Ghulam Ishaq Khan Institute (GIKI)

Assignment # 1

Subject: Data Structures and Algorithms	**Course Code:** CS221 / EE222 – A/E(B) - Fall - 25
Class: BS (AI / EE) – Batch 34	**Submission Deadline:** 19-Sep-2025 (Friday)
Course Instructor: M. Qasim Riaz - Lecturer - FCSE	**Total Marks: 10**

Note (Read notes & instructions first)

- First of all, read the instructions and statements of each exercise/question carefully then write the solution.
- It is written in front of each question that you have to submit it as handwritten and printed hard copy.
- *For handwritten file:*
  - In case of multiple questions, give heading of each question's number or the exercise you are going to solve (don't write statement of question)
  - Then **scan all questions and pages of handwritten document > convert into pdf > upload at teams**
- *For C++ Code File:*
  - Create a different file for each question.
  - Write Question no in the name of file.
  - Merge all files into One Zip file and upload it in your class Team's group (in the assignment section of your notebook).
  - The name of each Zip file should contain your roll number & assignment number.
  - For Example, if your roll number is 2022532 and you are doing 2nd assignment then file name of your Zip file should be written as ---> 2022532_2.
  - Now upload all these files to Microsoft teams.

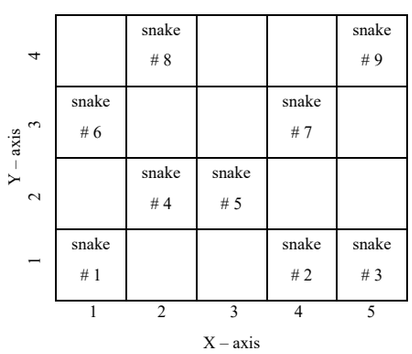
CHEATING/COPY CASE or LATE SUBMISSION will be graded as ZERO MARKS.

HAND-WRITTEN SCANNED PDF FILE OF CODE & ALSO CPP FILE OF CODE (UPLOAD-BOTH FOR Q1 & Q2)

Humans found another universe where they discovered that it consists of only two dimensions X and Y. Scientists also found the traces of some snake like creature in the new universe. Snakes have the ability to disappear and cannot be seen through the naked eyes, but scientists have special gadgets to locate them. According to current knowledge these snakes like creature can disappear but cannot move a lot (For them it takes around 20 years to move one meter) but they can be dangerous for any living-being conducting research in the surrounding area.

To understand the locations of snake's scientist are considering the universe like a 2D plane who's vertical (y-axis) and horizontal (x-axis) area is still unknown. Scientists we don't know the exact number of snakes present there. But scientists want to create a two-dimensional map to keep a record of exact locations where snakes are present.

The first major problem here is we don't know the exact size of universe in terms of x and y axis. The second one is how will we locate the position of snakes if total value of x-axis and y-axis are unknown.



Question # 1 (3 - Marks): Write a C++ program in which you will create a structure named as "UniverseCoordinate" the structure will contain three int variables "s_number", "x_position", "y_position" and one bool variable "is_snake" to store data of a specific point of new universe.

Variable “s_number” is to store the identification number of a single snake if found at that specific coordinate or location. “x_position” and “y_position” are to store the coordinate of 2D plane (it is not necessary that all coordinate points contain snakes). While “is_snake” variable will contain true or false with respect to presence of snake at the x and y coordinate position.

Question # 2 (7 - Marks): As there are more than one snakes, and the number of x and y axis are also more than one, so we need an 2D array to store that 2D data. As the total numbers of snakes, x-axis and y-axis values are unknown so we cannot fix the size of array permanently. We need to create 2D array named as “UniverseData” of the structure “UniverseCoordinate” you created in above question-1. The 2D array “UniverseData” must be created dynamically so scientists can enter unlimited & unknown number of x & y axis data. Initially you can create “UniversData” array of 2x2. Then you can expand it after giving the new values. Remember if a coordinate (for example 1,2) doesn’t have snake, then it’s “s_number” variable must contain 0 otherwise it should contain the number according to total number of snakes found till now.

Note: For help you can have a look at the last example of 1-D dynamic array given in “DS Lect 03 [Dynamic Memory & Arrays]” available at MS Teams. My advice will be to first practice the 1-D dynamic array given in above mentioned lecture.

Good Luck