these

QUESTION 12

Which of these could replace **<*1>** in the code to the right to convert `i` to an `int`?

A. `i.parseInt.toString()`

B. `i.parseInt()`

C. `i.toString()`

D. `i.intValue()`

E. None of these

```
Integer i;
// code to initialize i

int j = <*1>;
```

QUESTION 13

What is returned by `mystery(16)`?

A. 8 B. 4

C. 2 D. 1

E. None of these

QUESTION 14

What is returned by `mystery(-7)`?

A. 9 B. 15

C. 17 D. 627

E. None of these

```
public static int mystery(int y) {
  int count = 0;
  if (y==0) return 0;
  if (y<0) y*=-1;
  while (y != 1) {
    if (y%2 == 0) {
      y/=2;  ++count;
    }
    else {
      y*=3;  --y;  ++count;
    }
  }
  return count;
}
```

QUESTION 15

What is output by the code below?

```
A a = new A(5);
System.out.print(a.f());
```

A. 0 B. 1

C. 3 D. 5

E. None of these

QUESTION 16

What is output by the code below?

```
A a = new B(5,10);
System.out.print(a.f());
```

A. 15 B. 16

C. 17 D. 18

E. None of these

```
public class A {
  public A(int x) {
    this.x = x;
  }
  public int f() {
    return x - 3;
  }
  private int x;
}

public class B extends A {
  public B(int x, int y) {
    super(x);
    this.y = y;
  }
  public int f() {
    return y + 5 + super.f();
  }
  private int y;
}
```

QUESTION 17

If `int n` is initialized to `10`, what is the value of `count` after executing the code to the right?

A. 45 B. 81

C. 55 D. 100

E. None of these

```
int n;
// code to initialize n

int count = 0;

for (int i=0; i<n; ++i)
  for (int j=0; j<n; ++j)
    count++;
```

QUESTION 18

What is the running time of the nested loop in the code to the right? Give the smallest correct answer.

A. $O(1)$ B. $O(n)$

C. $O(n^2)$ D. $O(n^3)$

E. None of these

QUESTION 19

Which of the following is the escape sequence for a tab character?

A. `\'` B. `\\` C. `\t` D. `\n` E. None of these

QUESTION 20

Which of the following creates a `Coin` with the name nickel worth 5 cents?

A. `new Coin(5, "nickel")`

B. `new Coin("5", "nickel")`

C. `new Coin("nickel", "5")`

D. `new Coin(nickel, 5)`

E. None of these

QUESTION 21

Suppose you create a `Mint` class which can hold an arbitrarily large set of coins. Which of the following is a valid declaration for the data of the `Mint` class?

A. `private Set coinSet = new Set();`

B.
```
private Set coinSet =
                    new TreeMap(Coin);
```

C.
```
private Set coinSet =
                    new HashMap();
```

D. `private Coin[] = new Coin[];`

E. None of these

QUESTION 22

Suppose that the `Coin` class is modified to implement the `Comparable` interface. What must the declaration of the class be changed to?

A. `public class Coin extends Comparable`

B.
```
public class Coin implements
                              Comparable
```

C.
```
public class Coin instanceof
                              Comparable
```

D. `public class Coin : Comparable`

E. None of these

```
public class Coin {
  public Coin(int value, String name) {
    this.value = (value>0)?value:1;
    this.name = name;
  }
  public double getValue() {
    return value;
  }
  public String getName() {
    return name;
  }

  private int value;
  private String name;
}
```

QUESTION 23

Which of the following replaces **<*1>** in the code to the right to check whether `iter` is not finished traversing the list?

A. `iter.finished()`

B. `iter.hasNext()`

C. `iter != input.end`

D. `iter == true`

E. None of these

```
import java.util.*;

public static void printList(List input) {
  Iterator iter = input.iterator();
  while (<*1>) {
    System.out.print(iter.next());
  }
}

public static void main(String[] args) {
  List charList = new ArrayList();
  for (char ch='A'; ch<'J'; ++ch) {
    charList.add(new Character(ch));
  }

  printList(charList);
}
```

QUESTION 24

Assume **<*1>** is filled in correctly. What is output by the `main` method?

A. `ABCDEFGHI`

B. `JIHGFEDCBA`

C. `ABCDEFGHIJ`

D. `BCDEFGHIJ`

E. None of these

QUESTION 25

What is output by the code to the right?

A. `012`

B. `1-1-1`

C. `101`

D. `2`

E. None of these

```
int x = 0;
int y = ++x;
int z = y--;

System.out.print("" + (x + y + z));
```

QUESTION 26

What is output by the code to the right?

A. `4`

B. `5`

C. `6`

D. `7`

E. None of these

```
StringBuffer sb = new StringBuffer("tv");
sb.append("vcr");

System.out.print(sb.length());
```

QUESTION 27

What replaces **<*1>** and **<*2>** in the code to the right if `count()` is supposed to count the number of characters that are digits in `String s`?

A.
```
<*1>: i < s.length()-1
<*2>: (s.charAt(i) > '0') &&
      (s.charAt(i) < '9')
```

B.
```
<*1>: i < s.length()
<*2>: (s.charAt(i) >= '0') &&
      (s.charAt(i) <= '9')
```

C.
```
<*1>: i < s.length()-1
<*2>: true
```

D.
```
<*1>: i < s.length()
<*2>: true
```

E. None of these

```
public static int count(String s) {
  int total=0;
  for (int i=0; <*1>; ++i)
    if (<*2>) ++total;
  return total;
}
```

QUESTION 28

What replaces **<*1>** and **<*2>** in the code to the right if `count()` is supposed to count the number of characters that are not capital letters in `String s`?

