University Interscholastic League

Computer Science Competition

Number 91 (District 1 - 2005)

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.

What is the value of 10110011_2?

A. 178_{10} B. 179_{10} C. 180_{10} D. 181_{10} E. None of these

What replaces **<*1>** in the code to the right to indicate that `main()` is a class method?

A. `static` B. `class`
C. `method` D. `classmethod`
E. None of these

```
public class Test {
  public <*1> void main(String[] args) {
    System.out.print("Hello, world!");
  }
}
```

How many `*`s are output by the code to the right if `x` is initialized to `10` and `y` is initialized to `20`?

A. 8 B. 9
C. 10 D. 11
E. None of these

```
// code to initialize x and y

while (x < --y) System.out.print('*');
```

Which of these initializations of `x` and `y` would cause no `*`s to be output?

A.
```
x = 10;
y = 15;
```
B.
```
x = 10;
y = 13;
```
C.
```
x = 10;
y = 11;
```
D.
```
x = 10;
y = 9;
```
E. More than one of these

What replaces **<*1>** in the code to the right to make `PI` a class constant accessible from any class?

A. `final` B. `static`
C. `public final` D. `public static`
E. None of these

```
public class MathFunctions {
  <*1> double PI = 4*Math.atan(1);
  // other constants and class methods
  // not shown
}
```

A variable of which of these types must be cast to store its value in a variable of type `long`?

A. `byte` B. `short` C. `int` D. `double` E. None of these

Question 7

What replaces <*1> in the code to the right to initialize private data member v to be an array of doubles with the appropriate number of rows and columns?

A. `v = double[cols][rows];`

B. `v = double[rows][cols];`

C. `v = new double[cols][rows];`

D. `v = new double[rows][cols];`

E. None of these

Question 8

What replaces <*2> in the code to the right to throw an instance of `RuntimeException` with the message `"Matrices not compatible"`?

A.
```
throw new Exception(Runtime,
                    "Matrices not compatible");
```

B.
```
String s ="Matrices not compatible";
throw new Exception(Runtime, s);
```

C.
```
throw new RuntimeException(
                    "Matrices not compatible");
```

D. This is not legal since there is no `throws` list for the method

E. More than one of these

```
public class Matrix {

  public Matrix(int rows, int cols) {
    <*1>
  }

  public Matrix(double vals[][]) {
    v = vals;
  }

  public Matrix add(Matrix m) {
    if ((v.length != m.v.length) ||
        (v[0].length != m.v[0].length))
      <*2>
    Matrix answer =
        new Matrix(v.length, v[0].length);
    for (int i=0; i<v.length; ++i)
      for (int j=0; j<v[0].length; ++j)
        answer.v[i][j] =
                    v[i][j] + m.v[i][j];
    return answer;
  }

  public Matrix multiply(Matrix m) {
    // code not shown
  }

  private double v[][];
}
```

Question 9

What is output by the code to the right?

A. `Hippy` B. `slppy`

C. `His2` D. `sls2`

E. None of these

```
String s1 = "Hi";
String s2 = "ppy";

System.out.print(s1 + "s2");
```

Question 10

What replaces <*1> in the code to the right as the type of an object representing the integer 54?

A. `54`

B. `int`

C. `integer`

D. `Integer`

E. None of these

```
TreeSet ts = new TreeSet();

<*1> value = new <*1>(54);

ts.add(value);
```

```
public static void output(String s) {
  int len = s.length();
  for (int i=0; i<len; ++i) {
    System.out.print(s);
    s = s.substring(1);
  }
}
```

Question 11

What is output by the call `output("cstest")`?

A. `cstestcstestcstestcstestcstestcstest`

B. `cstestcstescstecstcsc`

C. `cstetstesttestetstt`

D. `cstest`

E. None of these

Question 12

Suppose the for loop is changed so that the test is `i<s.length()` instead of `i<len`. What would be output by the call `output("cstest")`?

A. `cstestcstecs`

B. `cstesttestte`

C. `cstetstesttestetstt`

D. `cstestcstescstecstcsc`

E. None of these

```
public static int mixer(int x, int y,
                                    int z) {
  x += y + z;
  y -= x + z;
  z *= x + y;
  return x + y + z;
}
```

Question 13

What is returned by `mixer(2,2,0)`?

A. -2 B. 4 C. -6

D. 8 E. None of these

Question 14

What is returned by `mixer(3,4,5)`?

