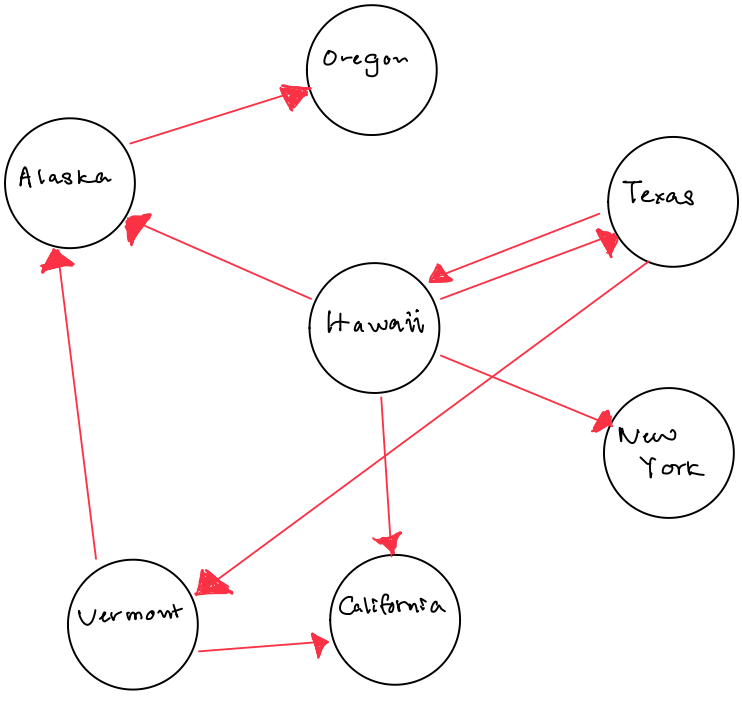
CMSC204
Kartchner

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



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

V(StateGraph) = {Oregon, Alaska, Texas, Hawaii, Vermont, New York, California).

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

2. a. Is there a path from Oregon to any other state in the graph? No.

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

   c. From which state(s) in the graph is there a path to Hawaii?

Texas

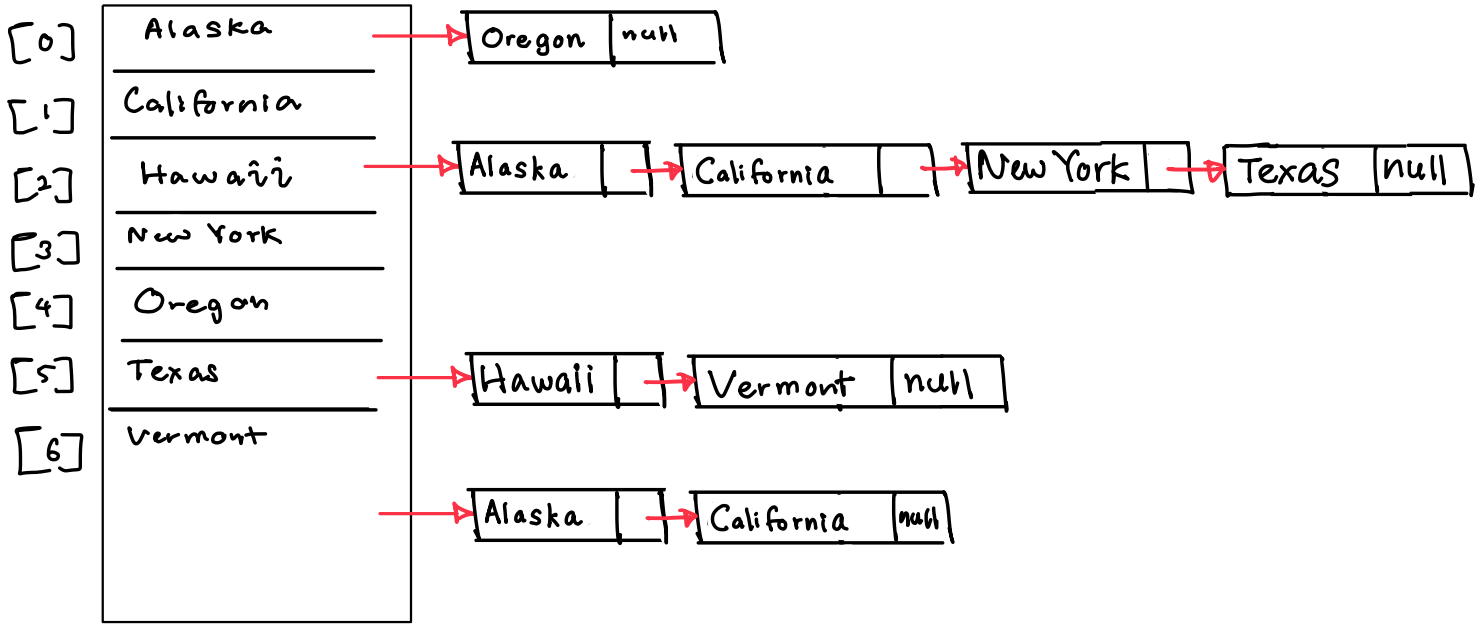
3. a. Show the adjacency matrix that would describe the edges in the graph.
Store the vertices in alphabetical order

