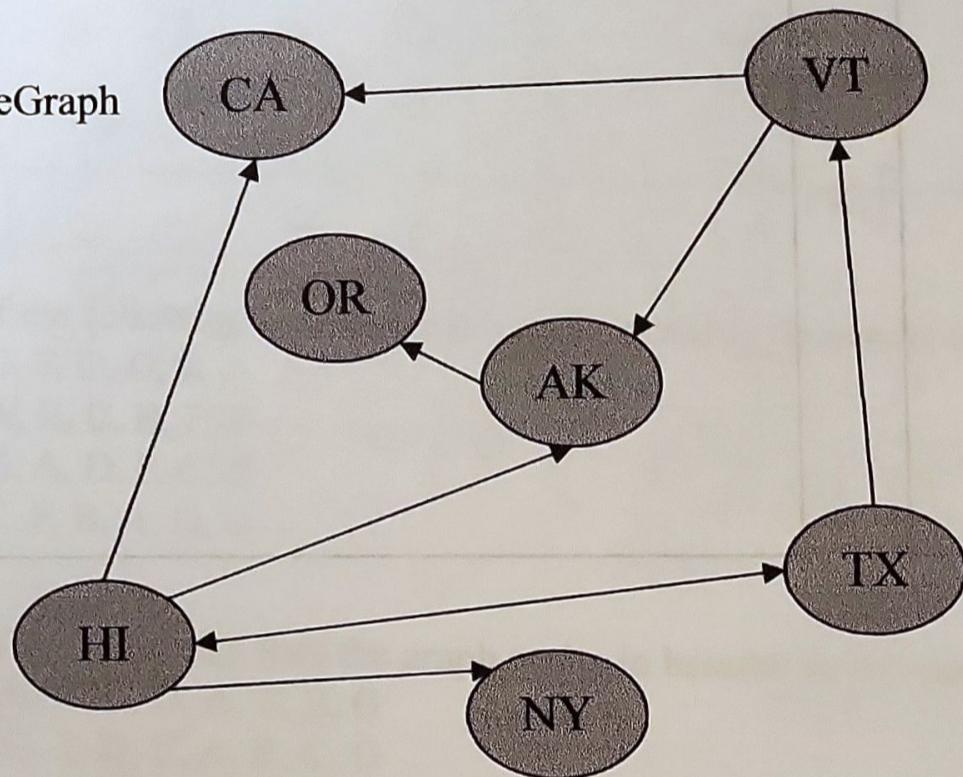


$$V(\text{StateGraph}) = \{\text{Oregon, Alaska, Texas, Hawaii, Vermont, New York, California}\}$$

$$E(\text{StateGraph}) = \{(\text{Alaska, Oregon}), (\text{Hawaii, Alaska}), (\text{Hawaii, Texas}), (\text{Texas, Hawaii}), (\text{Hawaii, California}), (\text{Hawaii, New York}), (\text{Texas, Vermont}), (\text{Vermont, California}), (\text{Vermont, Alaska})\}$$