A. -2 B. 4 C. -6

D. 8 E. None of these

Question 15

Which of these expressions has the value 0 for all integers x?

A. `x>>>16` B. `x & (~x)` C. `x ^ x`

D. Both B and C E. A, B, and C

Question 16

What replaces **<*1>** in the code to the right to call the other constructor with a radius of `1.0`?

A. `this(1.0);` B. `Circle(1.0);`

C. `super(1.0);` D. `build(1.0);`

E. None of these

Question 17

Assume **<*1>** is filled in correctly. Which of these begins the declaration of a class named `PlaneCircle` which is a subclass of `Circle`?

A.
```
public class Circle extends
                        PlaneCircle {
```

B.
```
public class Circle implements
                        PlaneCircle {
```

C.
```
public class PlaneCircle extends
                        Circle {
```

D.
```
public class PlaneCircle implements
                        Circle {
```

E. None of these

```
public class Circle {
  public Circle() { <*1> }
  public Circle(double radius) {
    r = radius;
  }

  public double area() {
    return Math.PI * r * r;
  }

  public double circum() {
    return 2 * Math.PI * r;
  }

  private double r;
}
```

Question 18

What is output by the code to the right?

A. 0 B. 01 C. 10

D. 1 E. None of these

```
int x = 0, y = 1;

if (x < y)
  System.out.print(x);
System.out.print(y);
```

Question 19

What is returned by the static method call `f(21301)`?

A. `"baaa"` B. `"ba"`

C. `"baa"` D. `"b"`

E. None of these

Question 20

Which of these strings cannot be returned by `f()`?

A. `"aaaa"` B. `"baba"`

C. `"bbbb"` D. `"bababa"`

E. All of these could be returned

```
public static String f(int z) {
  String s = "";
  while (z>0) {
    switch(z%10) {
    case 0: s+=s;
            break;
    case 1: s = s + 'a';
            break;
    case 2: s = 'b' + s;
            break;
    }
    z /= 10;
  }
  return s;
}
```

Suppose `IO.readLine()` reads a line of input from the keyboard and returns its representation as a `String`, including the newline character at the end. Which of these correctly checks that the input read from the keyboard is the word "Hello"?

A. `s1 == s2`
B. `s1.equals(s2)`
C. `s1.compareTo(s2) == 0`
D. Both B and C
E. A, B, and C

```
String s1 = "Hello\n";

String s2 = IO.readLine();
```

What replaces **<*1>** in the code to the right to extract an integer from `s` and store the result in `x`?

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

```
String s;
int x;

// code to initialize s

try {
  <*1>
}
<*2>(Exception e) {
  x = 0;
}
```

Assume **<*1>** is filled in correctly. What replaces **<*2>** in the code so that `x` is set to 0 when an exception is thrown inside the `try` block?

A. `finally` B. `catch`
C. `error` D. `oops`
E. None of these

What is output by the code to the right?

A. `array[3]` B. `27` C. `19`
D. `20` E. None of these

```
int array[] = {13, 15, 27, 19, 20};

System.out.print(array[3]);
```

What is the worst case running time of sequential search on an array with n entries? Choose the smallest correct answer.

A. `O(1)` B. `O(log n)` C. `O(n)` D. `O(n log n)` E. None of these

Question 26

What replaces <*1> in the code to the right to declare a reference to a Book named b which is set to the Book referenced by parameter o?

A. `Book b = o;`

B. `Book b = Book(o);`

C. `Book b = new Book(o);`

D. `Book b = (Book)o;`

E. None of these

For the remaining questions, assume that <*1> has been filled in correctly.

Question 27

What is output by the code below?

```
Book b1 = new Book("King", "Stephen",
                   "It");
Book b2 = new Book("King", "Stephen",
                   "It");

System.out.print(b1.equals(b2));
```

A. true B. 0 C. 1

D. false E. None of these

Question 28

What is output by the code below?

```
Book b1 = new Book("King", "Stephen",
                   "It");
Book b2 = new Book("King", "Stephen",
                   "The Gunslinger");

System.out.print(b1.compareTo(b2));
```

A. 11 B. 1 C. 0

D. -11 E. None of these

```
public class Book implements Comparable {

  public Book(String last, String first,
              String title) {
    authorLast = last;
    authorFirst = first;
    this.title = title;
  }

  public int compareTo(Object o) {
    <*1>
    int test = authorLast.compareTo(
                              b.authorLast);
    if (test != 0) return test;
    test = authorFirst.compareTo(
                              b.authorFirst);
    if (test != 0) return test;
    test = title.compareTo(b.title);
    return test;
    }

  public boolean sameAuthor(Book b) {
    return authorLast.equals(b.authorLast)
      && authorFirst.equals(b.authorFirst);
  }

  private String authorLast;
  private String authorFirst;
  private String title;
}
```

Question 29

For which of these looping constructs does the body of the loop always execute at least once?

