

ComS 207: Programming I
Midterm 2, Tue. Mar 21, 2006

Student Name:

Student ID Number:

Recitation Section:

1. True/False Questions (10 x 1p each = 10p)

Determine the value of each boolean expression given the following initial conditions:

```
boolean a=true, b=false;
```

```
int c=5, d=4;
```

- | | |
|---|--------------|
| (a) (a (a && b)) | TRUE / FALSE |
| (b) (b (a && b)) | TRUE / FALSE |
| (c) ((!(a && b)) == (!a !b)) | TRUE / FALSE |
| (d) (a && (c == d)) | TRUE / FALSE |
| (e) (b && (c != d)) | TRUE / FALSE |
| (f) ((!(a b)) == (!a && !b)) | TRUE / FALSE |
| (g) (!(!a) && (c-d > 0) && (b !b)) | TRUE / FALSE |
| (h) ((!false != !(true)) (3*3 + d*d <= c*c) && (a !a)) | TRUE / FALSE |
| (i) (!a (!b && (c != 0))) == (!(d -13%5 -1 > 0)) && !(a!=b)) | TRUE / FALSE |
| (j) ((c-3/2 == 4) && (!b && false)) (c == ++d) && (a && true)) | TRUE / FALSE |

2. Short Answer Questions (5 x 2p each = 10p)

(a) What is a ragged array?

(b) What is a method?

(c) What is the difference between an if statement and a switch statement?

(d) What is a debugger?

(e) What is the difference between a do loop and a while loop?

4. Rewriting Code (4 x 5p each = 20p)

(a) Rewrite the following while loop as a for loop.

```
int i = 20;
while(i > -10) {
    i = i -5;
    System.out.println("Value of i is " + i);
}
```

(b) Rewrite the following do loop as a for loop.

```
int number= -5, j=0;
do {
    System.out.println("number= " + number);
    number+=j;
    j++;
} while(number <10);
```

(c) Rewrite the following switch statement using only if and else statements.

```
switch(letter)
{
    case 'A':
    case 'a':
        aCount++;
        break;
    case 'B':
    case 'b':
        bCount++;
        break;
    default:
        System.out.println("Invalid Input");
        break;
}
```

(d) Rewrite the following for loop as a do loop.

```
for(;;)
    ;
```

5. What is the Output? (2 x 5p each = 10p)

For each of the following code snippets write down what will be printed on the screen.

```
(a) for(int a=0; a<5; a++)
    {
        for(int b=0; b<a; b++)
            System.out.print("#");
        System.out.println("#\n#");
    }
```

```
(b) int[] a={1, 2, 3, 4, 5, 6, 7, 8, 9, 0};
    int[] b={5, 3, 1, 0, 9, 2, 6, 8, 4, 7};
    for(int i=0; i<b.length; i++)
        System.out.print(b[a[b[i]]] + " ");
    System.out.println();
```

6. Programming Projects (TOTAL 65p, but each has a different weight)

(a) Numbers to Text (15p)

Write a complete Java program that reads in an integer number and output its digits in reverse order but in English. For example, if the input was 608 then the output should be "Eight Zero Six". You can assume that the user will be nice and will always input an integer.

(b) 3D Vectors (15p)

Write a complete Java program which asks the user to enter the coordinates of two 3D vectors. In other words, the program must read two sets of three floating point numbers which represent the x , y , and z coordinates of the two vectors: $u = (u_x, u_y, u_z)$ and $v = (v_x, v_y, v_z)$. The program must then calculate and print on the screen the following four values associated with the vectors: 1) the length of the vector u ; 2) the length of the vector v ; 3) the dot product between the two vectors; 4) the angle θ between the two vectors.

Hint 1: The length (or norm) of the vector u is defined as: $\|u\| = \sqrt{u_x^2 + u_y^2 + u_z^2}$

Hint 2: The dot product of two vectors u and v is defined as: $u \cdot v = u_x v_x + u_y v_y + u_z v_z$

Hint 3: The angle between two vectors u and v is defined as: $\theta = \arccos\left(\frac{u \cdot v}{\|u\| \|v\|}\right)$

(c) Largest Five (15p)

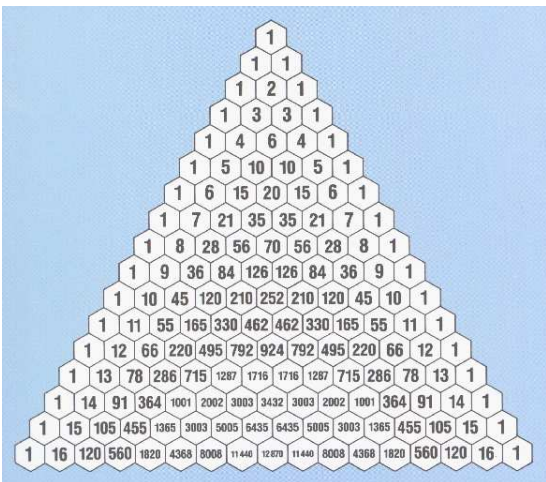
Write a Java program that initializes an integer array of size 10 with random integers between 1 and 10. The program must then find and print the five largest numbers stored in the array and their corresponding indices. If there are two (or more) numbers in the top five that have the same magnitude (this is possible since the array is initialized at random) then the number with the smaller index should be printed first. For example, if the random array is {9, 2, 4, 4, 2, 5, 7, 6, 7, 6} the program should print:

- 1) 9 at index 0
- 2) 7 at index 6
- 3) 7 at index 8
- 4) 6 at index 7
- 5) 6 at index 9

(d) Pascal's Triangle (20p)

Write a Java program that calculates and prints the first nine rows (0, 1, ... 8) of Pascal's Triangle (see the figure below). This triangle has many interesting mathematical properties and is formed as described below. Row 0 contains only a single number which is equal to 1. The first and the last number in all other rows is also 1. Any other number in the triangle can be calculated by adding the two numbers located above it. For example, the number 2 on row two is equal to the sum of the two 1's located above it on row one. Similarly, the first 15 on row six is equal to the sum of the numbers 5 and 10 located above it on row five. And so on.

NOTE: You will get 15 points if your program can calculate and print the first nine rows regardless of the output format. To get the extra 5 points you must print the output in the form of a triangle similar the figure below (**hint 1:** printing the output in this format is similar to printing the asterisks in problem 5.13.d on page 281 in your textbook; **hint 2:** the largest number in the first nine rows has at most two digits).



That's it. Good Luck!

Question	Max	Score
True/False	10	
Short Answer	10	
Code Snippets	15	
Rewriting Code	20	
What is the Output	10	
Numbers to Text	15	
3D Vectors	15	
Largest Five	15	
Pascal's Triangle	20	
TOTAL:	130	