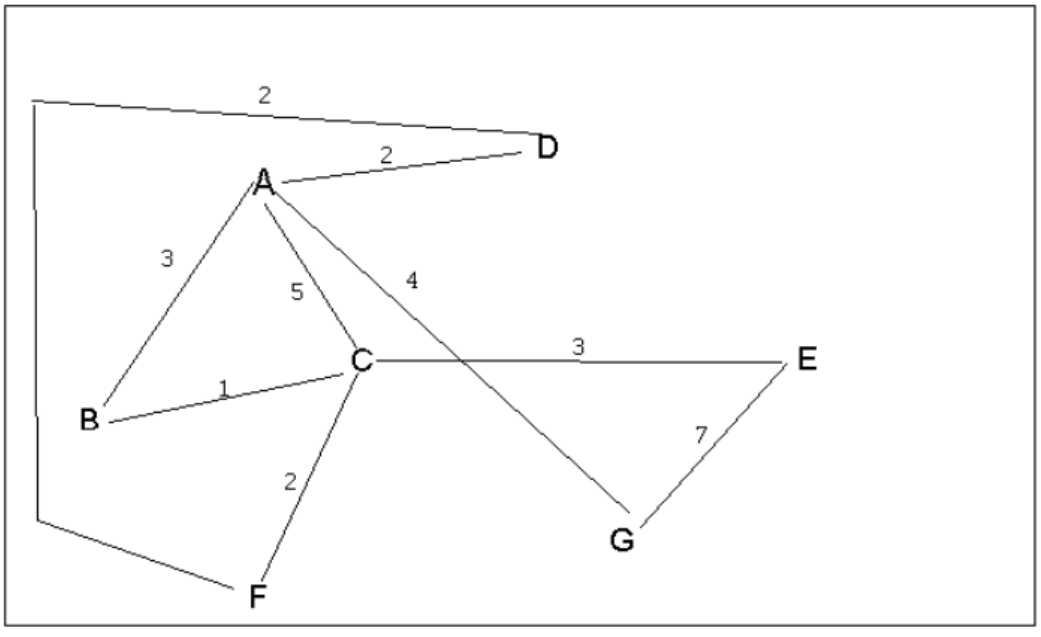
States

[0]	Alaska
[1]	California
[2]	Hawaii
[3]	New York
[4]	Oregon
[5]	Texas
[6]	Vermont

	0	1	2	3	4	5	6
0	0	0	0	0	1	0	0
1	0	0	0	0	0	0	0
2	1	1	0	1	0	1	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	1	0	0	0	1
6	1	1	0	0	0	0	0

