Assignment 8_1:

This week you will write 2 programs: NumberArray.java and Rectangle.java.

1. Array of integers (50 points)

Write NumberArray.java program that meets the following requirements:

Given the following array of integers:

```java
int[] x = {1, 4, 3, 5, 9, 2, 3, 7, 1, 6};
```

a) Write a method `static int sumOfSquares(int[] m)` that returns the sum of squares of all numbers in the array. This method should return 231 when applies to the array x above.

b) Write a method `static boolean isIncreasing(int[] m)` that returns true if all numbers in array m are sorted in increasing order. Otherwise, it returns false.

An array \(\{x_1, x_2, \ldots, x_{n-1}, x_n\}\) is called increasing if the following condition holds:

\[
x_1 \leq x_2 \leq \ldots \leq x_{n-1} \leq x_n
\]

This method should return false when applies to the array x above.

c) Write a method `static int numberOfIncreasingSubArrays (int[] m)` that returns the number of increasing sub-arrays in array m. This method should return 4 when applies to the array x above, because it can be divided into 4 increasing sub-arrays:

\[
1, 4, 3, 5, 9, 2, 3, 7, 1, 6
\]

d) Write a method `static void longestSubArray(int[] m)` that displays the first longest sub-array in array m. This method should display the following numbers when applies to array a above:

```
The first longest sub-array is 3 5 9
```

e) Write a method `static int fattest(int[] m)` that returns the index of the first fattest number in
array m. The fatness of a number in an array is defined as the sum of the previous number (if it exists) and the next number (if it exists). For array a above, the fatness of each number is show below:

Array m: {1, 4, 3, 5, 9, 2, 3, 7, 1, 6}
Fatness:   {4, 4, 9, 12, 7, 12, 9, 4, 13, 1}

This method should returns 8 when applies to the array a above. Note that the fatness of number at this location is 13 (maximum).

2. ArrayList of Rectangles (50 points)
   a) Write a Rectangle.java class that has the following fields and methods:
      Fields: width, height
      Methods: constructor, toString(), perimeter(), area()
   In the main() method of Rectangle class do the followings:
   b) Create an ArrayList object that contains the following 5 rectangles:
      (3, 5), (2, 2), (7, 5), (4, 4), (5, 8), where the 1st component is the width, and the 2nd component is the height.
      Display this ArrayList object.
   c) Write a method static int totalArea(ArrayList a) that returns the sum of areas of all rectangles in the arraylist a. This method should return 110 when applies to the arraylist in b).
   d) Write a method static int numberOfSquares(ArrayList a) that returns the number of squares in arraylist a. This method should returns 2 when applies to the arraylist in b).
   e) Write a method static Rectangle smallestRectangle(ArrayList[] a) that returns the first rectangle in the array satisfying both the following 2 conditions:
      • Its perimeter is greater than 20
      • Its area is smallest
This method should returns \((7, \ 5)\) when applies to the arraylist in b).