1. Draw the StateGraph



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

→ $V(\text{StateGraph}) =$

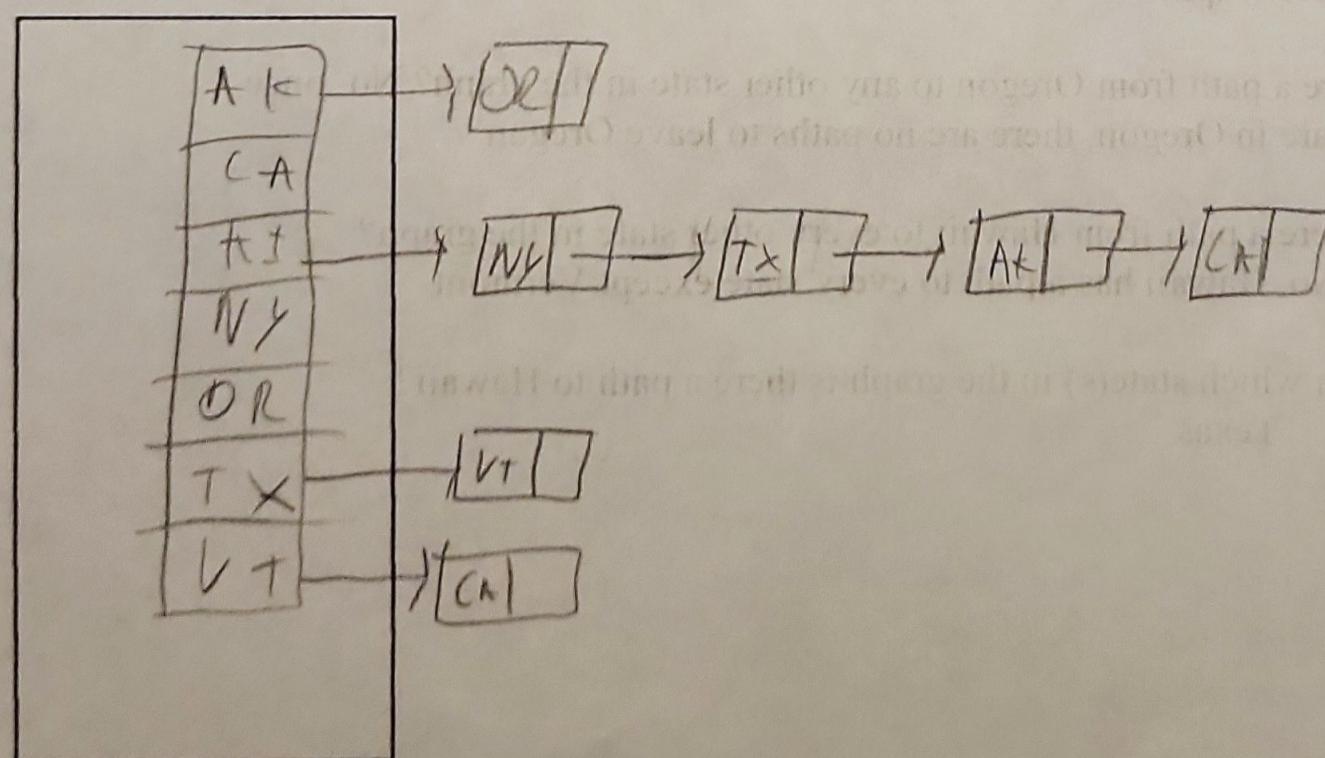
→ $E(\text{StateGraph}) =$

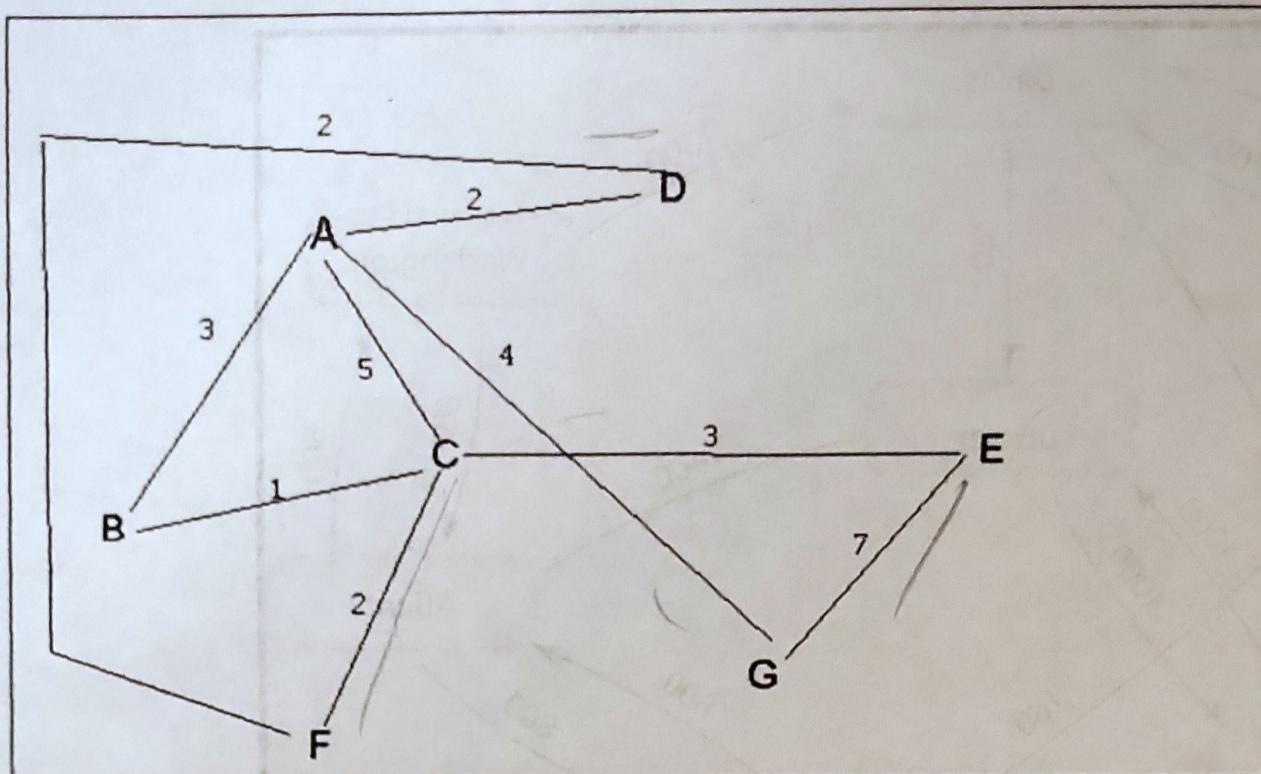
2. a. Is there a path from Oregon to any other state in the graph? No, once you are in Oregon, there are no paths to leave Oregon
- b. Is there a path from Hawaii to every other state in the graph?
No, Hawaii has a path to every state except Vermont
- c. From which state(s) in the graph is there a path to Hawaii?
Texas

