CMPS 12B
Introduction to Data Structures
Programming Assignment 1

The purpose of this assignment is to gain experience implementing recursive algorithms in Java. You will write recursive methods `maxArray()` and `minArray()` with headings

```
static int maxArray(int[] A, int p, int r);
static int minArray(int[] A, int p, int r);
```

Function `maxArray()` is described in section 3.3 (pages 143-144) of the text, and is similar to `mergeSort()` in its divide-and-conquer approach. The function returns the largest value in the subarray `A[p...r]` by performing the following procedure. If subarray `A[p...r]` contains just one element, that element is returned. If subarray `A[p...r]` contains more than one element, the middle index is computed as `q=(p+r)/2`, the maxima of subarrays `A[p...q]` and `A[q+1...r]` are computed recursively, then the larger of the two maxima is returned. Function `minArray()` follows a similar procedure to return the smallest value in the subarray `A[p...r]`.

These methods will be surrounded by a class called `Extrema` and will be called from function `main()` defined below.

```
public static void main(String[] args){
   int[] B = {-1, 2, 6, 3, 9, 2, -3, -2, 11, 5, 7};
   System.out.println( "max = " + maxArray(B, 0, B.length-1) );
   System.out.println( "min = " + minArray(B, 0, B.length-1) );
}
```

The output of this program will be the two lines

```
max = 11
min = -3
```

You may wish to also define two helper functions called `max()` and `min()` that simply return the maximum and minimum of a pair of ints. Place your functions, along with function `main()` above in the class `Extrema`, and place that class definition in a file called `Extrema.java`. A template for this file will be placed on the examples section of the webpage. As you write your program test it on many different input arrays to thoroughly check its operation. When you submit the project though, include function `main()` exactly as written above.

Write a Makefile that creates an executable jar file called `Extrema`. Include a clean utility that removes all `.class` files and the executable jar file from the current directory. (See lab1 to understand how to do all this.) Submit the files `README`, `Makefile`, and `Extrema.java` to the assignment name `pa1` by the due date.