Midterm Exam #2
CS170000

Student Name________________________________________
INSTRUCTIONS:

- Keep your eyes on your own paper and do your best to prevent anyone else from seeing your work.
- Do NOT communicate with anyone other than the professor/proctor for ANY reason in ANY language in ANY manner.
- This exam is closed note, closed books, and no calculator.
- Turn all mobile devices off and put them away now. You cannot have them on your desk.
- Write neatly and clearly indicate your answers. What I cannot read, I will assume to be incorrect.
- Stop writing when told to do so at the end of the exam. I will take 5 points off your exam if I have to tell you multiples times.
- Academic misconduct will not be tolerated. Suspected academic misconduct will be immediately referred to the Emory Honor Council. Penalties for misconduct will be a zero on this exam, and F grade in the course, and/or other disciplinary action that may be applied by the Emory Honor Council.

TIME: This exam has 5 questions. Please check to make sure no page is missing. You will have 50 minutes to complete this exam.

I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Emory community. I have also read and understand the requirements and policies outlined above.

Signature: ____________________________

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Problem 1 (10 pts)

Based on the code fragment below answer following questions:

1. What is the return type of \texttt{max(int a, int b)} method __________________________
2. What is the return type of \texttt{max(int a, double b)} method __________________________
3. What will be the value of variable \texttt{z} _______________________________________________________________________
4. What will be the value of variable \texttt{u} _______________________________________________________________________
5. What is the argument of \texttt{main} method (variable name and type) __________________________

```java
public class Problem1 {

    public static int max(int a, int b) {
        int result;
        if (a > b)
            result = a;
        else
            result = b;
        return result;
    }

    public static double max(int a, double b) {
        double result;
        if (a > b)
            result = a;
        else
            result = b;
        return result * 2;
    }

    public static void main(String[] args) {
        int x = 1, y = 3;
        int z = max(x, y);
        int u = max(y, 1.0);
    }
}
```
Problem 2 (30 pts)
Write down the output of the following program.

```java
public class Problem2 {
    public static int a = 10;

    public static int A(int x, int y)
    {
        System.out.println("A says a = " + a);
        if (a > 2)
            return B(x) + B(y);
        else
            return C(x) + C(y);
    }

    public static int B(int x)
    {
        System.out.println("B says a = " + a);
        a++;    
        return (a + x + 1);
    }

    public static int C(int y)
    {
        System.out.println("C says a = " + a);
        a++;    
        return (a - y - 1);
    }

    public static void main(String[] args) {
        a = 1;
        int a = -1, b = 1;
        System.out.println( A(a, b) );
        b = 2;
        System.out.println( A(Problem2.a, b) );
    }
}
```
Problem 3 (20 pts)
Implement a method that reverses elements in the array provided as an argument.

```java
public class ReverseElements {

    public static void reverse(double[] a) {
        // write your code here
    }

    public static void main(String[] args) {
        double[] a = {1.1, 5.3, 3.4, 8.9, 0.0, 1.3, 5.2, 7.8, 9.9};
        System.out.println("initial array = "+ Arrays.toString(a));
        // call reverse method
        reverse(a);
        System.out.println("reversed array = "+ Arrays.toString(a));
    }
}
```

Example program output:

initial array = [1.1, 5.3, 3.4, 8.9, 0.0, 1.3, 5.2, 7.8, 9.9]
reversed array = [9.9, 7.8, 5.2, 1.3, 0.0, 8.9, 3.4, 5.3, 1.1]
Problem 4 (15 pts)
Write a Java program that reads sequence of numbers supplied as a command line argument and finds the maximum of these numbers. You can assume that numbers are real values (of type double). You can use method `Double.parseDouble(String str)` to convert string representation to a value of type `double`.

Example of program execution:

```
>> javac FindMax.java
>> java FindMax 9 8 3 1 2 12 17 2
maximum value is 17.0
```

Write your program here:
Problem 5 (25 pts)
For this problem you need to write 3 methods that take int typed two-dimensional array and return the following quantities:

- Sum of all elements in the array
- Sum of elements in each column
- Sum of diagonal elements

You can assume that array has equal number of columns and rows (i.e. squared).

Example:
For the two-dimensional array

```
1  2  3
4  5  6
7  8  9
```

The diagonal elements are \{1, 5, 9\}.

```java
import java.util.Arrays;

public class Problem5 {
    public static int SumDiagonalElements(int[][] a) {
        // write your code here
    }

    public static int SumAllElements(int[][] a) {
        // write your code here
    }
}
```
public static int[] SumColumnsElements(int[][] a) {
    // write your code here
}

public static void main(String[] args) {
    int[][] a = {
        {1, 2, 3},
        {4, 5, 6},
        {7, 8, 9}
    };

    System.out.println("sum of all elements in the array = " + SumAllElements(a));

    int[] columnSums = SumColumnsElements(a);
    System.out.println("sum column elements = " + Arrays.toString(columnSums));

    System.out.println("sum of diagonal elements = " + SumDiagonalElements(a));
}

Example program output:

sum of all elements in the array = 45
sum column elements = [12, 15, 18]
sum of diagonal elements = 15
Problem 6 (10 pts)
Write a method that randomly shuffles the rows in a two-dimensional int array using the following header: public static void shuffle(int[][] a). Original array is provided as an argument to the method. Note: for this problem you will need to use random number generator.

```java
public static void shuffle(int[][] a)
{
    // write your code here
}
```