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



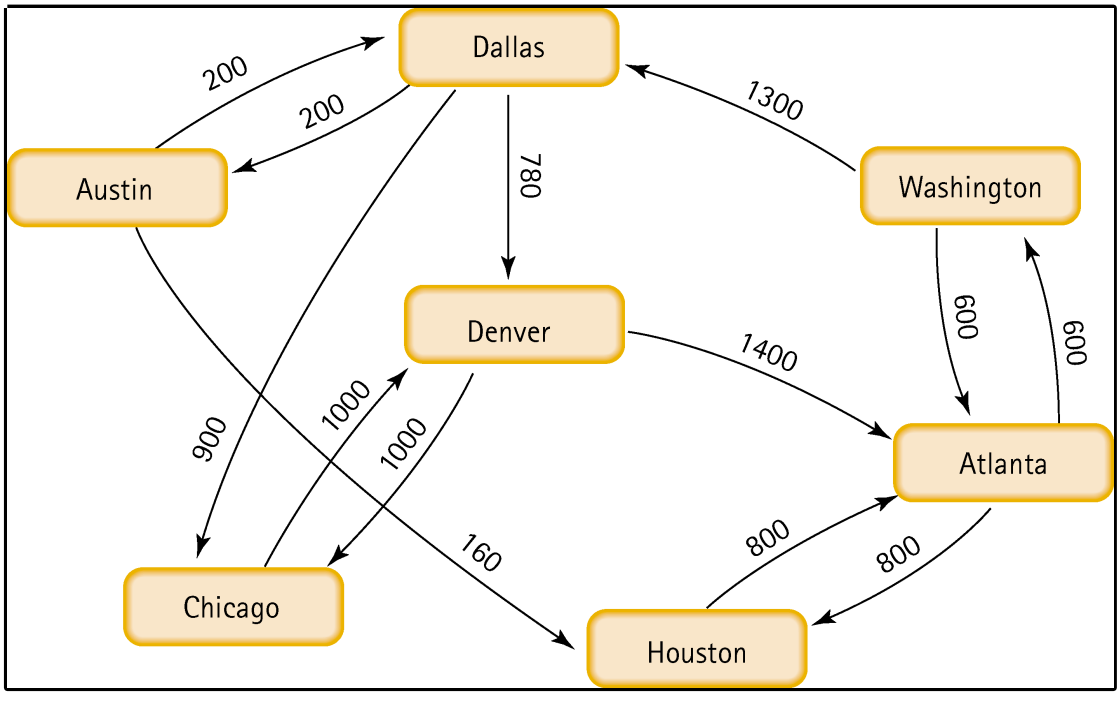


4 a. Which of the following lists the graph nodes in depth first order beginning with E?

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

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



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

Houston → 800

Washington → 600

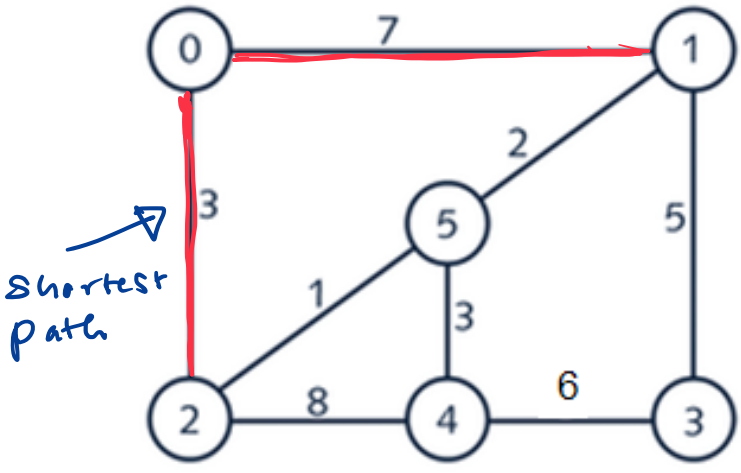
Dalas → 1900

Denver → 2680

Austin → 2100

Chicago → 2800

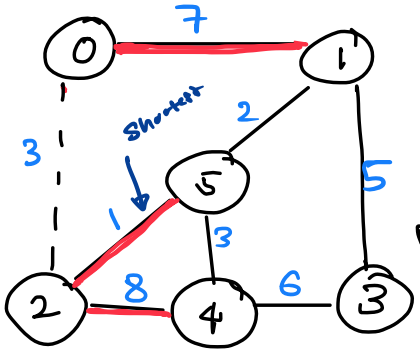
6. Find the minimal spanning tree using Prim's algorithm. Use 0 as the source vertex . Show the steps.