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

States	Ak	CA	HI	NY	OR	TX	VT
Flm	Ak	0 0	0 0	1 0	0	0	0
	CA	0 0	0 0	0 0	0 0	0	0
	HI	1 1	0 1	0 1	0 0	0 0	0
	NY	0 0	0 0	0 0	0 0	0	0
	OR	0 0	0 0	0 0	0 0	0	0
	TX	0 0	0 0	0 0	0 0	0	0
	VT	1 0	0 0	0 0	0 0	0	0

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





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

Stack

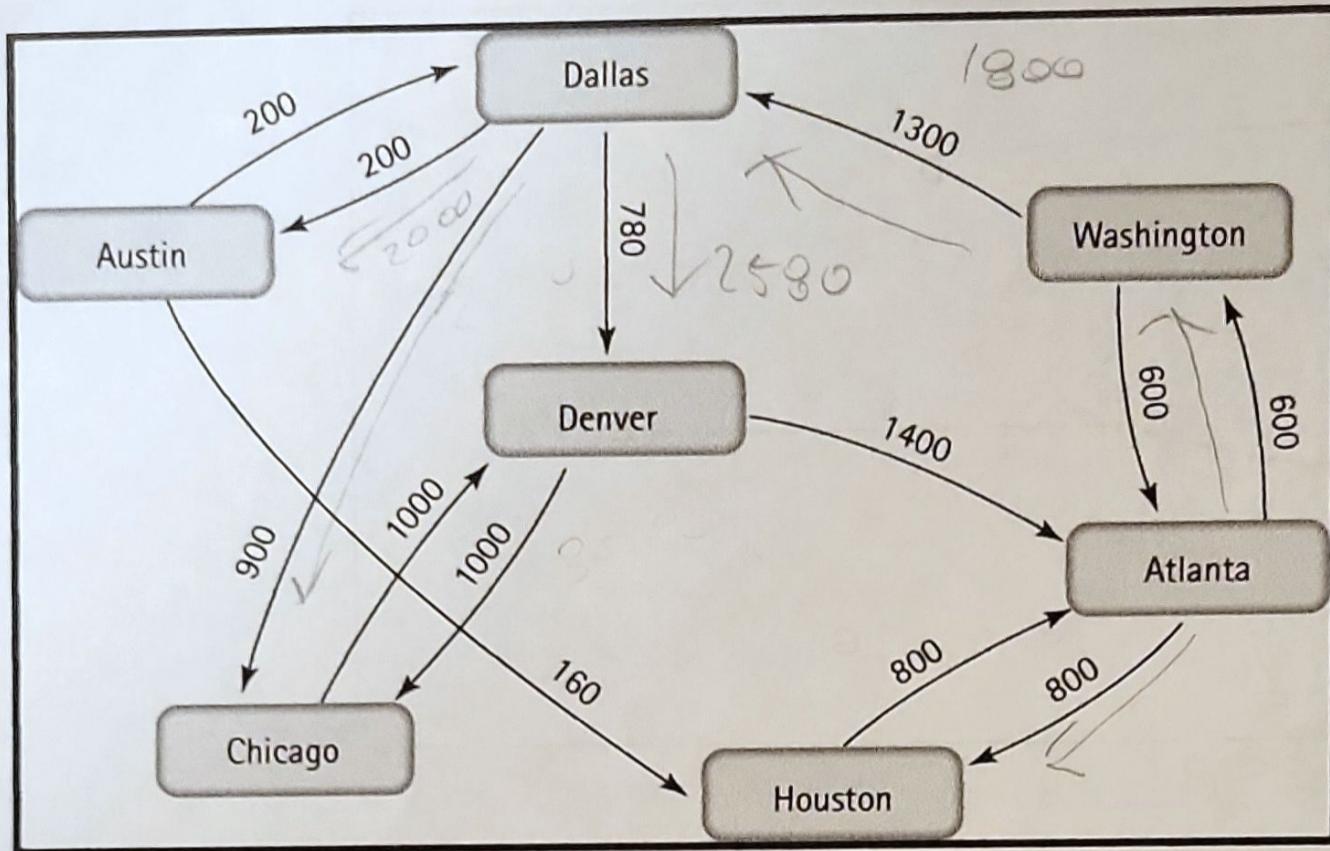
E C F B A D G

4 b. Which of the following lists the graph nodes in breadth first order beginning at F?

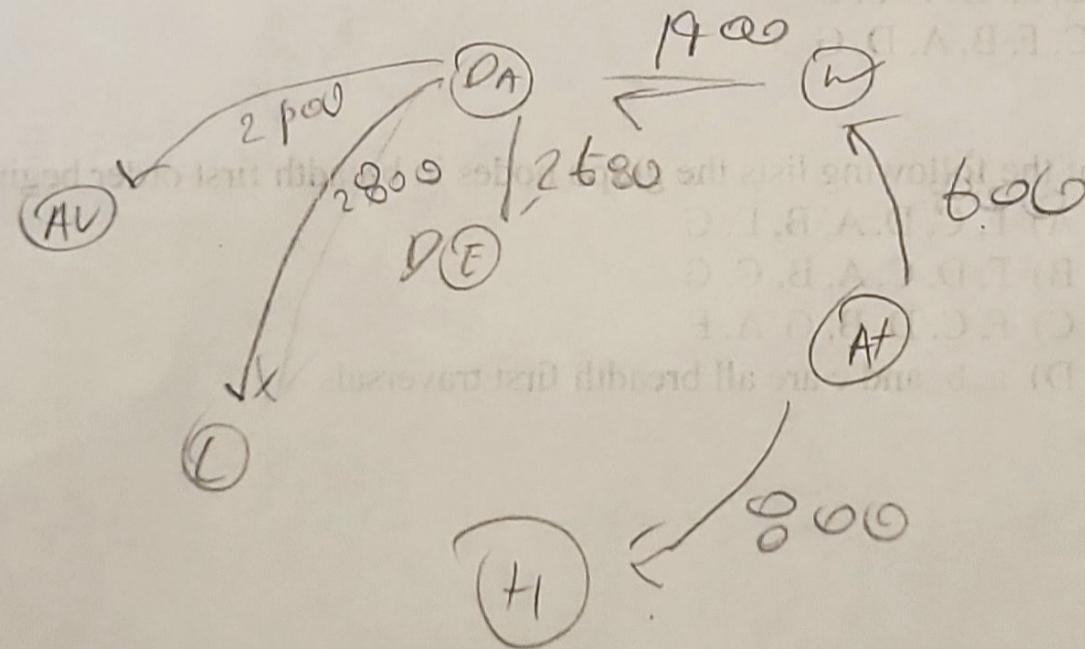
- (A) F, C, D, A, B, E, G
- (B) F, D, C, A, B, C, G
- (C) F, C, D, B, G, A, E
- (D) a, b, and c are all breadth first traversals

