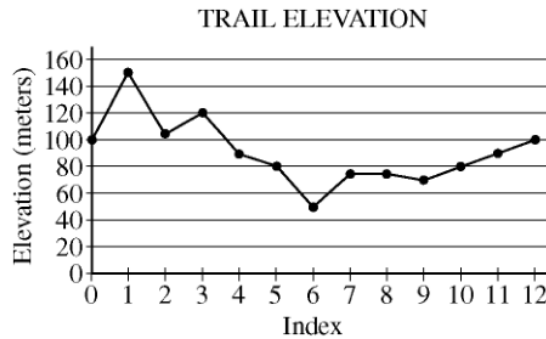


See notes below with details on how I want you to do this work.

### 2010 AP<sup>®</sup> COMPUTER SCIENCE A FREE-RESPONSE QUESTIONS

3. A hiking trail has elevation markers posted at regular intervals along the trail. Elevation information about a trail can be stored in an array, where each element in the array represents the elevation at a marker. The elevation at the first marker will be stored at array index 0, the elevation at the second marker will be stored at array index 1, and so forth. Elevations between markers are ignored in this question. The graph below shows an example of trail elevations.



The table below contains the data represented in the graph.

**Trail Elevation (meters)**

Index	0	1	2	3	4	5	6	7	8	9	10	11	12
Elevation	100	150	105	120	90	80	50	75	75	70	80	90	100

The declaration of the `Trail` class is shown below. You will write two unrelated methods of the `Trail` class.

```
public class Trail
{
    /** Representation of the trail. The number of markers on the trail is markers.length. */
    private int[] markers;

    /** Determines if a trail segment is level. A trail segment is defined by a starting marker,
     * an ending marker, and all markers between those two markers.
     * A trail segment is level if it has a difference between the maximum elevation
     * and minimum elevation that is less than or equal to 10 meters.
     * @param start the index of the starting marker
     * @param end the index of the ending marker
     * Precondition: 0 <= start < end <= markers.length - 1
     * @return true if the difference between the maximum and minimum
     * elevation on this segment of the trail is less than or equal to 10 meters;
     * false otherwise.
     */
    public boolean isLevelTrailSegment(int start, int end)
    { /* to be implemented in part (a) */ }

    /** Determines if this trail is rated difficult. A trail is rated by counting the number of changes in
     * elevation that are at least 30 meters (up or down) between two consecutive markers. A trail
     * with 3 or more such changes is rated difficult.
     * @return true if the trail is rated difficult; false otherwise.
     */
    public boolean isDifficult()
    { /* to be implemented in part (b) */ }

    // There may be instance variables, constructors, and methods that are not shown.
}
```

- (a) Write the `Trail` method `isLevelTrailSegment`. A trail segment is defined by a starting marker, an ending marker, and all markers between those two markers. The parameters of the method are the index of the starting marker and the index of the ending marker. The method will return `true` if the difference between the maximum elevation and the minimum elevation in the trail segment is less than or equal to 10 meters.

For the trail shown at the beginning of the question, the trail segment starting at marker 7 and ending at marker 10 has elevations ranging between 70 and 80 meters. Because the difference between 80 and 70 is equal to 10, the trail segment is considered level.

The trail segment starting at marker 2 and ending at marker 12 has elevations ranging between 50 and 120 meters. Because the difference between 120 and 50 is greater than 10, this trail segment is not considered level.

Complete method `isLevelTrailSegment` below.

```
/** Determines if a trail segment is level. A trail segment is defined by a starting marker,
 * an ending marker, and all markers between those two markers.
 * A trail segment is level if it has a difference between the maximum elevation
 * and minimum elevation that is less than or equal to 10 meters.
 * @param start the index of the starting marker
 * @param end the index of the ending marker
 *      Precondition: 0 <= start < end <= markers.length - 1
 * @return true if the difference between the maximum and minimum
 *         elevation on this segment of the trail is less than or equal to 10 meters;
 *         false otherwise.
 */
public boolean isLevelTrailSegment(int start, int end)
```

**Please write your answer on a piece of paper. Do this without using repl and without looking up the solutions online.**

**If you're stuck, after you have tried to read this and grapple with it, look at my tips video for some tips, then try again.**

**If you are still unable to do the problem, Google "2010 APCS Trail FRQ" and you should be able to find multiple solutions online.**

**In the end, your proof that you did this is that you will hand a piece of paper to the sub with your name on it that shows that you did this and/or corrected it.**

**After you finish part a, there is a part b on the next page.**

- (b) Write the `Trail` method `isDifficult`. A trail is rated by counting the number of changes in elevation that are at least 30 meters (up or down) between two consecutive markers. A trail with 3 or more such changes is rated difficult. The following table shows trail elevation data and the elevation changes between consecutive trail markers.

**Trail Elevation (meters)**

Index	0	1	2	3	4	5	6	7	8	9	10	11	12
Elevation	100	150	105	120	90	80	50	75	75	70	80	90	100
		\/	\/	\/	\/	\/	\/	\/	\/	\/	\/	\/	\/
Elevation change	50	-45	15	-30	-10	-30	25	0	-5	10	10	10	

This trail is rated difficult because it has 4 changes in elevation that are 30 meters or more (between markers 0 and 1, between markers 1 and 2, between markers 3 and 4, and between markers 5 and 6).

Complete method `isDifficult` below.

```
/** Determines if this trail is difficult. A trail is rated by counting the number of changes in
 * elevation that are at least 30 meters (up or down) between two consecutive markers. A trail
 * with 3 or more such changes is rated difficult.
 * @return true if the trail is rated difficult; false otherwise.
 */
public boolean isDifficult()
```

**Please write your answer on the same piece of paper that you did part a. Do this without using repl and without looking up the solutions online.**

**If you're stuck, after you have tried to read this and grapple with it, look at my tips video for some tips, then try again.**

**If you are still unable to do the problem, Google "2010 APCS Trail FRQ" and you should be able to find multiple solutions online.**

**In the end, your proof that you did this is that you will hand a piece of paper to the sub with your name on it that shows that you did this and/or corrected it.**