Name (print): ________________________________

• 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 notes, 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 multiple 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, an F grade in the course, and/or other disciplinary action that may be applied by the Emory Honor Council.

• TIME: This exam has 6 questions on 14 pages including the title page. Please check to make sure all pages are included. 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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1. (10 points) For each entry below, state whether the code is correct, or has an error. If there is no error, write the output. If there is, show where the error is (you can circle the incorrect code) and explain why it is an error.

The following variables were initialized for you:

```java
String s1 = "exam2";
int[] arr1 = {1, 2, 3, 4, 5};
String[] arr_s = {"CS", "170"};
```

(a) `System.out.println(arr1[arr1.length]);`

(b) `System.out.println(arr1[s1.length]);`

(c) `System.out.println(arr1[s1.length()]);`

(d) `System.out.println(arr1[s1.length()-1]);`

(e) `System.out.println(s1.charAt(arr1[3]);`
(f) `System.out.println( s1.charAt(arr_s.length) );`

(g) `System.out.println( arr1[ (int) s1.charAt(4) ] );`

(h) `System.out.println( arr_s[1].charAt(arr1[ s1.length()- 3 ]);`
2. (14 points) Draw the array $A$ that would result after the following code is executed.

(a) 
```
char[] B = {'c', 's', '1', '7', '0'};
char[] A = new char[B.length];
for (int i = B.length -1; i >= 0; i--){
    A[i] = B[i];
}
```

(b) 
```
int[] A = { 1, 2, 3, 5, 8, 13};
for (int i=0; i < A.length-1; i++){
    int temp=A[0];
    A[i]=A[i+1];
}
```

(c) 
```
int[] A = { 1, 2, 3, 5, 8, 13};
for (int i=0; i < A.length-1; i++){
    int temp=A[i];
    A[i+1]=temp;
    A[i]=A[i+1];
}
```
3. (18 points) Read the following Java code. Then answer the questions.

```java
public class Q3{
    public static double minScore = 60;

    public static double curve10Sqrt(double score){
        double res = Math.sqrt(score) * 10;
        return res;
    }

    public static void curveAddPoint(double score, double addPoint){
        double res = score + addPoint;
    }

    public static void curveAll(double[] score){
        double[] res = score;
        for(int i = 0; i<res.length; i++){
            res[i] += 10;
        }
    }

    public static boolean isFailed(double score){
        return score < minScore;
    }

    public static void main(String[] args){
        double[] myRawScore = {38, 47, 59};
        if(isFailed(myRawScore[0])){
            System.out.println("Failed!");
        }

        double myNewScore1 = curve10Sqrt( myRawScore[0]);
        System.out.print("Score 1 After curving ( square root times 10): ");
        if(isFailed(myNewScore1)){
            System.out.println("Failed!");
        }else{
            System.out.println("Passed!");
        }

        curveAddPoint(myRawScore[1], 30);
        System.out.print("Score 2 After curving ( adding 30 points): ");
        if(isFailed(myRawScore[1])){
            System.out.println("Failed!");
        }else{
```
```java
    System.out.println("Passed!");
}

curveAll(myRawScore);
System.out.print("Score 3 After curving: ");
if(isFailed(myRawScore[2])){
    System.out.println("Failed!");
}else{
    System.out.println("Passed!");
}
}
```

(a) (3 points) Write one example for each type of parameter. Write down variable name
and its data type

Class variable:

Local variable:

Parameter variable:

(b) (1 points) What is the return datatype of method `curve10Sqrt`?
(c) (1 points) What is the input datatype(s) of method `curveAddPoint`?

(d) (2 points) What does the method `isFailed` do?

(e) (11 points) What is the output of this program?

HINT:

* Math.sqrt() will return the square root of one value.
* Math.sqrt(38) is larger than 6, but smaller than 7.
4. (18 points) Consider the following array \{3, 1, 9, 2, 10, 4, 8\}

(a) (3 points) Write out the values in the list that will be inspected during a linear search for the value 10.

(b) (6 points) The 2 sets of list below show the sequence of a list of numbers when it is sorted using one of the sorting algorithms we studied. Steps that have no changes to the arrays are being omitted. For each set of lists, label the name of the sorting algorithm after each set.

Step 1: \{1, 3, 9, 2, 10, 4, 8\}
Step 2: \{1, 2, 9, 3, 10, 4, 8\}
Step 3: \{1, 2, 3, 9, 10, 4, 8\}
Step 4: \{1, 2, 3, 4, 10, 9, 8\}
Step 5: \{1, 2, 3, 4, 8, 9, 10\}

Sorting algorithm ______________________

Step 1: \{1, 3, 9, 2, 10, 4, 8\}
Step 2: \{1, 2, 3, 9, 10, 4, 8\}
Step 3: \{1, 2, 3, 4, 9, 10, 8\}
Step 4: \{1, 2, 3, 4, 8, 9, 10\}

Sorting algorithm ______________________

(c) (5 points) Now we can apply binary search for a value on the current sorted array \{1, 2, 3, 4, 8, 9, 10\}
Please write out the values that will be inspected during a binary search for the key 7.
(d) (4 points) What is the return value of searching for key 7?
5. (20 points) You’re helping Emory University to maintain OPUS on the exam score reporting system. Suppose for each department, the exam scores for each student are represented in a 2D-array:

- each row is the exam scores for one student.
- each column is the exam score for one course.