A. while B. do/while C. for D. All of these E. None of these

```
public class Stack {
  public Stack() {
    items = new ArrayList();
  }

  public void push(Object o) {
    items.add(o);
  }

  public Object pop() {
    return items.remove(items.size()-1);
  }

  private ArrayList items;
}
```

Which of the following methods could be added to the class, providing a way to check whether a `Stack` is empty?

A.
```
public boolean isEmpty() {
  return items == null;
}
```

B.
```
public boolean isEmpty() {
  return items.length == 0;
}
```

C.
```
public boolean isEmpty() {
  return items.get(0) == Exception;
}
```

D.
```
public boolean isEmpty() {
  return items.size() == 0;
}
```

E. None of these

What is output by the code below?

```
Stack s = new Stack();
s.push("te");
s.push("x");
s.push("as");
System.out.print(s.pop());
System.out.print(s.pop());
System.out.print(s.pop());
```

A. `texas` B. `saxet`

C. `asxte` D. `etxsa`

E. None of these

What is the worst case running time of the `pop()` method for a `Stack` which contains n objects?

A. `O(1)` B. `O(log n)` C. `O(n)`

D. $O(n^2)$ E. None of these

Which of these conditions causes the right side of the boolean operator | not to be evaluated?

A. left side true B. right side true C. left side false D. right side false E. None of these

Question 34

Which of the following outputs the character stored in `char ch`, first converting it to upper case if it is in lower case?

A.
```
System.out.print(ch);
```

B.
```
System.out.print(
                Character.toUpperCase(ch));
```

C.
```
System.out.print(
                ch.toUpperCase());
```

D.
```
System.out.print((ch>='a')?
                (char)(ch+'A'-'a'):ch);
```

E. More than one of these

Question 35

What is output by the code below?

```
int m[] = {2,2,2,2,2,2,2,2};
System.out.print(process(m));
```

A. 0 B. 3

C. 4 D. Does not terminate

E. None of these

Question 36

What is output by the code below?

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

A. 0 B. 3

C. 4 D. Does not terminate

E. None of these

Question 37

What is output by the code below?

```
int m[] = {2,3,4,5,6,7,8,9};
process(m);
System.out.print(m[4]);
```

A. 5 B. 6

C. 7 D. Undefined

E. None of these

```
public static int process(int [] m) {
  int count = 0;
  int front = m[0];
  int [] newm;
  while (front > 0 && front <= m.length) {
    newm = new int[m.length/front];
    for (int i=1; i<=newm.length; ++i)
      newm[i-1] = m[i*front-1];
    m = newm;
    front = m[0];
    count++;
  }
  return count;
}
```

Question 38

What is output by the code to the right?

A. 4 1 B. 3 1

C. 4 0.75 D. 3 0.75

E. None of these

```
int x = 11, y = x/3;

double z = y/4;

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

Which of these is an accurate description of static method `mystery()`?

A. Rearranges the elements of `m` so that all elements smaller than the element at index `i` come before all elements larger than or equal to that element

B. Rearranges the elements of `m` so that all elements larger than or equal to the element at index `i` come before all elements smaller than that element

C. Rearranges the elements of `m` so that all elements smaller than or equal to the element at index `i` come before all elements larger than that element

D. Sorts `m`

E. None of these

```
public static void mystery(int m[],
                           int i) {
  int front = 0, back = m.length-1;
  int temp = m[0];
  m[0] = m[i];
  m[i] = temp;
  while (front < back) {
    while (m[front]<=m[0]) front++;
    while (m[back]>m[0]) back--;
    if (front < back) {
      temp=m[front];
      m[front]=m[back];
      m[back]=temp;
    }
  }
}
```

Which of these sorting methods is most likely to use `mystery()` as a subroutine?

A. Selection Sort
B. Insertion Sort
C. Merge Sort
D. Quick Sort
E. More than one of these

Computer Science Answer Key
UIL District 1 2005

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