University Interscholastic League

Computer Science Competition

Number 85 (District 1 - 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 1001010_2 + 110011_2?

A. 1111101_2 B. 1111111_2 C. 1111021_2 D. 0_2 E. None of these

QUESTION 2

What is output by the code to the right if `int i` is 3?

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

```
for (int j=i; j>0; --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 would be used to add to the `switch` statement an action to take when none of the cases are matched?

A. `else:` B. `otherwise:`
C. `case:` D. `default:`
E. None of these

QUESTION 6

What is output by the code to the right?

A. Nothing
B. `UIL Computer Science`
C. `Compute`
D. `Comp`
E. None of these

```
String s = "UIL Computer Science";

System.out.print(s.substring(4,7));
```

QUESTION 7

Which of the following could be used in another class to declare variable d to be a Dog and intialize d to be a dog named Rex?

A.
```
Dog d(Rex,null,null);
```

B.
```
Dog d = new Dog(name = "Rex");
```

C.
```
Dog d = new Dog("Rex");
```

D.
```
Dog d = new Dog();
d.name = "Rex";
```

E. More than one of these

QUESTION 8

When a Dog is created by the constructor, what is the data member mother initialized to?

A. 0

B. The Dog being created

C. null

D. Not initialized

E. None of these

QUESTION 9

Suppose d is a Dog named Rex with father named Spot whose father is named Rover. None of the three Dog objects have ever had their setMother() method called. The Dog named Rover has never had its setFather() method called. What is output by d.printFamily()?

A.
```
Rex born of unknown and Spot
Spot born of unknown and Rover
```

B.
```
Rex born of unknown and Spot
Spot born of unknown and Rover
Rover born of unknown and unknown
```

C.
```
Rex born of Spot born of Rover
```

D.
```
Rex born of unknown and Spot
null born of unknown and unknown
Spot born of unknown and Rover
null born of unknown and unknown
Rover born of unknown and unknown
null born of unknown and unknown
null born of unknown and unknown
```

E. More than one of these

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

  public void setMother(Dog d) {
    mother = d;
  }

  public void setFather(Dog d) {
    father = d;
  }

  public void printFamily() {
    System.out.println(name + " born of " +
       ((mother==null)?"unknown":
                       mother.name)

       + " and " +

       ((father==null)?"unknown":
                       father.name));

    if (mother!=null) mother.printFamily();
    if (father!=null) father.printFamily();
  }

  private String name;
  private Dog 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, c+d)`
B. `f(c+d, a+b)`
C. `f(a+c, b+d)`
D. All of these
E. None of these

QUESTION 11

What is returned by the call `f(1,3.7)`?

A. 1 B. 2
C. 3 D. 4
E. None of these

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

QUESTION 12

Assume that `getLine()` returns a line of input from the keyboard. Which of these replaces **<*1>** in the code to the right to convert it to an integer?

A. `s.parseInt()`
B. `s.parse(int)`
C. `Integer.parseInt(s)`
D. `Integer.s.parseInt()`
E. None of these

```
String s = getLine();

int count = <*1>;

for (int i=0; i<count; ++i) {
  // do something
}
```

QUESTION 13

What is returned by `mystery(8)`?

A. 8 B. 4
C. 2 D. 1
E. None of these

QUESTION 14

What is returned by `mystery(-15)`?

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

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

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

QUESTION 16

What is output by the code below?

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

A. 0 B. 1

C. 3 D. 5

E. None of these

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. 50

C. 55 D. 60

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<i; ++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 new line character?

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

QUESTION 20

Which of the following creates a `Coin` with the name quarter worth 25 cents?

A. `new Coin(25, "quarter")`

B. `new Coin("25", "quarter")`

C. `new Coin("quarter", "25")`

D. `new Coin(quarter, 25)`

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 money = new Set();`

B.
```
private Set money =
                    new TreeSet(Coin);
```

C.
```
private Set money =
                    new HashSet();
```

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

E. More than one of these

QUESTION 22

Suppose that the `Coin` class is modified to implement the `Comparable` interface. What method must be added to the class?

A. `public int Comparable(Object o)`

B. `public boolean equals(Object o)`

C. `public boolean compareTo(Object o)`

D. `public int equals(Object o)`

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 make `iter` an iterator for `List input`?

A. `List.input.iterator()`

B. `input.iterator()`

C. `(List)input.iterator()`

D. `iterator(input)`

E. None of these

