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 10 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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<tr>
<th>Question</th>
<th>1</th>
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<tbody>
<tr>
<td>Points:</td>
<td>6</td>
<td>10</td>
<td>7</td>
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<td>8</td>
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1. (6 points) For each of the following give a basic definition of the term. You do not need to give a formal definition. Then, give an example in java. (An example can be a piece of java code (one or two statements).)

   (a) Casting

   **Solution:** Casting is a unary operator which explicitly converts a datatype to another one.
   Example: casting from double to int
   ```java
   int x = (int) 9.16;
   ```

   (b) Runtime error

   **Solution:** An error that occurs as the program runs and prevents the program from completing. Example:
   ```java
   String s = "Hello"; char c = s.charAt(5);
   ```

   (c) final

   **Solution:** A Java keyword to define a constant. Example: final int PI = 3.14;
2. (10 points) Evaluate each expression. Then give the result of the evaluation and the data type of the result. If the expression cannot be evaluated or would cause an error, you may simply write “error” for the value. The first row has been done for you.

```java
String s1 = "Book", s2 = "13";
char c1 = 'A';
int i1 = 2, i2 = 13;
double d1 = 2.0, d2 = 13.0;
```

<table>
<thead>
<tr>
<th>Expression</th>
<th>Value</th>
<th>Type</th>
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<tbody>
<tr>
<td>i1+1</td>
<td>3</td>
<td>int</td>
</tr>
<tr>
<td>i2 % i1</td>
<td>1</td>
<td>int</td>
</tr>
<tr>
<td>i2 / i1 + 2</td>
<td>8</td>
<td>int</td>
</tr>
<tr>
<td>i1 + d1</td>
<td>4.0</td>
<td>double</td>
</tr>
<tr>
<td>(int) d2 / d1 + i1</td>
<td>8.5</td>
<td>double</td>
</tr>
<tr>
<td>s1.length() + d1</td>
<td>6.0</td>
<td>double</td>
</tr>
<tr>
<td>i1++ == d1</td>
<td>true</td>
<td>boolean</td>
</tr>
<tr>
<td>Integer.parseInt(s2) - d2</td>
<td>0.0</td>
<td>double</td>
</tr>
<tr>
<td>s1.charAt(0) != c1 + 1</td>
<td>false</td>
<td>boolean</td>
</tr>
<tr>
<td>c1 + i1 + s2</td>
<td>&quot;6713&quot;</td>
<td>String</td>
</tr>
<tr>
<td>s1.substring(0,3) + s2.substring(0,3)</td>
<td>Error</td>
<td>IndexOutOfBoundsException</td>
</tr>
</tbody>
</table>
3. (7 points) Assume the statements below are part of a Java program which compiles and runs. What is the output if the user types 35?

```java
Scanner myScanner = new Scanner(System.in);
int num = myScanner.nextInt();
boolean check;

check = (num % 2 == 0);
if(num <= 30 || !check){
    System.out.println("one");
}
System.out.println("two");
if(check){
    System.out.println("three");
} else if (num >= 30){
    System.out.println("four");
} else
    System.out.println("five");
System.out.println("six");

switch(num + '0'){
    case 35:
        System.out.println("a");
        break;
    case 350:
        System.out.println("b");
        break;
    case 94:
        System.out.println("d");
        break;
    default:
        System.out.println("e");
        break;
}

while(num * 2 <= 90){
    System.out.println(num);
    num += 5;
}
```

Solution:

one
two
four
six
e
35
40
45
-1 for each omission or incorrect inclusion
4. Consider the following program (with the lines numbered for convenient reference).

```java
1: import java.util.Scanner;
2: public class LogicalError {
3:   public static void main(String args[]) {
4:     Scanner myScanner = new Scanner(System.in);
5:     String inputStr = myScanner.next();
6:     int i = 0;
7:     char letter;
8:     while(i < inputStr.length()){
9:         letter = inputStr.charAt(i);
10:        inputStr = inputStr + letter;
11:        System.out.println(inputStr);
12:        i = i + 1;
13:     }
14: }
15: }
16: }
```

The intent of the program is to double the text in inputStr by adding the characters to it one by one. For example for the inputStr as "Hello", the program should print "HelloH", "HelloHe",..., and stop after printing "HelloHello". However, when we run this program with inputStr as "Hello", we observe the following output (running forever).

HelloH
HelloHe
HelloHel
HelloHell
HelloHello
HelloHelloH
HelloHelloHe
(forever)

(a) (3 points) Explain why the program runs forever and doesn’t stop after doubling the string.

**Solution:** The error is on line 8. `inputStr.length()` will always be increasing since `inputStr` is changing inside the while loop, so `i` will always be smaller than `inputStr.length()`, making the while condition to be true all the time.
(b) (4 points) What line(s) of code would you change to eliminate this error? Change the line(s) to make the program function correctly, assuming that `inputStr` can be any string.

**Solution:** One fix is to define another String as

```java
String outputStr = inputStr;
```
before the loop and then use it inside the loop instead of lines 10 and 11.

```java
outputStr = outputStr + letter;
System.out.println(outputStr);
```

Another fix can be storing the size of `inputStr` in an integer as

```java
int len = inputStr.length();
```
before the loop and then change the condition in line 8 to

```java
while (i<len)
```
5. (8 points) The program below accepts 2 integers from the user. You should add code to figure out if the user entered one number less than 10 and one number greater than 10 (they don’t need to be in order). Your program should print out either “Valid: One is less and one is greater than 10!”, or “Not Valid!”. You may assume the user only enters integer values in the terminal window.

```java
import java.util.Scanner;

public class InBetween {
    public static void main(String args[]) {
        Scanner myScanner = new Scanner(System.in);

        int a = myScanner.nextInt();
        int b = myScanner.nextInt();

        /*---------- Your code here ----------*/

    }
}
```

Solution:

```java
if ((a > 10 && b < 10) || ( a< 10 && b > 10 ))
    System.out.println("Valid: One is less and one is greater than 10!");
else
    System.out.println("Not Valid");
```
6. (12 points) You want to write a program that reads in a word from the user and checks if this word has the same number of a’s and b’s. You can assume the user enters lowercase strings! Examples of running this program:

```java
>>> java CheckAB
Enter a word: abaadn
Not the same number of a’s and b’s!

>>> java CheckAB
Enter a word: abcbbaa
The same number of a’s and b’s!
```

```java
import java.util.Scanner;

public static CheckAB {
    public static void main(String[] args) {
        Scanner myScanner = new Scanner(System.in);

        System.out.println("Enter a word: ");
        String s = myScanner.next();

        /*------ Your code here -------*/
    }
}
```

**Solution:**

```java
int i = 0;
int countA = 0, countB = 0;
while (i < s.length()) {
    if(s.charAt(i) == 'a') {
        countA++;
    }
    else if(s.charAt(i) == 'b') {
        countB++;
    }
    i++;
}
if(countA == countB){
```
System.out.println("The same number of a’s and b’s!");
}
else {
    System.out.println("Not the same number of a’s and b’s!");
}