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 8 questions on 11 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. (4 points) Convert each of the following numbers from binary to decimal or from decimal to binary, as specified. **Put your answer to each question on the line provided.**
   (a) 110110 from binary to decimal
      Answer: _______
   
   (b) 28 from decimal to binary
      Answer: _______
   
   (c) 52 from decimal to binary
      Answer: _______
   
   (d) 10101 from binary to decimal
      Answer: _______
2. (9 points) Each question below contains 2 different compile-time and/or run-time errors. Find them in each question, and circle what’s causing the error. Pick one of the errors for each question, put a * to the left of the line the error is on, and indicate whether the error is a compile-time or run-time error.

(a) Type of error: ________________
   ```java
   int[] numbers = new int {3, 2, 1, 0, 2};
   for (int i = 0; i < numbers.length; i++) {
       numbers[i-1] = numbers[i];
   }
   ```

(b) Type of error: ________________
   ```java
   String greeting = "hello!", greeting2 = 'hi';
   char[] mashup = new char[greeting.length()];
   for (int i == 0; i < 5; i++) {
       if (i % 2 > 0) {
           mashup[i] = greeting.charAt(i);
       } else {
           mashup[i] = greeting2.charAt(i/3);
       }
   }
   ```
(c) Type of error: ____________________

```java
int x = 0, y = 1, z = -1;

int[] xyz = new int[3];
xyz[0] = x;
xyz[1] = y;
xyz[2] = z;

for(int element : xyz){
    System.out.println("Original element is " + element);
}

for(i = 0; i < 3; ){
    if(x == 0){
        x++;
    }
    i = x;
}
```
3. (9 points) For each of the code fragments below, write in the whitespace below the code what output is produced when `bar()` is called. Take care to format the output correctly.

(a) public static double foo(int x){
    System.out.print("foo! ");
    double out = x/2 + 1;
    if(out < x*3){
        x++;
        out--;
    }
    return out;
}

public static void bar(){
    int x = 10;
    int val = 3;
    double y;

    val = (int) foo(x);
    y = foo(val);
    System.out.println("x has value " + x);
    System.out.println("val has value " + val);
    System.out.println("y has value " + (int) Math.floor(y));
}
(b) public static void foo(int[] array, int num){
    for(int index = 0; index < num; index++){
        array[index] += 2*num;
    }
}

public static void bar(){
    int[][] values = {{0, 1}, {2, 3}};
    for(int index = 0; index < values.length; index++){
        System.out.println("Bar "+index+"!");
        foo(values[index], index+1);
    }
    System.out.println(values[0][0] + ", " + values[0][1] + 
                      "\n                      + values[1][0] + ", " + values[1][1]);
}
4. For each of the following questions, consider the series of arrays as steps in a sorting algorithm iteration. Identify on the line provided which algorithm is being performed, and write the array as it would appear after the next iteration in the whitespace provided.

(a) (2 points) Sorting algorithm: 
\{3, 0, -2, 4, 7, 3\}
\{-2, 0, 3, 4, 7, 3\}
\{-2, 0, 3, 4, 7, 3\}

(b) (2 points) Sorting algorithm: 
\{1, 4, 0, 3, -1\}
\{1, 4, 0, 3, -1\}
\{0, 1, 4, 3, -1\}

(c) (2 points) Sorting algorithm: 
\{6, 5, 3, 2, -1\}
\{-1, 5, 3, 2, 6\}
5. For the following arrays, list the index inspected (so, which index has its value compared to the key) at each step for the given searching algorithm. Separately, indicate and circle the index returned by the search. If the element is not found, assume the algorithm returns -1. If the algorithm is not applicable, write “impossible”.

(a) (1 point) \{-1, 0, 2, 6, 7, 9, 15\} binary search with key -3.

(b) (1 point) \{-1, 2, 4, 0, 6, 20, 23, 24\} linear search with key 30.

(c) (1 point) \{-1, 3, 2, 6, 4\} linear search with key 2.

(d) (1 point) \{0, 2, 3, 1, 5, 6, 8\} binary search with key 1.
6. (6 points) Write a method named `stringRep` that, given a string and an integer \( N \), returns a string made of \( N \) repetitions of the last \( N-1 \) characters of the string. You may assume that the string has at least one character, and \( N \) is between 1 and the length of the string, inclusive.

Example inputs → return values:
- ("Kiwi", 1) → ""
- ("Kiwi", 2) → "ii"
- ("Kiwi", 3) → "wiwiwi"
7. (6 points) Write a method named `bottomSum` that takes an array of doubles and returns the sum of the smallest and second smallest values in the array. You may assume the array will have at least two elements in it.

Example inputs → return values:
- `{1.0, 4.0, 2.5, 3.2, 9.0, 0.2} → 1.2`
- `{2.2, 3.3, 0.0, 1.1} → 1.1`
- `{−5.3, −4.3} → −9.6`
8. (6 points) Given that a method with the method header

\[
\text{public static int findMin(int[]} \text{values})
\]

already exists, write an method overloading the \text{findMin} method. Your overloaded method should find and return the minimum element in an array of \text{doubles}. The array is \textbf{not} guaranteed to have any elements in it.