Rowan Barr
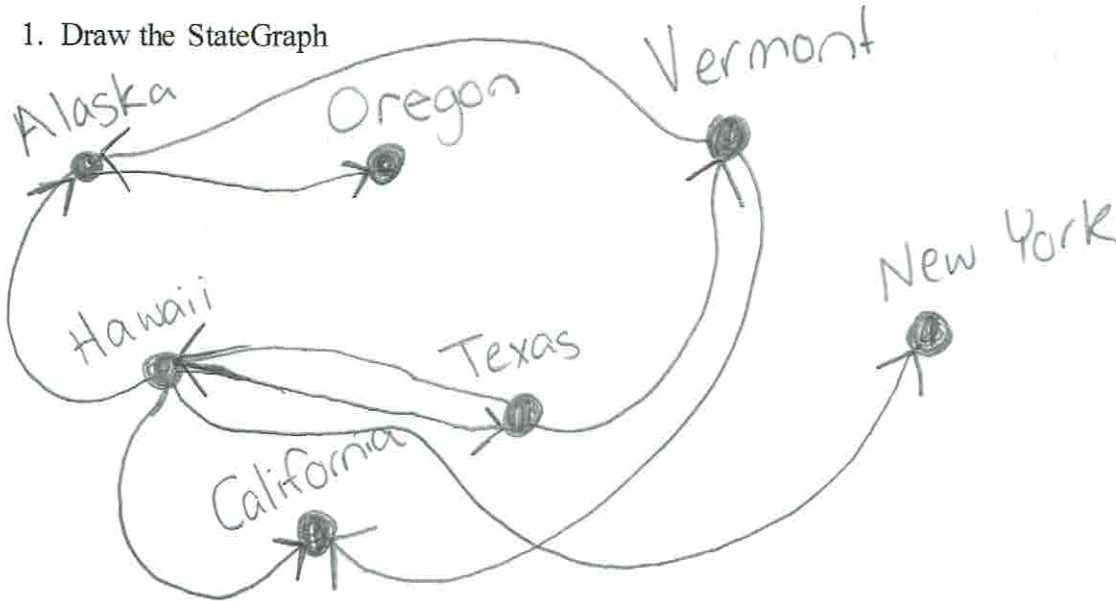
V(StateGraph) = {Oregon, Alaska, Texas, Hawaii, Vermont, NewYork, California}
E(StateGraph) = {(Alaska, Oregon), (Hawaii, Alaska), (Hawaii, Texas), (Texas, Hawaii), (Hawaii, California), (Hawaii, New York), (Texas, Vermont), (Vermont, California),   (Vermont, Alaska)}

1. Draw the StateGraph

Alaska   Oregon   Vermont

Hawaii   Texas   New York

California

1. Describe the graph pictured above, using the formal graph notation.

V(StateGraph) = {Oregon, Alaska, Texas, Hawaii, Vermont, New York, california}

E(StateGraph) = {(A,O), (H,A), (H,T), (T,H), (H,C), (H,NY), (T,V), (V,C)}

2. a. Is there a path from Oregon to any other state in the graph?

b. Is there a path from Hawaii to every other state in the graph?