Queue

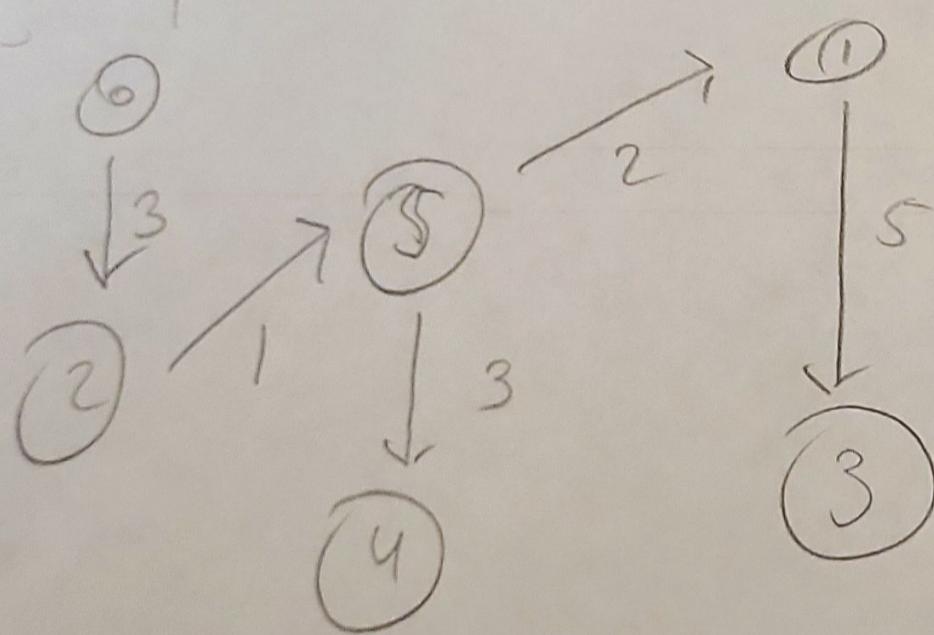
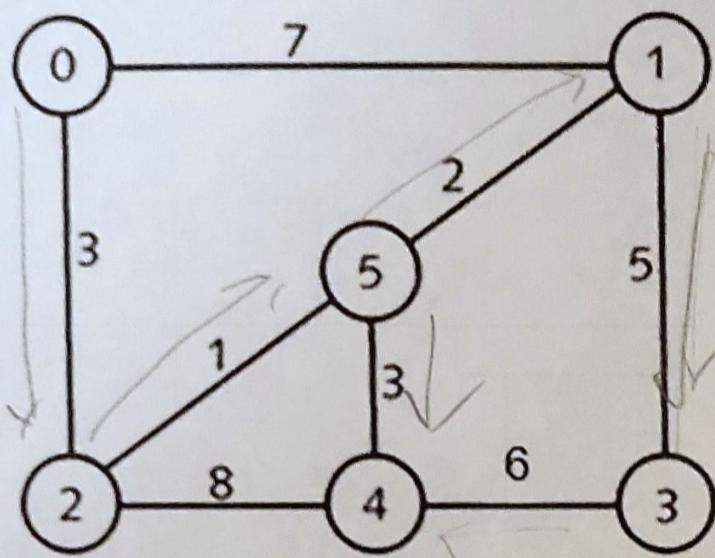
F T C D A B E G



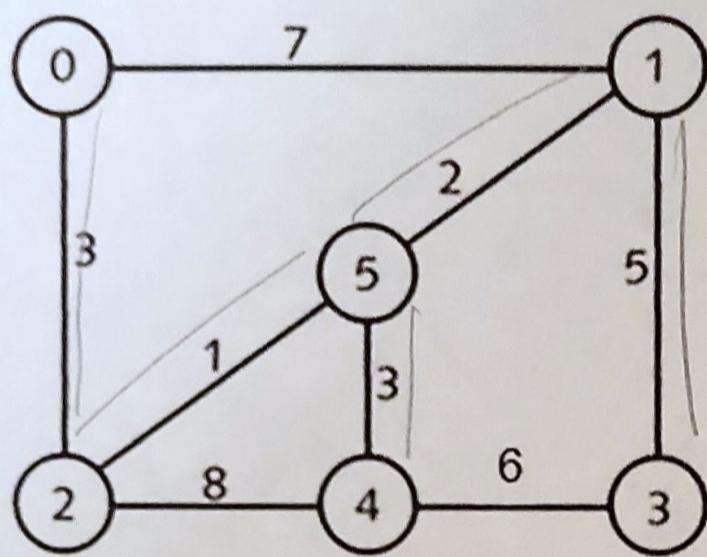
5. Find the shortest distance from Atlanta to every other city