$V(T) = \{0\}$

$E(T) = \phi$

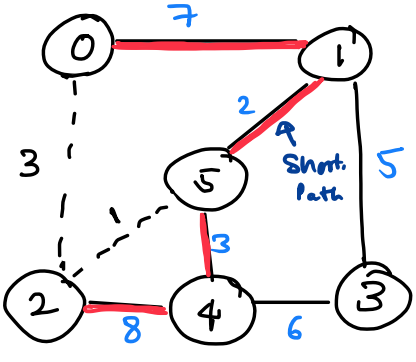
$N = \{1, 2, 3, 4, 5\}$



$V(T) = \{0, 2\}$

$E(T) = \{(0,2)\}$

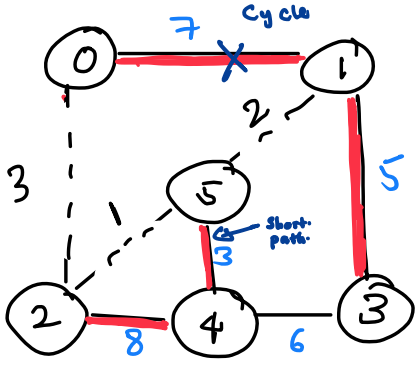
$N = \{1, 3, 4, 5\}$



$V(T) = \{0, 2, 5\}$

$E(T) = \{(0,2), (2,5)\}$

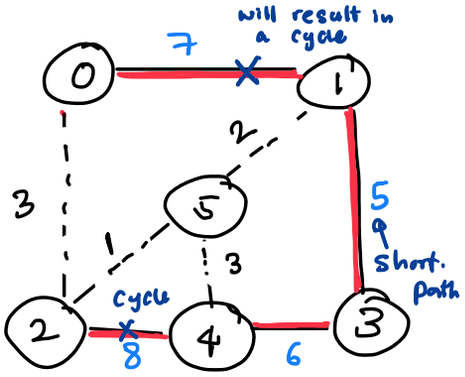
$N = \{1, 3, 4\}$



$V(T) = \{0, 1, 2, 5\}$

$E(T) = \{(0,2), (2,5), (5,1)\}$

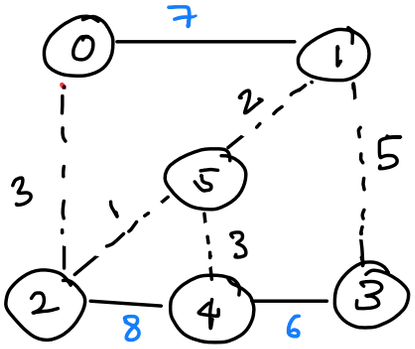
$N = \{3, 4\}$



$V(T) = \{0, 1, 2, 4, 5\}$

$E(T) = \{(0,2), (2,5), (5,1), (5,4)\}$

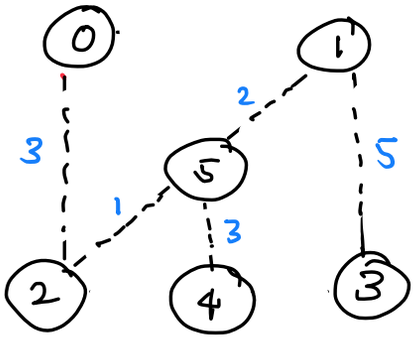
$N = \{3\}$



$V(T) = \{0, 1, 2, 3, 4, 5\}$

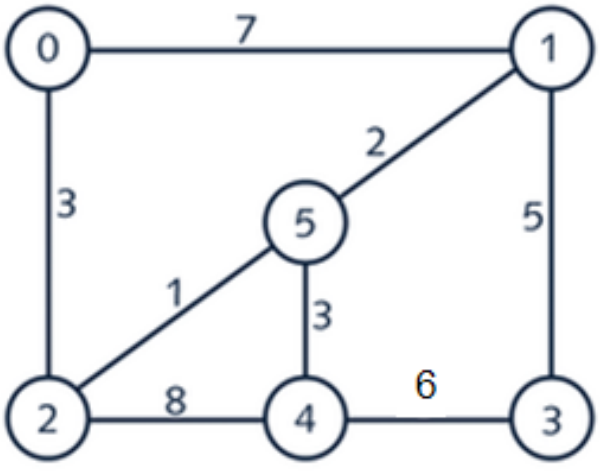
$E(T) = \{(0,2), (2,5), (5,1), (5,4), (1,3)\}$