c. From which state(s) in the graph is there a path to Hawaii?
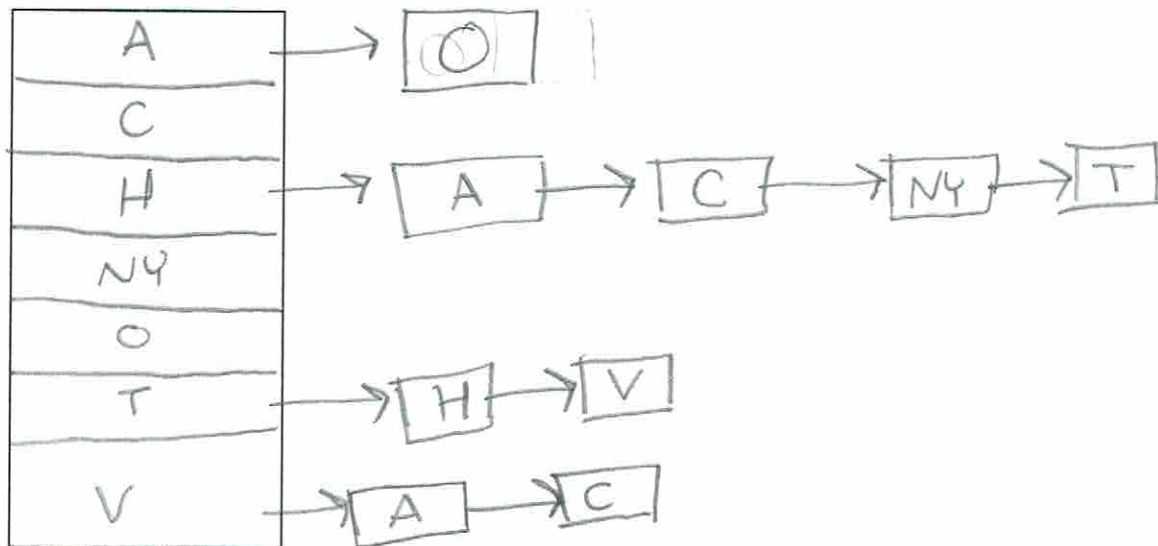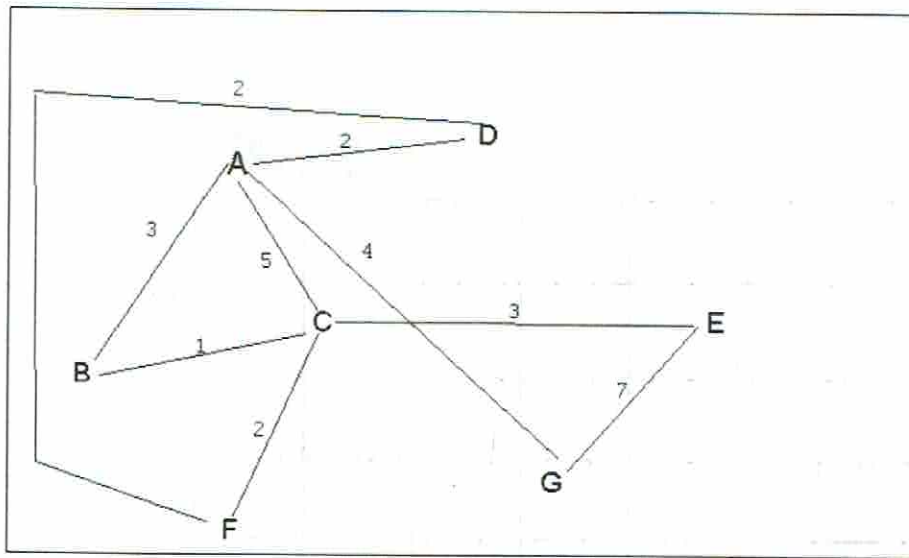
2a : No.

2b : Yes.

2c : Texas.

3.

a. Show the adjacency matrix that would describe the edges in the graph. Store the vertices in alphabetical order

For a directed graph:

States	A	C	H	NY	O	T	V
A	0	0	0	0	1	0	0
C	0	0	0	0	0	0	0
H	1	1	0	1	0	1	0
NY	0	0	0	0	0	0	0
O	0	0	0	0	0	0	0
T	0	0	1	0	0	0	1
V	1	1	0	0	0	0	0

3. b. Show the adjacency lists that would describe the edges in the graph

A	→ [O]
C	
H	→ [A] → [C] → [NY] → [T]
NY	
O	
T	→ [H] → [V]
V	→ [A] → [C]