A.
```
<*1>: i < s.length()
<*2>: !Character.isUpperCase(
                        s.charAt(i))
```

B.
```
<*1>: i < s.length()-1
<*2>: !Character.toUpperCase(
                        s.charAt(i))
```

C.
```
<*1>: i < s.length()-1
<*2>: false
```

D.
```
<*1>: i < s.length()
<*2>: false
```

E. None of these

QUESTION 29

What is the value of `i` after executing the code to the right?

A. 0 B. 1

C. 5 D. 6

E. None of these

```
String s = "autobahn";
int i=0;
do {
  ++i;
} while (s.charAt(i)!='a');
```

QUESTION 30

What are the contents of matrix `B` after the call `transform(B)` if `B` is the matrix below?

1	2	3	4
2	3	4	5
7	8	9	10

A.

4	6	8	4
10	12	14	5
7	8	9	10

B.

2	3	4	5
7	8	9	10

C.

10	13	16	19

D.

2	3	4	5
3	4	5	6
8	9	10	11

E. None of these

```
public static void transform(int[][] A) {
  for (int i=0; i<A.length-1; ++i)
    for (int j=0; j<A[i].length-1; ++j)
      A[i][j] += A[i+1][j+1];
}
```

QUESTION 31

Which sorting algorithm is used by the method to the right?

A. MergeSort
B. Selection sort
C. QuickSort
D. Insertion sort
E. None of these

```
public static void sort(int[] A) {
  int max, maxindex;

  for (int i=A.length-1; i>=0; --i) {
    max=A[i];
    maxindex=i;
    for (int j=0; j<=i-1; ++j)
      if (A[j]>A[maxindex]) {
        max=A[j];
        maxindex=j;
      }
    A[maxindex]=A[i];
    A[i]=max;
  }
}
```

QUESTION 32

If `A` is the array below, how many times will the boolean test `(A[j]>A[maxindex])` of the `if` statement be evaluated on the method call `sort(A)`?

5	4	3	2	1

A. 0
B. 10
C. 15
D. 25
E. None of these

QUESTION 33

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

A. 0 B. 10

C. 50 D. 100

E. None of these

```
for (int i=0; i<10; ++i) {
  if (i>4 && i<7) continue;
  for (int j=0; j<10; ++j) {
    if (j==5) break;
    System.out.print('*');
  }
}
```

QUESTION 34

What exceptions can be thrown by method `mystery()`?

A. `AWTException` only

B. `AWTException` and subclasses of `AWTException`

C. `AWTException`, subclasses of `AWTException`, and unchecked exceptions

D. All exceptions

E. None of these

```
public static void mystery()
                        throws AWTException {
  // code omitted
}
```

QUESTION 35

Suppose `m` is a variable of type `Media` which is currently referencing a `CD`. Which of these is a valid call to method `Test.mystery()` using `m`?

A. `Test.mystery(CD.m)`

B. `Test.mystery((CD)m)`

C. `Test.mystery(CD(m))`

D. More than one of these

E. None of these

```
public class Media {
  // code omitted
}

public class CD extends Media {
  // code omitted
}


public class Test {
  public static void mystery(CD cd) {
    // do something
  }
}
```

QUESTION 36

Suppose `m` is the same as above. What is the value of this expression?

```
m instanceof Media
```

A. 0 B. true

C. 1 D. false

E. None of these

QUESTION 37

Which of these replaces **<*1>** in the code to the right to allocate a linked list?

A. `new List()`

B. `new List(Linked, Object)`

C. `new LinkedList<Object>`

D. `new LinkedList()`

E. None of these

QUESTION 38

Which of these replaces **<*2>** in the code to the right to check if the queue is empty?

A. `List.isempty()`

B. `List.isEmpty()`

C. `items.size() == 0`

D. `items.size(0)`

E. None of these

QUESTION 39

Assume that **<*1>** and **<*2>** are filled in correctly. What is output by the code below?

```
Queue q = new Queue();
q.enqueue(new Character('a'));
q.enqueue(new Character('b'));
q.enqueue(new Character('c'));
System.out.print(q.dequeue());
System.out.print(q.dequeue());
System.out.print(q.dequeue());
```

A. nothing

B. `979899`

C. `abc`

D. `cba`

E. None of these

```
public class Queue {
  public Queue() {
    items = <*1>;
  }

  public void enqueue(Object o) {
    items.addLast(o);
  }

  public Object dequeue() {
    return items.removeFirst();
  }

  public boolean isEmpty() {
    return <*2>;
  }

  private LinkedList items;
}
```

QUESTION 40

What is the maximum number of levels for a binary tree with 19 nodes?

A. 5 B. 6 C. 19 D. 100 E. None of these

COMPUTER SCIENCE ANSWER KEY
UIL DISTRICT 2 2004

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

IMPORTANT NOTE TO GRADERS: Correct answers receive **6 points**, and incorrect answers receive a deduction of **2 points**. No points are given or deducted for unanswered questions.