For example, if we have a 2D array, showing exam scores for 3 students (0,1,2), in 3 courses(0,1,2):

```java
double[][] scores =
{ {100,100,100},
  {90,90,90},
  {80,80,80} };
```

So, `score[1][1]` is the exam score of student 1 on course 1: 90
You can design your own user-defined method. Make sure the input and return data type are correct.

(a) Your job is to evaluate the AVERAGE EXAM SCORE for EACH STUDENT:

Write a user-defined method named `arrayRowMean`, which takes an 2D-array of double (Assume the 2D-array is not ragged), array. This method will return a new double array. Each element of this returned array is the mean value (i.e. average) of each ROW.

```java
double[] a = arrayRowMean(arr); // a is { 100, 90, 80 }
// ******* YOUR CODES HERE *******
(b) You’ll get extra stipend if you can help to evaluate the AVERAGE SCORE for EACH COURSE:
write another user-defined method, named `arrayColMean`, which takes an 2D-array of double( Assume the 2D-array is not ragged), array. This method will return a new double array. Each element of this returned array is the mean value (i.e. average) of each COLUMN.

double[] b = arrayColMean(arr); // b is { 90, 90, 90 }
// ******** YOUR CODES HERE *******
6. (20 points) You wake up and find yourself back in the 80’s. Two guys, Steve and Ronald, ask you to join their team for obvious reasons - you know computer science. They promise you a 1% stock share if you can help them to design a computer game “Rock-Scissors-Paper” for their ”new-generation personal computer”, Macintosh...

Now write a Java program for a simple game:

- 3 round of ”Rock-Scissors-Paper” between you and computer
- Each round, computer will generate a hand shape randomly;
- User will input a hand shape by choosing 1: Rock, 2: Scissors, or 3: Paper.
- In each round, you can get 1 point ONLY when you WIN. If it is DRAW or LOSE, computer get one point.
- After each round, program will show:
  (1) Game result for each round: You win! or You Lose! (Again, draw shows lose too)
  (2) The current scores for both computer and user.

- At the end of the game, show final scores of computer and user.

**Hint:**

* Use Math.random() to generate random numbers. Make sure to convert it to 3 different integers.

* In order to avoid complicated logical expression to judge who won, use a 2D boolean array to show **pair-wise relationship** for any two hand shape. (e.g. Each row means hand shape of human; each column means hand shape of computer, then the value will represent in this case, whether human win or human lose).

* Part of the user-defined methods are given. Please use them in your main method. Make sure the input and return data type are correct.

**Sample Output:** when playing with your game, the output should be in the following format (result may vary, because it is generated randomly)

*Welcome to play ROCK-SCISSOR-PAPER!!*

*----------------------------------------*

**Round 1**
Choose between (1)Rock, (2)Scissors or (3)Paper: (input 1~3)3

|-Computer choose: Paper
|-you choose: Paper

You Lose!
Score: Computer(1), Human(0)
----------------------------------------
Round 2
Choose between (1)Rock, (2)Scissors or (3)Paper: (input 1~3)2
   |-Computer choose: Rock
   |-You choose: Scissor
You Lose!
Score: Computer(2), Human(0)
----------------------------------------
Round 3
Choose between (1)Rock, (2)Scissors or (3)Paper: (input 1~3)1
   |-Computer choose: Scissor
   |-You choose: Rock
You Win!
Score: Computer(2), Human(1)
----------------------------------------
Final Score:
Computer v.s. Human
  2 : 1

import java.util.Scanner;
public class Q6{

    //2d array for win/lose
    public static boolean[][] isWin=
    {
        // ******** YOUR CODES HERE ********

    }

    public static void gameInfo(int humanHand, int computerHand){
        String[] hand = {"Rock", "Scissor", "Paper"};
        System.out.println(" |-Computer choose: "+hand[computerHand]);
        System.out.println(" |-You choose: "+ hand[humanHand]);
    }

    public static boolean playOneRound(int humanHand){
        // USE Math.random() to generate 3 random numbers
int computerHand;
// ******* YOUR CODES HERE *******

gameInfo(humanHand, computerHand);
boolean res = isWin[humanHand][computerHand];
return res;
}

public static void main(String[] args){
    int roundNumber = 3;
    int computerPoints = 0;
    int humanPoints = 0;

    System.out.println("Welcome to play ROCK-SCISSOR-PAPER!!");
    System.out.println("----------------------------------------");

    // ******* YOUR CODES HERE *******