4 a. Which of the following lists the graph nodes in depth first order beginning with E?
A)   E, G, F, C, D, B, A
B)   G, A, E, C, B, F, D
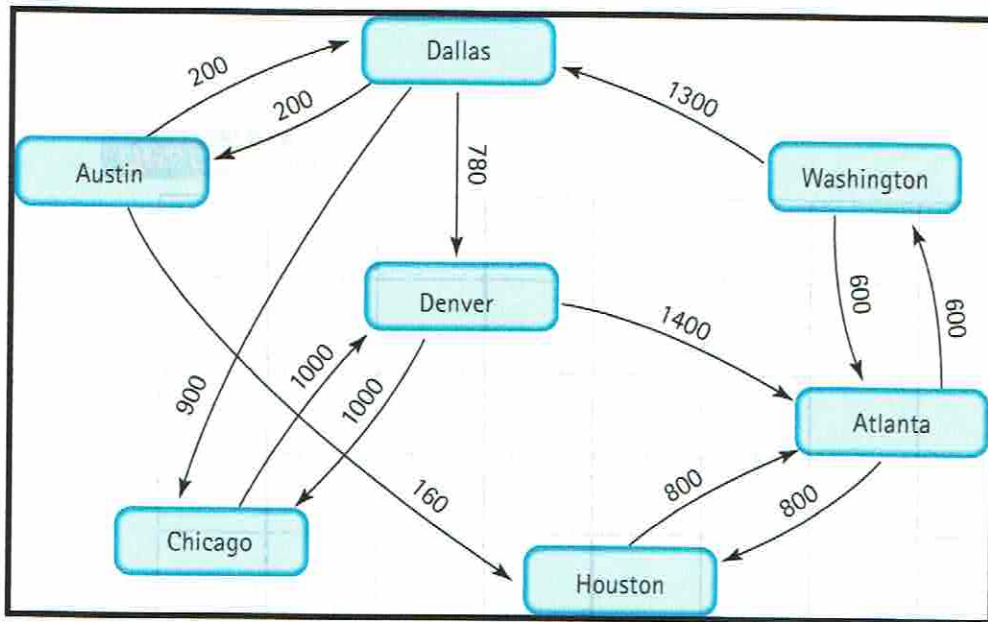C)   E, G, A, D, F, C, B
D)   E, C, F, B, A, D, G

C

4 b. Which of the following lists the graph nodes in breadth first order beginning at F?
A) F, C, D, A, B, E, G ✓
B) F, D, C, A, B, C, G ✗
C) F, C, D, B, G, A, E ✗
D) a, b, and c are all breadth first traversals

A

The graph shows cities connected by directed edges with distances:
- Austin to Dallas: 200
- Dallas to Austin: 200
- Dallas to Washington: 1300
- Dallas to Denver: 780
- Austin to Houston: 900
- Dallas to Chicago: 1000
- Chicago to Denver: 1000
- Denver to Atlanta: 1400
- Denver to Houston: 160
- Washington to Atlanta: 600
- Atlanta to Washington: 600
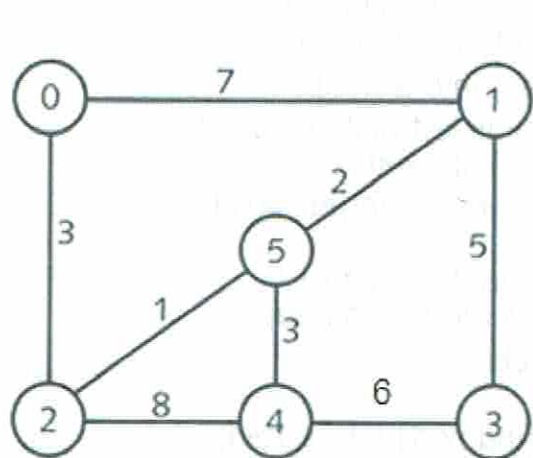- Houston to Atlanta: 800
- Atlanta to Houston: 800

5. Find the shortest <u>distance</u> from Atlanta to every other city

Atlanta to Washington: 600
Atlanta to Houston: 800
Atlanta to Dallas: 1900
Atlanta to Denver: 2680
Atlanta to Austin: 2100
Atlanta to Chicago: 2800

6. Find the minimal spanning tree using Prim's algorithm. Use 0 as the source vertex. Show the steps.
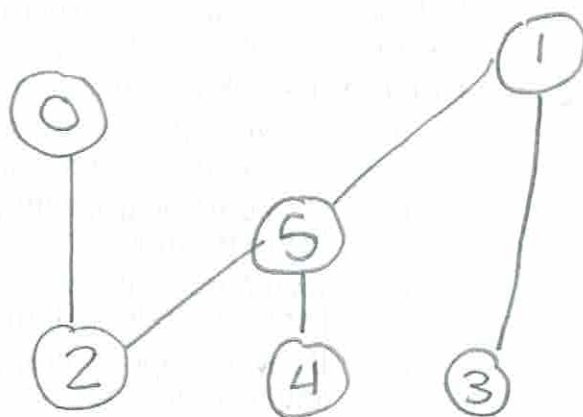
Set: $\{0\}$

