Exercise 7: Graphs

Choice Questions

1. An edge that has identical end-points is called a

   a) Multi-path b) Loop c) Cycle d) Multi-edge

2. A graph in which there is no multiple edges or loops is called

   a) Complete graph b) Connected graph c) Simple graph d) Subgraph

3. A graph in which there exists a path between any two of its nodes is called

   a) Complete graph b) Connected graph c) Digraph d) Undirected graph

4. Given n is the number of nodes in a undirected graph, how many edges the graph has at most?

   a) n b) $n(n-1)/2$ c) $n(n-1)$ d) n^2

5. Given n is the number of nodes in a complete graph, the memory use of an adjacency matrix for the graph is

   a) $O(n)$ b) $O(n^2)$ c) $O(n^3)$ d) $O(log(n))$

True or False Questions

1. ___ Graph is a linear data structure.

2. ___ A simple path P is known as a cycle if the path has the same endpoints.

3. ___ A directed graph is strongly connected if there is at least one path between each pair of vertices.

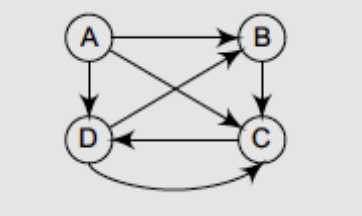
4. ___ For a simple graph, the adjacency matrix has 0s on the diagonal.

5. ___ If the graph is sparse, an adjacency matrix should be the first choice as the representation.

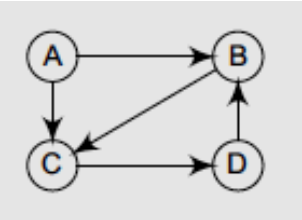
6. ___ Adding new nodes in graph is easy and straightforward when the graph is represented using an adjacency list.

Review Questions

1. Consider the graph given below. State all the simple paths from A to D and B to D.



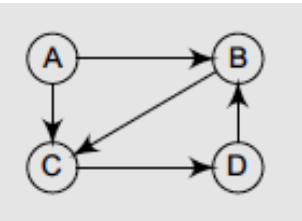
2. Consider the graph G given below.
   (a) Write the adjacency matrix of G.
   (b) Calculate the reachability matrix.
   (c) Is the graph strongly connected?



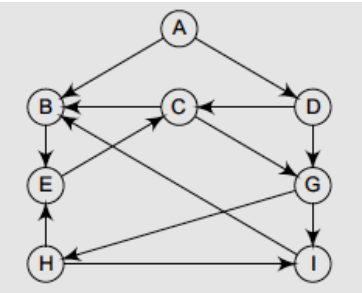
3. Given the following adjacency matrix, draw the weighted graph.

	A	B	C	D	E
A	0	4	0	2	0
B	0	0	0	7	0
C	0	5	0	0	0
D	0	0	0	0	3
E	0	0	1	0	0

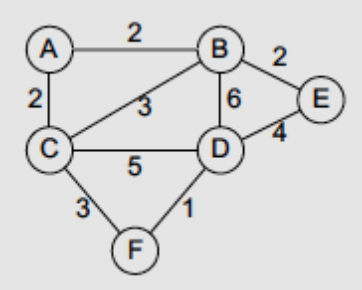
4. Consider the graph given below and show its adjacency list in the memory.



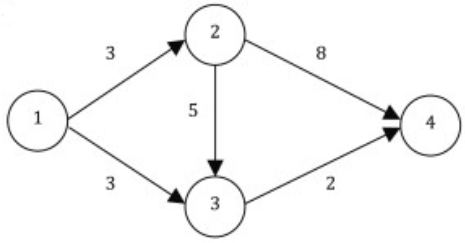
5. Consider the graph given below. Find out its depth-first and breadth-first traversal scheme.



6. Consider the graph given below. Find the minimum spanning tree of this graph using Kruskal's algorithm.



7. Find the shortest paths between all pairs of nodes in the following graph using Floyd-Warshall's algorithm and Dijkstra's algorithm.



Programming Exercises

Download the supplied codes in ex7_supplied_codes.zip .

1. Write a program to implement a directed graph of N vertices using adjacency list (by completing the supplied code `ex1.c`).
   (a) Implement the functions for creating and displaying the graph.
   (b) Implement the functions for adding and deleting an edge from the graph.
2. Write a program to implement the breadth-first search algorithm on graph, where the graph is represented in adjacency matrix (by completing the supplied code `ex2.c`).