Exercise 8: Introduction to Programming

Problem 1: Java

1. The following function is defined:

```java
public static int foo(int[] arr)
{
    int m = arr[0];
    for (int i=1; i<arr.length; i++)
    {
        if (arr[i] > m)
          m = arr[i];
    }
    return m;
}
```

   (a) What will be the returned value of `foo` for the array `arr=[2,-3,3,4,-7]` ?

   (b) What operation does the function perform?

   (c) How will the answer change if, instead of `if (arr[i] > m)`, the code would be `if (arr[i] < m)`?

2. The following function is defined:

```java
public static boolean bar(int n)
{
    if (n < 2 || (n % 2 == 0 && n != 2))
      return false;

    int i = 3;
    while (i < n)
    {
        if (n % i == 0)
            return false;
        i = i + 2;
    }
    return true;
}
```

   Note: the operator `||` means 'OR', the operator `&&` means 'AND'. The operator `%` is the modulo operator (i.e. it returns the remainder of the division. For example: `3%2=1` , `4%2=0`).

   (a) What are the returned values of `bar` for the following numbers: $-3, 1, 2, 3, 4, 5, 9, 11, 16$?

   (b) Which operation does the function perform?

3. The following function is defined:

```java
public static int baz(int n)
{
    int x = 1;
    for (i=1; i<=n; i++)
    {
        x = x * i;
    }
    return x;
}
```

   (a) What are the returned values of `baz` for the following numbers: $1, 2, 3, 4, 5$?
   Note: `i++` means `i=i+1` (i.e. it increases `i` by one).

   (b) Which operation does the function perform?

Problem 2: L-Systems

1. For the following L-systems, write the first N strings (N is given for each system):

   (a)

   variables: A B
   constants: None
   axiom: A
   rules: A→AB, B→A
   N: 4

   (b)

   variables: A B C
   constants: None
   axiom: A
   rules: A→C, B→A, C→AB
   N: 10

   (c)

   variables: B, A
   constants: (,)
   axiom: B
   rules: A→AA, B→A(B)B
   N: 3

2. For system 1c ($N = 0, 1, 2, 3, 4$), draw using the following rules:
   'A': draw a line segment.
   'B': draw a line segment ending in a leaf.
   '(': push position and angle, turn left 45 degrees.
   ')': pop position and angle, turn right 45 degrees.