6. Find the minimal spanning tree using Prim's algorithm. Use 0 as the source vertex. Show the steps.



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

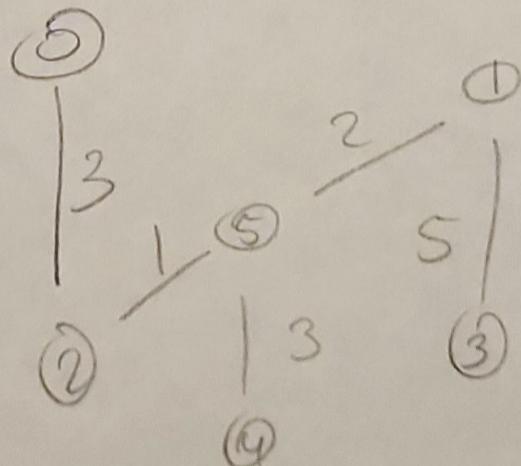


$5 \leftarrow 2$
 $5 \leftarrow 1$
 $5 \leftarrow 3$
 $0 \leftarrow 3$

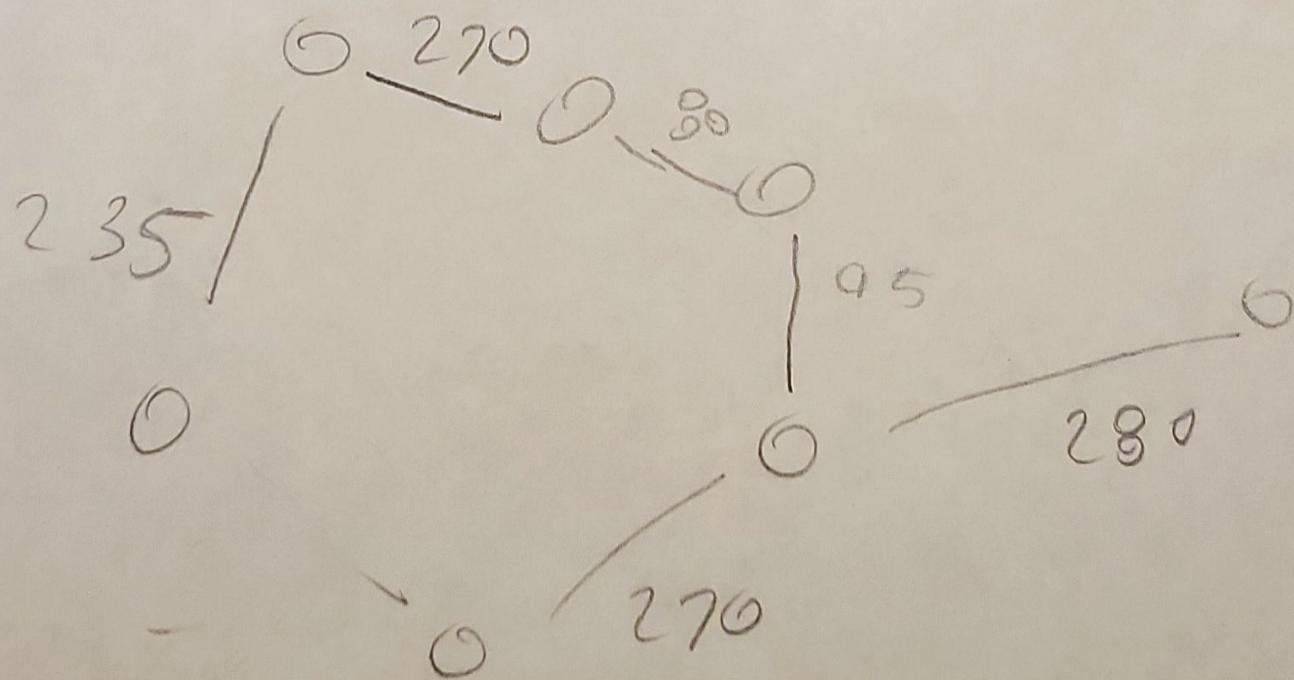
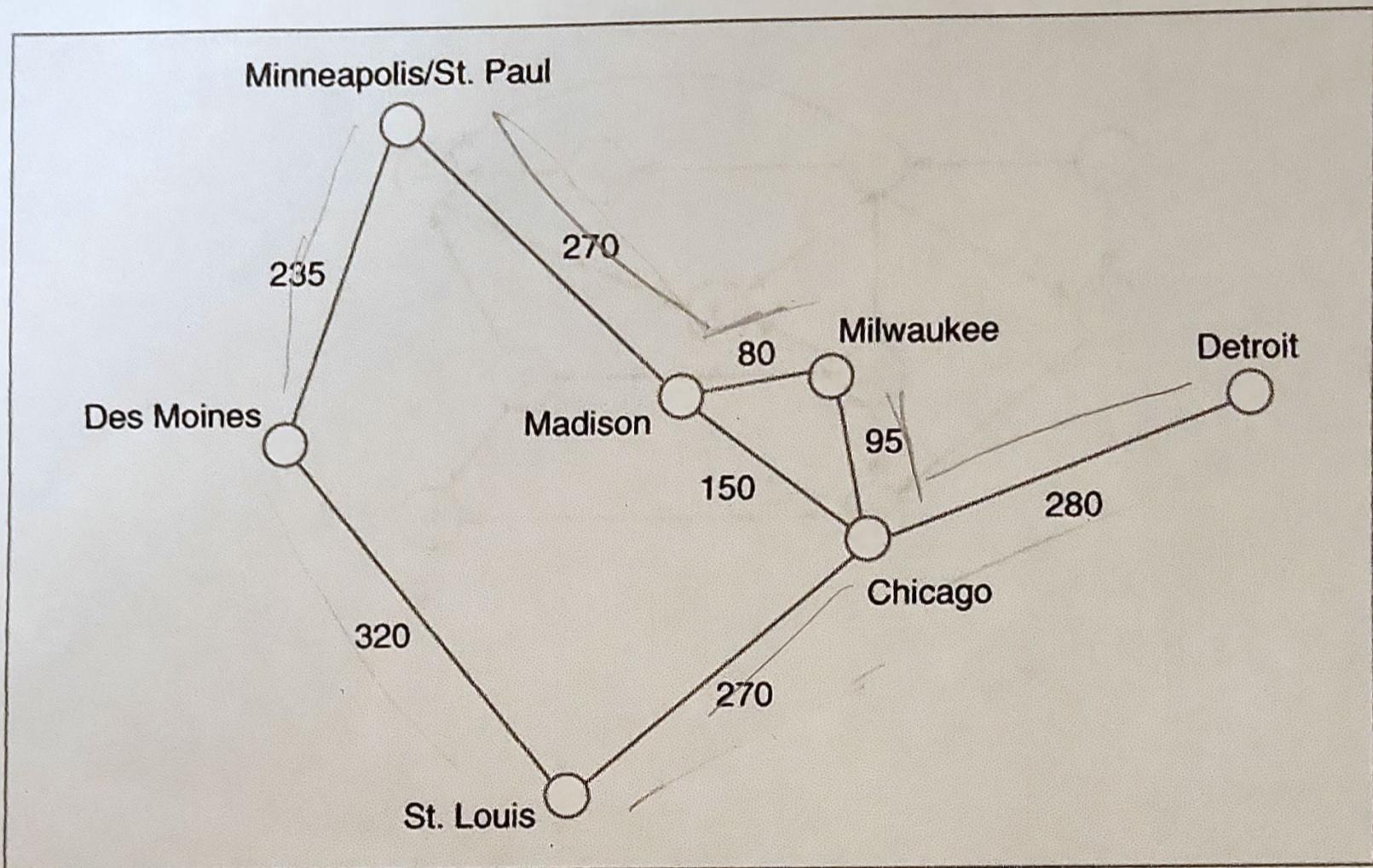
$1 \leftarrow 3$
 $4 \leftarrow 3$
 $0 \leftarrow 1$
 $4 \leftarrow 2$