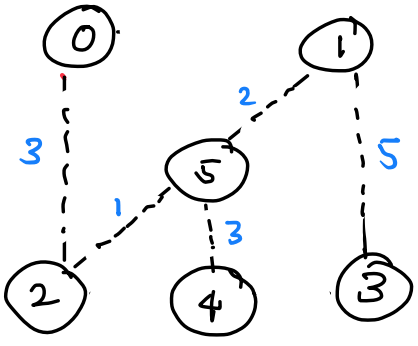
$N = \{\}$

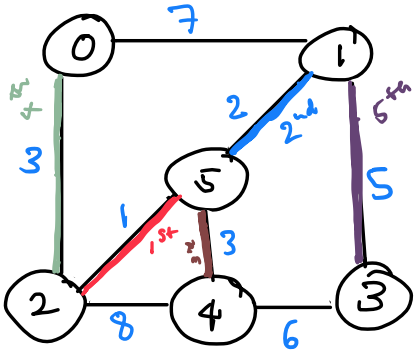


The minimum spanning tree

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





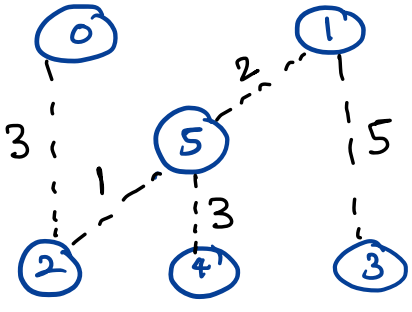


List all the vertices and edges in the order of weights

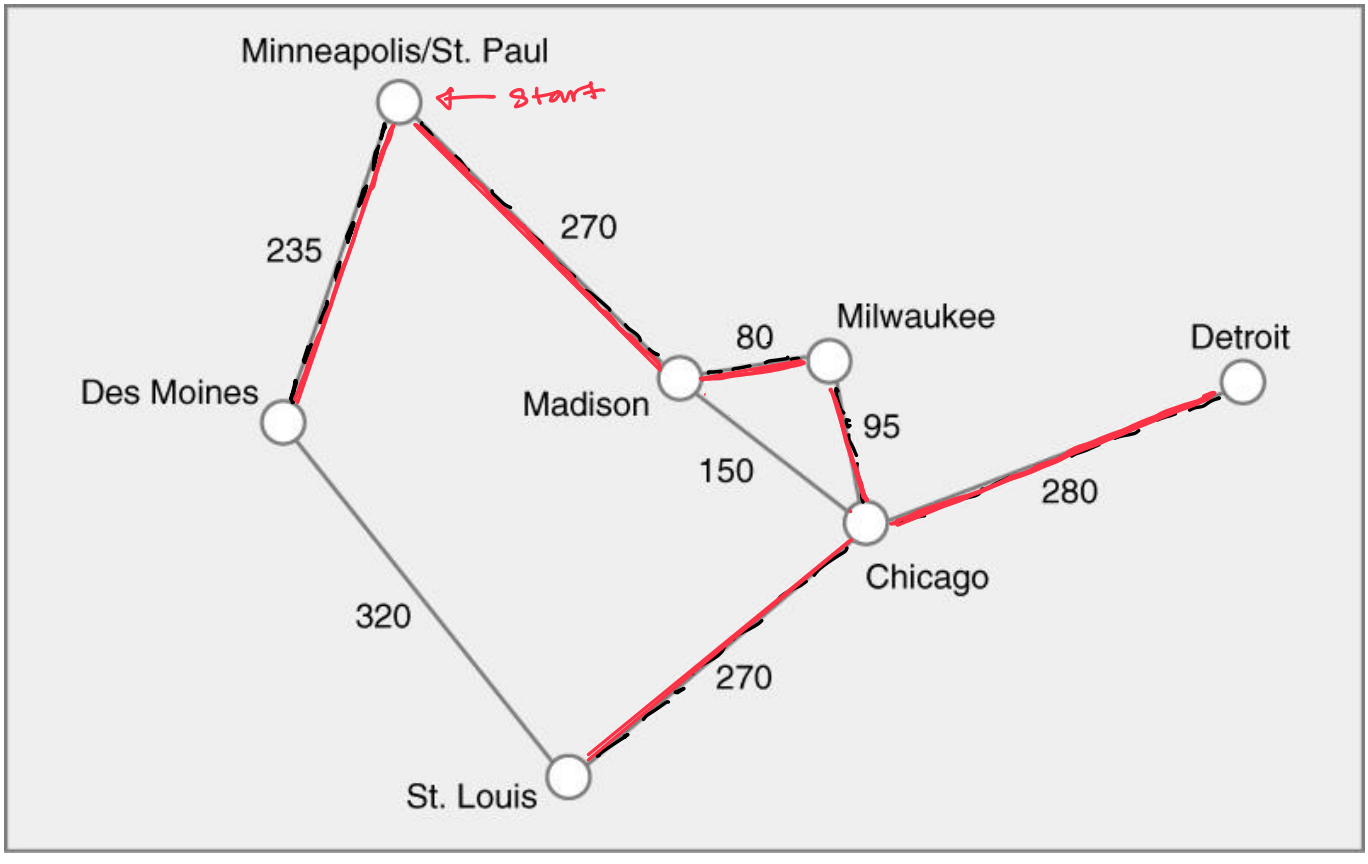
2-5 (1) ✓ add to the MST
5-1 (2) ✓ add to the MST
5-4 (3) ✓ add to the MST
0-2 (3) ✓ add to the MST
1-3 (5) ✓ add to the MST
4-3 (6) x not adding as it will cause a cycle
0-1 (7) x not adding as it will cause a cycle
2-4 (8) x not adding as it will cause a cycle

* the path @ each step is shown with the corresponding colour.

