CptS 223 Homework #4 - Graphs

Please complete the homework problems on the following page using a separate piece of paper. Note that this is an individual assignment and all work must be your own. Be sure to show your work when appropriate.

1. **[13]** Define these terms as they relate to graph and graph algorithms: Use mathematical terms where appropriate.

Graph: An abstract notation used to represent connections between pairs of objects

Vertice: the meeting point of two lines that form an angle

Edge: the line connecting two vertices; weighted or unweighted

Undirected Graph: a graph whose edges are bilateral

Directed Graph: a graph whose edges are directional

Path: a series of edges joining vertices together

Loop: an edge that connects a vertex to itself

Cycle: a path of edges and vertices where the vertex is reachable from itself

Acyclic: not displaying or forming a cycle

Connected: a graph where there are no unreachable vertices

Sparse: a graph where the number of edges is much less than the possible #

Weight: the "cost" to travel on edge

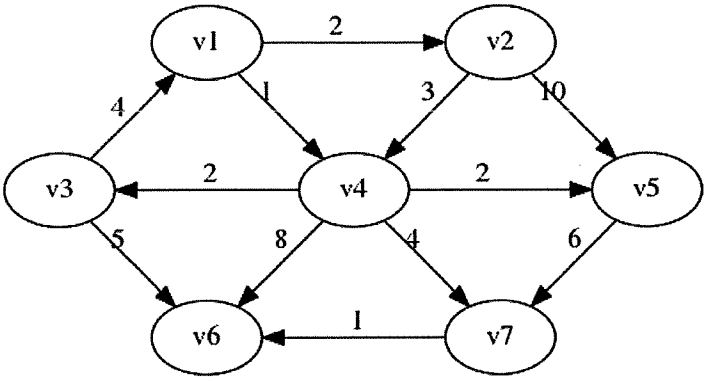
2. [4] Under what circumstances would we want to use an adjacency matrix instead of an adjacency list to store our graph?

if we want to have a fast lookup time to see if an edge is present between two nodes

3. [6] Name three problems or situations where a graph would be a good data structure to use:

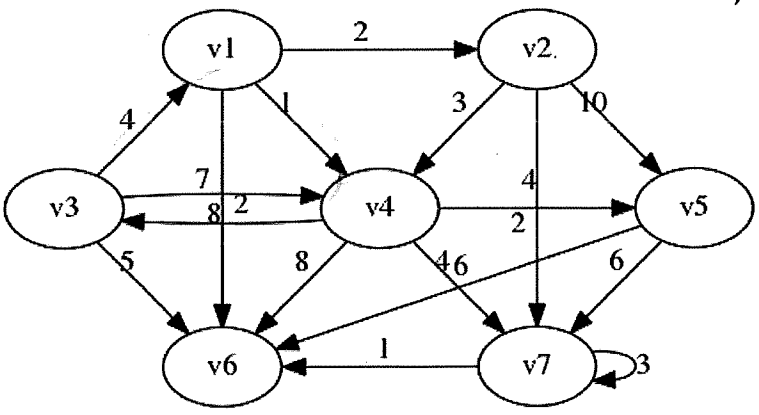
finding distances between points
longest path from point A to B
shortest path from point A to B

4. [4] What kind of graph is this?



a directed graph

5. [4] Identify the loop in this graph:

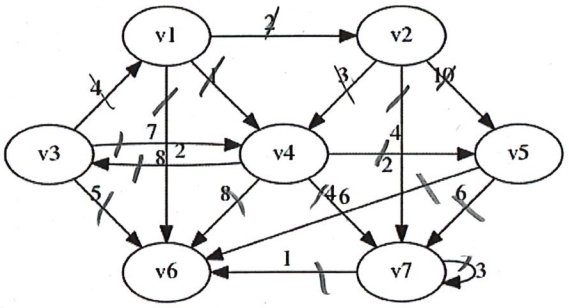


v3 → v1 → v4

v7

v3 → v4

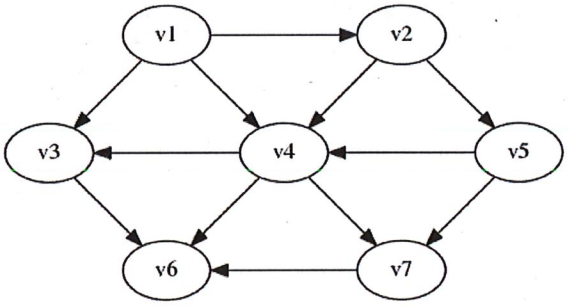
6. [4] How many vertices and edges are in this graph:



Vertices 7

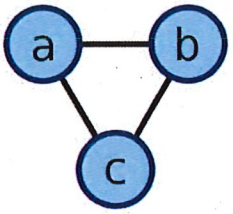
Edges 17

7. [6] Are these cyclic or acyclic graphs?



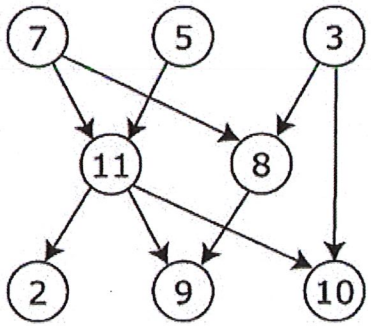
Cyclic? no loop

Yes (No)



Cyclic? not directional

Yes (No)

