CSCI201A - S3 - Set B

Provide a recursive solution to solve the following problems. Each item is 2.5 pts each. Partial points will be given for iterative solutions.

1. Crash and Recover Patterns

Suppose that you are working for a financial company that is trying to determine which companies exhibited a “crash and recover” behavior throughout a given timeframe. A “crash and recover” behavior occurs when consecutive time periods exhibit downward values and its symmetrical window exhibits upward values.

For example:

Day Index	**Stock Price**
Day 1	5.00
Day 2	4.00
Day 3	2.00
Day 4	3.00
Day 5	7.00
Day 6	9.00

The problem is, given a finite timeline, the financial company doesn’t know where exactly the “crash and recover” behavior occurred. In the example given above, it is possible that this is only a window of days (i.e. it is possible that we are looking at 12 days worth of data and the “crash and recover” can happen at any point in between). How can you come up with a recursive algorithm that will tell the company you work for at what point/s do “crash and recover” scenarios occur?

Example:

Given a timeline of 11 days, determine at which points a “crash and recover” occured. It is possible to have more than two occurrences in a given timeline.

Day Index	**Stock Price**

Day 1	5.00
Day 2	4.00
Day 3	2.00
Day 4	3.00
Day 5	7.00
Day 6	9.00
Day 7	8.00
Day 8	8.00
Day 9	7.00
Day 10	8.00
Day 11	10.00

In the table above, “crash and recover” occurrences happened from Day 1 to Day 6 AND Day 8 to Day 11.

2. What If?

You are one of the Marvel watchers and with the recent development of having multiple versions of various stories, you want to make sure that the timeline you are watching will not be at risk of forking to another version. In order to do this, you need to check how many palindromic segments you can find in a given timeline. A timeline is given by an array of values representing the health of the world’s mightiest heroes. A palindromic event is given if a segment identified is palindromic (symmetric on both ends) with at least a length of 3. However, the timeline is filled with continuous values so to generalize it, you’d consider consecutive values to either be an up or a down. Consecutive positions in the timeline are considered to be up if the values are going up (i.e. [55.6, 102.5] == up) and consecutive positions in the timeline are considered to be down if the values are going down (i.e. [102, 21] == down). An example of a palindromic segment would be [up, up, down, down] or [up, down, down, up] or [up, down, up, down, up].

Example:

Timeline = [5, 6, 1, 3, 6, 7, 3, 6, 1]

Answer: There are 4 unique palindromic segments (5 in total).

Note:

1. The minimum requirement is to find all palindromic segments with at least a length of 3 regardless of position in the timeline.
2. Hint: Try to transform the data first to something more manageable.

3. Fear is the Mind Killer

A Dune harvester is crawling through a grid to harvest spice for house Atreides. The harvester starts at the beginning of the cell (0, 0) and ends at the last cell (R - 1, C - 1). The harvester can only move from left to right, top to bottom or diagonally. There is a risk however that the crawler may attract a sandworm. Each cell is given a value to determine the risk factor of attracting such a sandworm. A sandworm will be attracted if the sum of the numbers in the path it takes is greater than or equal to some threshold value t. In that case the harvester will have to stop. What algorithm will you provide house Atreides to determine the unique paths that the harvester has taken that hasn't reached the end of the grid? A unique path is defined as a path that doesn't intersect with existing paths.

Example:

t = 10

3	4	1
6	7	3
1	6	2

Unique paths:

3, 4, 1

3, 6, 1

3, 7