choose edge weight 3

$\{0,2\}$

choose edge weight 1

$\{0,2,5\}$

CEW 2

$\{0,2,5,1\}$
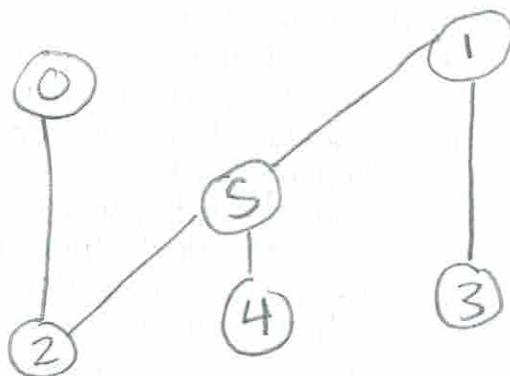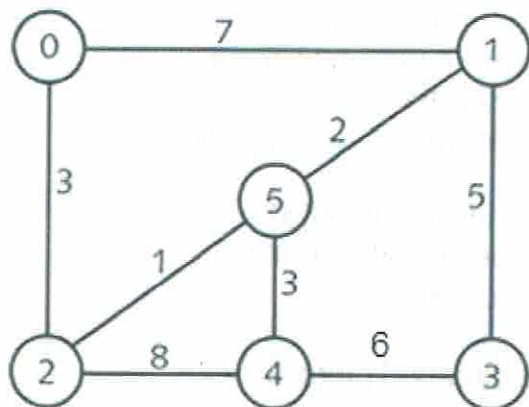
CEW 3

$\{0,2,5,1,4\}$

CEW 5

$\{0,2,5,1,4,3\}$

7. Find the minimal spanning tree using Kruskal's algorithm.
Show the weights in order and the steps.

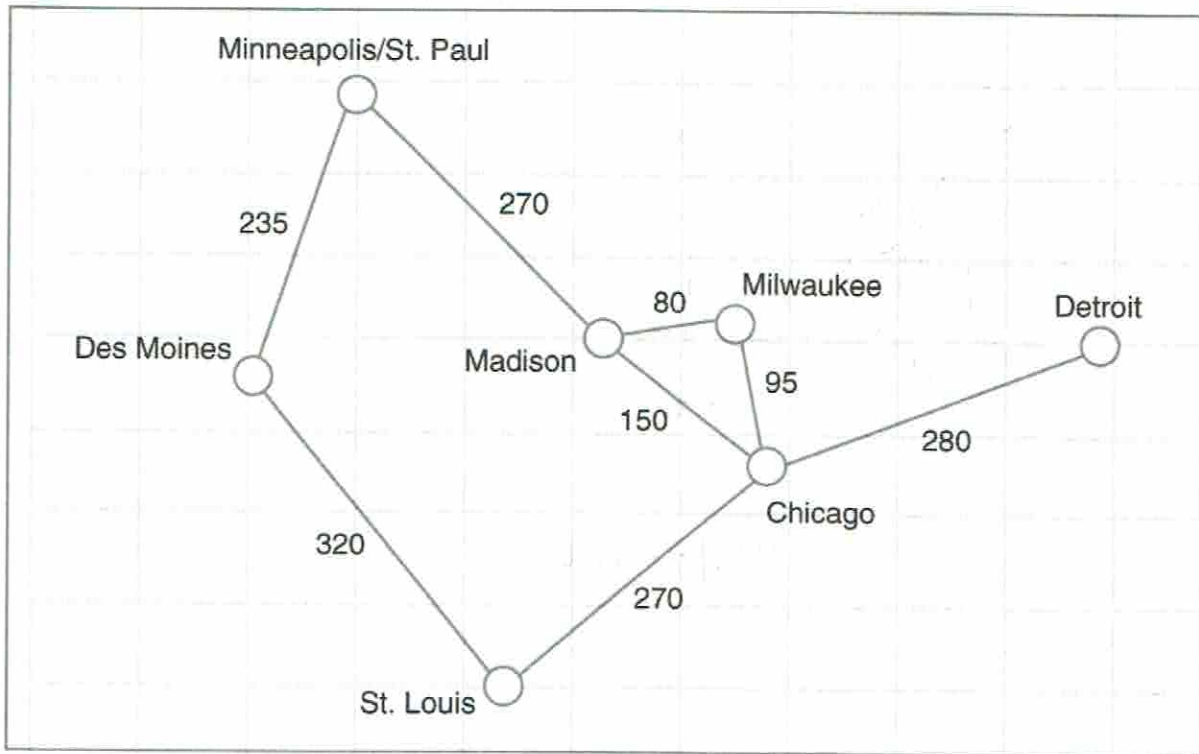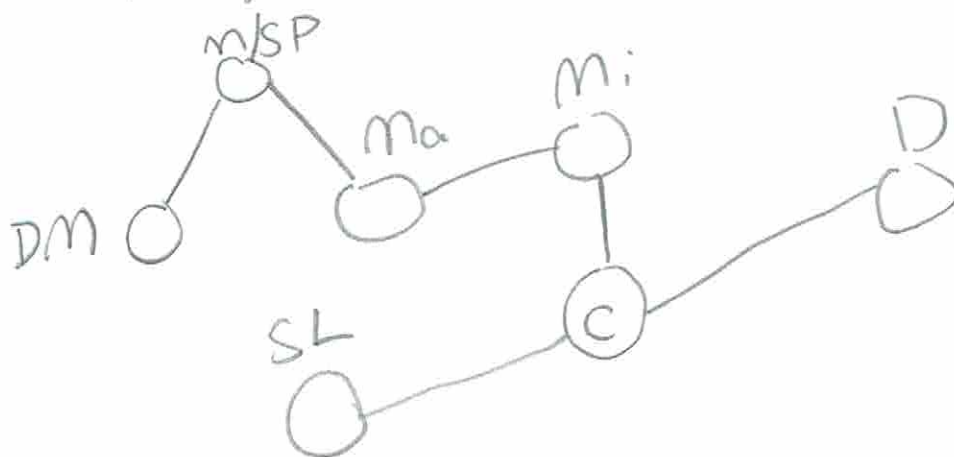| 2,5	5,1	0,2	5,4	1,3	4,3	0,1	2,4
1	2	3	3	5	6	7	8