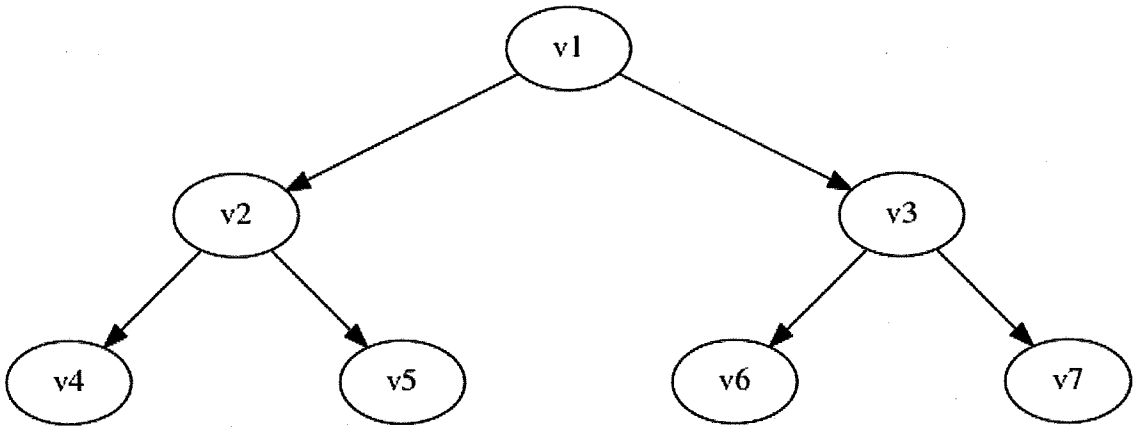


Cyclic? no loop

Yes (No)

8. [5] A tree is a particular kind of graph. What kind of graph is that?

a directed acylic graph



9. [4] What is the difference between a breadth-first search and a depth first search?

BFS

queue

oldest vertex with fill

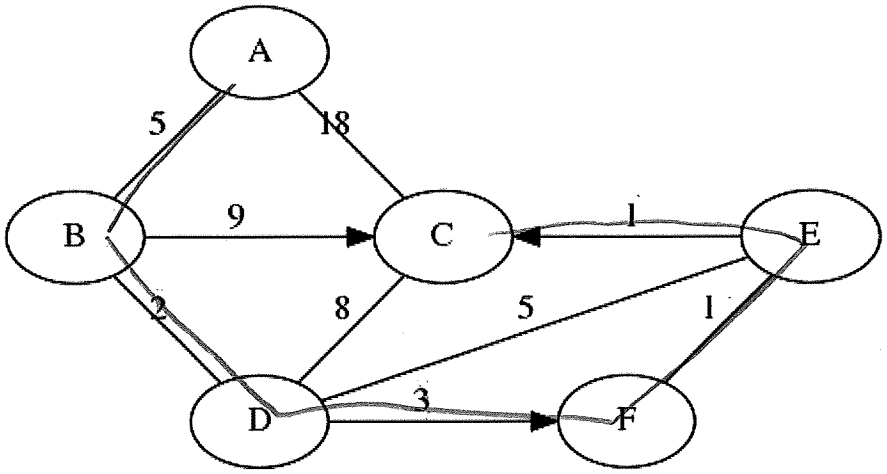
DFS

Stack

Vertices along edge explored first

10. [10] Dijkstra's Algorithm. Use Dijkstra's Algorithm to determine the shortest path starting at A. Note that edges without heads are bi-directional. To save time, you do not have to add items to the "priority queue" column after it has been discovered (listed in the "distance" column). Use the table below to show your work.

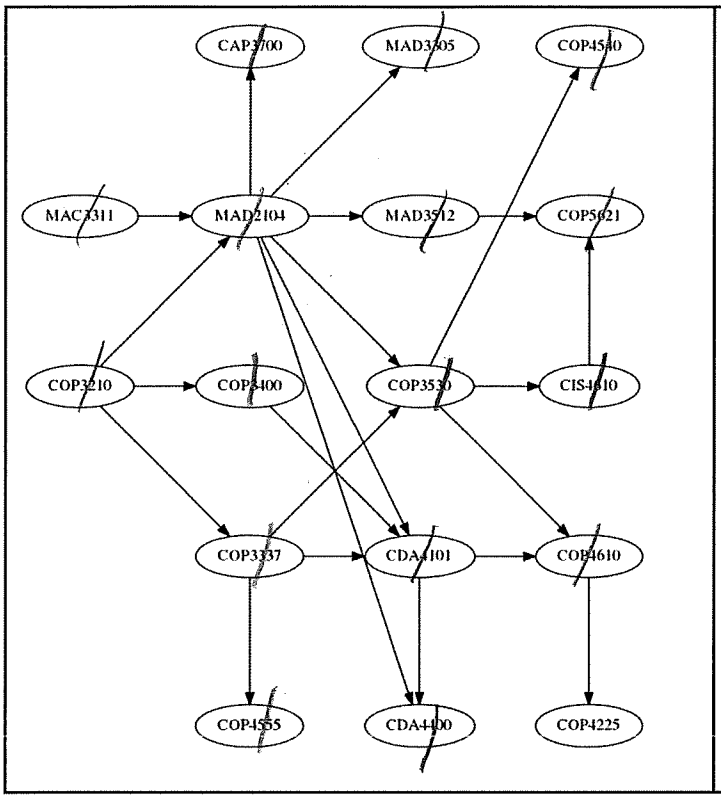
What's the shortest route (by weight) from A to C?



Node: Distance	Priority Queue
5	B, C
7	D, C
10	F, E, C
12	E, C

11. [10] Topo sort. Show the final output of running Topo Sort on this graph:

A, B, C, D, F, E



What's the vertice with the largest degree and its value?

MAD2104

degree 8

What's the vertice with the highest indegree and its value?

CDA4101

indegree 3

What's the vertice with the highest outdegree and its value?

MAD2104

outdegree 6

Topo sort output:

Mac3311, cop3210, mad2104, cop3337, cop4555, cop3400, cap3700, mad3305, mad3512, cop3530, cop4540, CDA4101, CDA4400, cop4610, cis4610, cop5621, cop4225