1 2 3 3 5

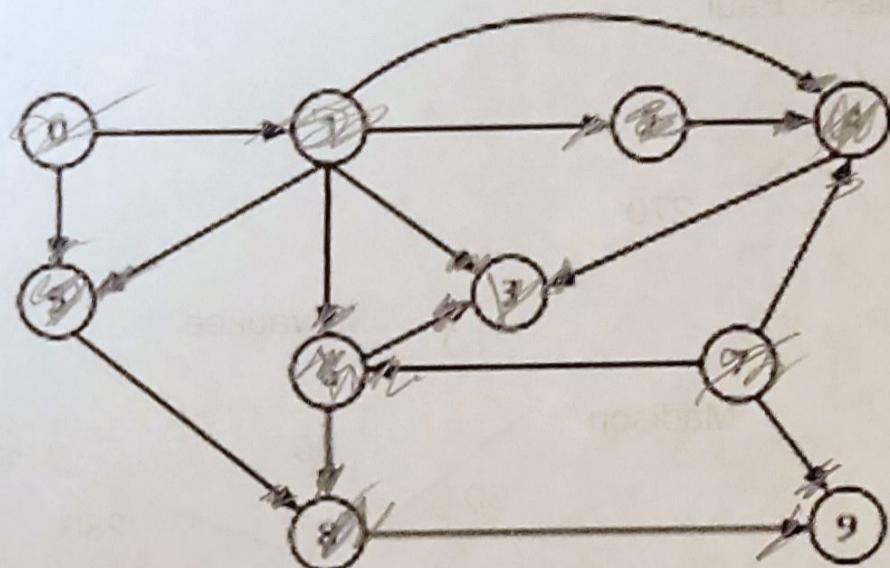
weights in order



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



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



Pred Count +

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

Order

-	0	1	3	2	1	7	-	2	+
-	1	0	2	1	0	0	-	2	1
--	-	1	0	-	-	-	-	1	1
2	7	-	0	-	-	-	-	0	1

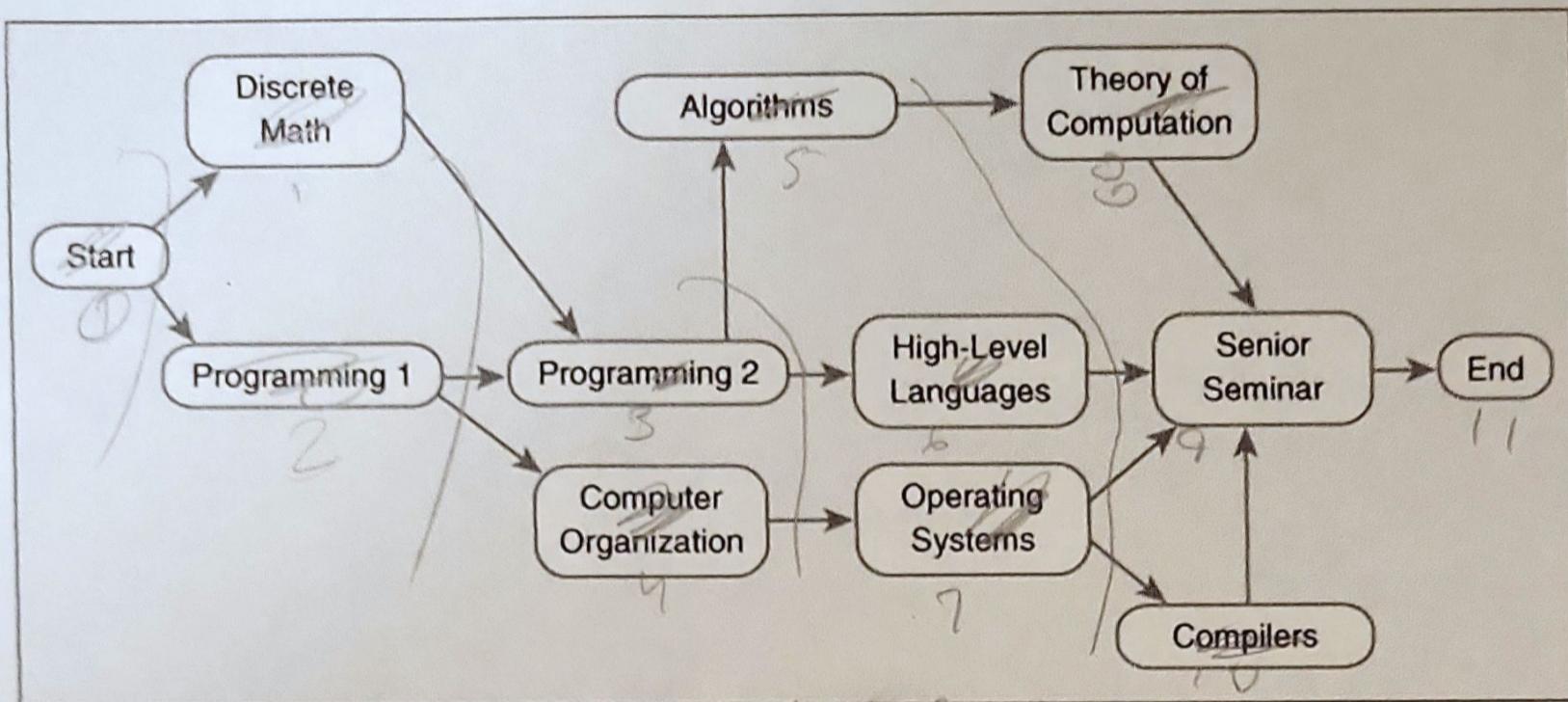
topologicalOrder

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

queue

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

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



pred count

0	1	1	2	1	1	1	1	1	1	1	1	1
-	0	0	2	1	1	1	1	1	4	1	1	1
-	-	-	0	0	1	1	1	1	4	1	1	1
-	-	-	-	0	0	0	1	4	1	1	1	1

0 1 2 3 4 5 6 7 8 9 10
+ topo logical order

0, 1, 2, 3, 4, 5, 6, 7, 8, 10, 9, 11