**Bonus Assignment: Working with Graph**

This is a bonus assignment and submission is optional. If the score of this assignment is better than the minimum lab score of the student, then the minimum lab score is going to be replaced by this bonus lab score.

In this assignment, we are going to work with graph algorithms to solve a number of interesting problems that we have learned in the class.
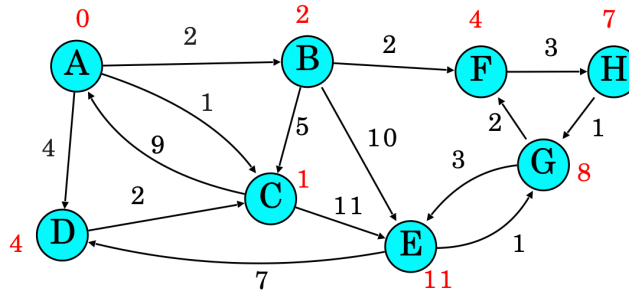
Deliverable 1: To start create a graph data structure that we have discussed in the class. The Vertex class must be used in all of the following algorithms.

Next, in the main function, randomly initialize a graph of NxN (N is an integer value ranging between 10 and 5000) size by using the defined Vertex data structure.

Deliverable 2: Implement the topological sort algorithm and display the Vertices in sorted order (use the inDegree variable of the Vertex class).

Deliverable 3: Implement the BFS and DFS traversal algorithms to display the content of the the graph (use the mark variable in order to avoid looping through the elements). Do not use recursion, rather use the built-in Queue and/or the Stack variable in the implementation of your algorithm.

Deliverable 4: Incorporate the Vertex class (add the path variable of char type in the class) and implement Dijkstra's Algorithm and display the path and total cost for each vertex as the following (for the graph shown above):

A: B (2)
A: C (1)
A: D (4)
A: B F H G E (11)
A: B F (4)
A: B F H (7)
A: B F H G (8)

You must use a priority queue data structure to select the next candidate vertex to be marked as visited. It should be possible to specify any Vertex to be the root or the source for this algorithm.

Additional methods can be used in order to display the path from a given source vertex to the destination vertex.

Create a report with a title page and explain for each deliverable, how you have completed the requirements with screenshots.

Submit the solution on the Blackboard website by 11:59pm, 8 December 2023. Let me know if you have any questions. Thank you.

Assignment rubrics	Total points: 50	Points
Deliverable 1: Defines the Vertex class and initializes the graph by using random value	5 points
Deliverable 2: Implements the topological sort algorithm and displays the vertices accordingly	10 points
Deliverable 3: Traverses the graph by using DFS and BFS techniques discussed in the class	10 points
Deliverable 4: Implements the algorithm and displays the path from a given source vertex to all the other vertices as shown	15 points
Report Requirement: implementation of each deliverables were clearly explained in the report with adequate screenshots	15 points
The program uses features/algorithms that has not been taught in the class	– 25 points