```
import java.util.*;

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

public static void main(String[] args) {
  List intList = new ArrayList();
  for (int i=0; i<10; ++i) {
    intList.add(new Integer(i));
  }

  printList(intList);
}
```

QUESTION 24

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

A. `0123456789`

B. `9876543210`

C. `012345678910`

D. `109876543210`

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. `6`

C. `7`

D. `10`

E. None of these

```
StringBuffer sb = new StringBuffer("help");
sb.append("me");

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 in `String s`?

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

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

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 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>: `true`

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

E. None of these

Question 29

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

A. 0 B. 1
C. 7 D. 8
E. None of these

```
String s = "thisisatest";
int i=0;
do {
  ++i;
} while (s.charAt(i)!='t');
```

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.

1	2	3	4
2	3	4	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; ++i)
    for (int j=0; j<A[i].length; ++j)
      A[i][j]++;
}
```

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 min, minindex;

  for (int i=0; i<A.length; ++i) {
    min=A[i];
    minindex=i;
    for (int j=i+1; j<A.length; ++j)
      if (A[j]<A[minindex]) {
        min=A[j];
        minindex=j;
      }
    A[minindex]=A[i];
    A[i]=min;
  }
}
```

QUESTION 32

What is the running time of the method to the right if array A has length n? Choose the smallest correct answer.

A. $O(n)$
B. $O(n \log n)$
C. $O(n^2)$
D. $O(n^4)$
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==3 || 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. `IOException` only
B. `IOException` and subclasses of `IOException`
C. `IOException`, subclasses of `IOException`, and unchecked exceptions
D. All exceptions
E. None of these

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

QUESTION 35

Suppose `b` is a `Book`. Which of these is a valid call to method `Test.mystery()` using `b`?

A. `Test.mystery(Media.b)`
B. `Test.mystery((Media)b)`
C. `Test.mystery(Media(b))`
D. More than one of these
E. None of these

QUESTION 36

Suppose `b` is a `Book`. What is the value of this expression?

```
b instanceof Media
```

A. 0 B. true
C. 1 D. false
E. None of these

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

public class Book extends Media {
  // code omitted
}


public class Test {
  public static void mystery(Media m) {
    // do something
  }
}
```

QUESTION 37

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

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

Which of these replaces <*1> in the code to the right to allocate an Object array with size max?

A. `Object[max]`

B. `Object(max)`

C. `new Object(max)`

D. `new Object[max]`

E. None of these

Which of these replaces <*2> in the code to the right to check that the stack is full?

A. `return top==0`

B. `return top==max-1`

C. `return top==max`

D. `return top==max++`

E. None of these

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

```
Stack s = new Stack(5);
s.push(new Character('a'));
s.push(new Character('b'));
s.push(new Character('c'));
System.out.print(s.pop());
System.out.print(s.pop());
System.out.print(s.pop());
```

A. nothing

B. 979899

C. abc

D. cba

E. None of these

```
public class Stack {
  public Stack(int maxSize) {
    max = maxSize;
    items = <*1>;
    top = 0;
  }

  public void push(Object o) {
    if (top<max) {
      items[top] = o;
      ++top;
    }
  }

  public Object pop() {
    if (top>0) {
      --top;
      return items[top];
    }
    else return null;
  }

  public boolean isEmpty() {
    return top==0;
  }

  public boolean isFull() {
    <*2>;
  }

  private int top, max;
  private Object[] items;
}
```

COMPUTER SCIENCE ANSWER KEY
UIL DISTRICT 1 2004

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

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.