Add 2,5

Add 5,1

Add 0,2

Add 5,4

Add 1,3

8. Find the minimal spanning tree using the algorithm you prefer. Use Minneapolis/St. Paul as the source vertex

m/S, choose 235 → ms,Dm, choose 270 →
ms,Dm,Ma, choose 80 → ms, Dm, Ma, Mi,
Choose 95 → ms, Dm, Ma, Mi, C, choose 270 →
ms, Dm, Ma, Mi, C, SL, choose 280 →
MS, Dm, Ma, Mi, C, SL, D

9. List the nodes of the graph in a breadth first topological ordering. Show the
   steps using arrays predCount, topologicalOrder and a queue
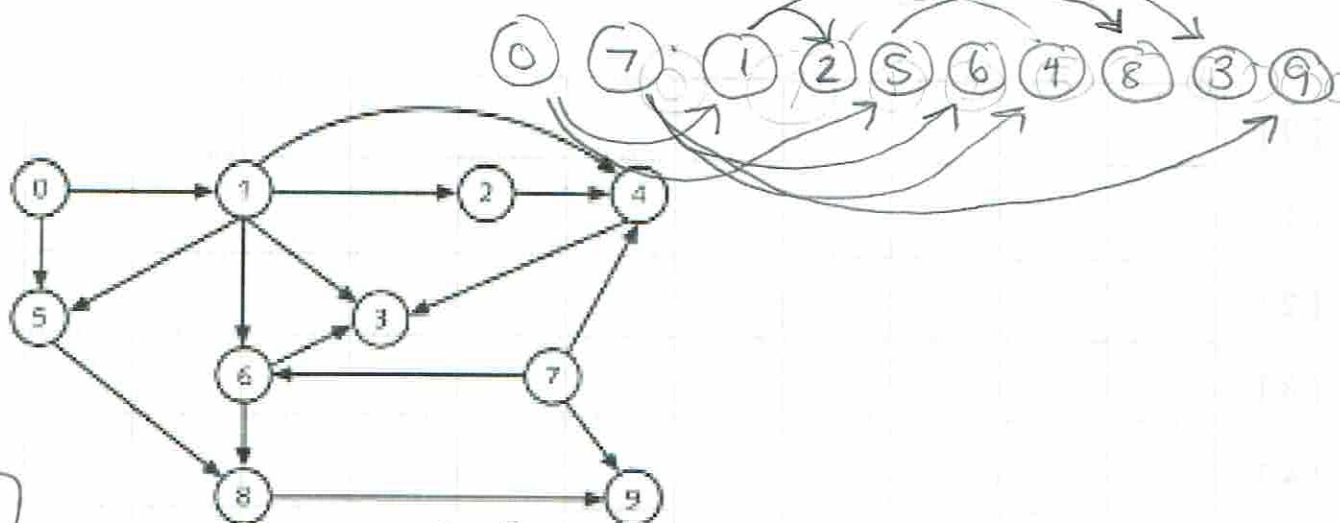
STEPS

