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.

Time: This exam has 6 questions on 7 pages, including this title page. Please make sure all pages are included. You will have 50 minutes to complete this exam.

Honor code: 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: ________________________________
1) (15 pts) Given the following code

```java
public class Exam {
    public static int ID = 100;

    public static void main(String[] args) {
        int value1 = 40;
        double value2;

        value2 = quest1(value1);
        System.out.println(value2);
    }

    public static double quest1(int num) {
        int ID = num % 100;
        return (double)ID * 22.5;
    }
}
```

a) What is the life-time of the class variable ID?
   The entire run of the program.

b) What are the parameter variables of method quest1?
   num

c) What are the local variables of method quest1?
   ID

d) What kind of variable is value2 in the method main?
   local

e) Change the second line in method quest1 to use the class variable ID.
   return (double)Exam.ID * 22.5;
2) (15 pts) Assume the following statements are part of a valid Java program that compiles and runs. Give the output of the program.

```java
public class Question2 {

    public static int key;

    public static void main(String[] args) {
        int value = 0;
        key = 110;

        System.out.println("value = " + value + ", key = " + key);
        value = myMethod(key, 2);
        System.out.println("value = " + value + ", key = " + key);
        method2("Exam: 2");
    }

    public static int myMethod(int value, int key) {
        int result;

        System.out.println("In myMethod");
        if( key >= 100 ) {
            result = 2;
            Question2.key = 1;
        } else {
            result = 10;
            Question2.key = 5;
        }
        return result * key;
    }

    public static int method2(String label) {
        char digit = (char)('1' + key);
        System.out.println("Method 2: " + digit);

        for(int key = 0; key < label.length(); key += 2) {
            System.out.print(label.charAt(key) + " ");
        }
        System.out.println();
        key = label.charAt(6) - '1';
    }
}
```

Output

value = 0, key = 110
In myMethod
value = 20, key = 5
Method2: 6
E a : 2
3) (15 pts) The following Java code snippet reads in words from the keyboard and adds them to an array of type String until the user enters 0. Find the errors in the code and describe and fix each error.

```java
Scanner in = new Scanner(System.in);
String[] words = new String[1];
String curWord;
boolean done = false;
int count = 0;

while( !done ) {
    if( in.hasNextDouble() ) {
        curWord = in.nextString();
        if( count == a.length ) {
            String[] h;
            for(int i = 0; i < a.length() + 1; i++) {
                h[i] = a[i];
            }
        }
        if( curWord[0] == '0' ) {
            done = true;
        }
        words[count] = curWord;
    }
}
```

a should be words
in.hasNextDouble should be in.hasNext
in.nextString() should be in.next()
array h needs to be allocated
a.length() + 1 should be words.length
words = h; after copying array
curWord[0] should be curWord.charAt(0)
count++ after words[count] = curWord
4) (15 pts)

a) Show the contents of array `vals` after running the following?

```java
int vals[] = new int[10];
vals[0] = 1;
vals[1] = 1;

for(int i = 2; i < vals.length; i++) {
    vals[i] = vals[i-1] + vals[i-2];
}
```

{1, 1, 2, 3, 5, 8, 13, 21, 34, 55}

b) Show the contents of array `vals` after running the following?

```java
int[] vals = {3, 1, 8, 2, 5, 0};
int p;

for(int i = 1; i < vals.length; i++) {
    if( vals[i-1] > vals[i] ) {
        p = vals[i];
        vals[i] = vals[i-1];
        vals[i-1] = p;
    }
}
```

{1, 3, 2, 5, 0, 8}
5) (15 pts) Given the following code

```java
class Question5 {
    public static void main(String[] args) {
        double num1 = 5.0;
        double num2 = 7.5;
        int c;

        c = func(num2, num1);
        System.out.println("num1 = " + num1);
        System.out.println("num2 = " + num2);
    }

    public static int func(double value, double key) {
        int c = 0;

        while (value > key) {
            value = value - 1.0;
            c += 2;
        }
        return c;
    }
}
```

a) What is the output if the parameters to method `func` were passed by value?

```
num1 = 5.0
num2 = 7.5
```

b) What is the output if the parameters to method `func` were passed by reference?

```
num1 = 5.0
num2 = 4.5
```
6) **(25 pts)** Write a method that takes a two-dimensional array as a parameter and returns a two-dimensional array that contains the transpose (i.e. the rows become columns and the columns become rows) of the input. For instance:

\[
\begin{align*}
\text{input} & = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \quad \text{output} & = \begin{bmatrix} 1 & 4 & 7 \\ 2 & 5 & 8 \\ 3 & 6 & 9 \end{bmatrix}
\end{align*}
\]

The method should be able to handle any size array.

```java
public int[][] transpose(int[][] in)
{
    int[][] out = new int[in.length][in[0].length];

    for(int i = 0; i < in.length; i++) {
        for(int j = 0; j < in[0].length; j++) {
            out[i][j] = in[j][i];
        }
    }

    return out;
}
```