Start with
0 and 7

Remove 0

Decrement
1 and 5

Add 1

Remove 7

Decrement
4, 6 and 9

Remove 1

Decrement
2, 3, 4, 5, 6

Add 2

Add 5

Add 6

Remove 2

Decrement 4

Add 4

predCount

0	1	1	3	3	2	2	0	2	2
0	1	2	3	4	5	6	7	8	9

topologicalOrder

0	7	1	2	5	6	4	8	3	9

Queue

0*	7*	1*	2*	5*	6*	4*	8	3	9

| Remove | Decrement | Add | Remove | Decrement | Add 9 |
| 4 | 3 | 3 | 8 | 9 | |

| Remove 5 | Decrement 8 | Remove 6 | Decrement 3,8 | Add 8 | Remove 8, 3,9 |

10. List the nodes of the graph in a breadth first topological ordering.
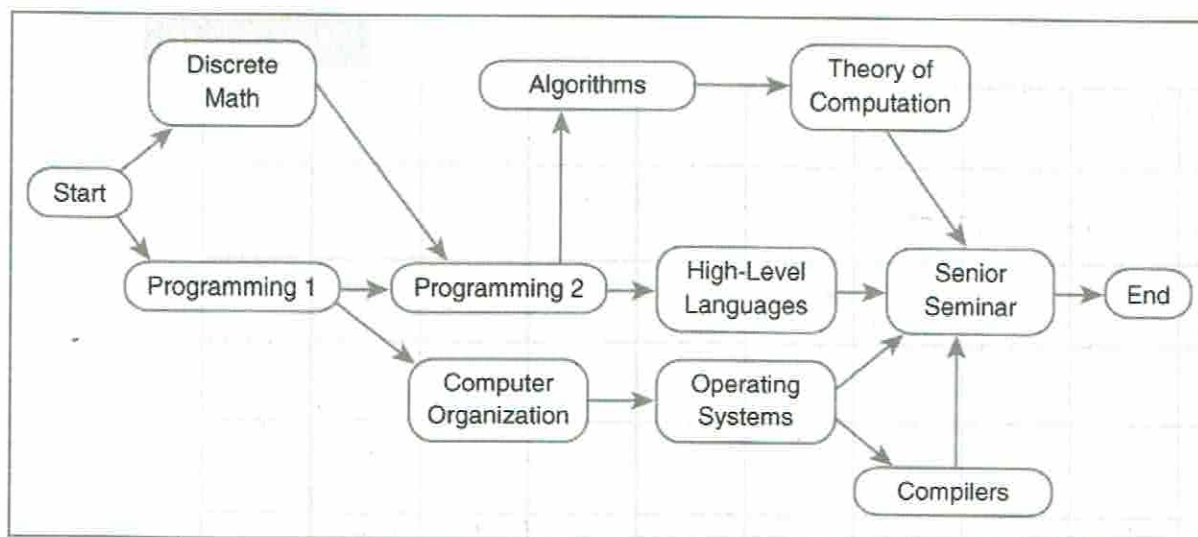
prod Count

Start	0
Dm	1 0
P1	1 0
P2	2 1 0
A	1 0
CO	1 0
HLL	1 0
TOC	1 0
OS	1 0
SS	4 3 2 1 0
CMPI	1 0
END	1

queue
Start, ~~DM~~, ~~P1~~ P2, ~~CO~~, A, HLL, ~~OS~~, ~~TOC~~,
~~compl~~, SS, ~~END~~

(TO
→ Start, DM, P1, P2, CO, A, HLL, OS, TOC,
COMPL, SS, END