The MST



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



St paul. → Des Moins

St Paul → Madison

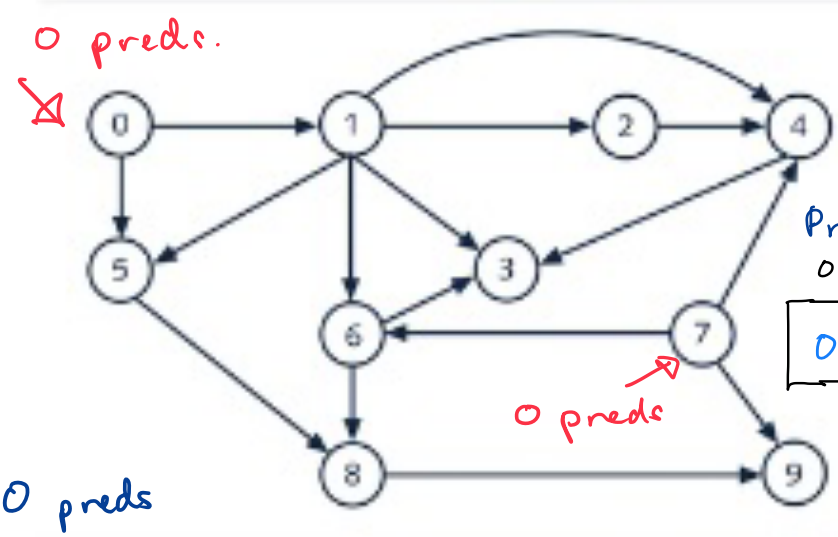
Madison → Milwaukee

Milwaukee → Chicago

Chicago → St. Louise

Chicago → Detroit

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

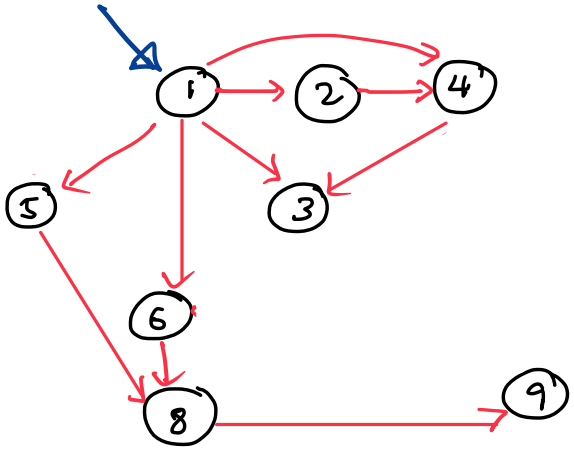


PredCount

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

queue

0, 7



PredCount

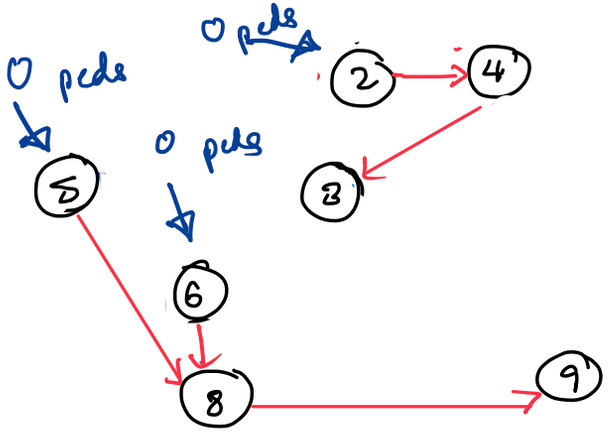
0	1	2	3	4	5	6	7	8	9
0	1	1	2	3	2	2	0	2	2

Topological order

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

Queue

0, 7, 1



PredCount

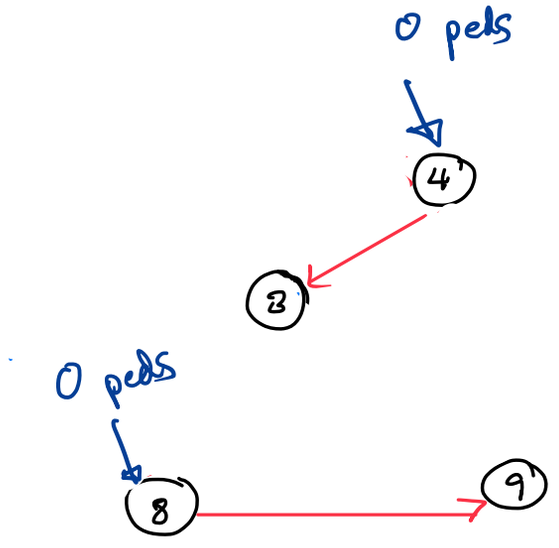
0	1	2	3	4	5	6	7	8	9
-	-	0	1	1	0	0	-	2	1

Topological order

0	1	2	3	4	5	6	7	8	9

Queue

0, 7, 1, 2, 5, 6



PredCount

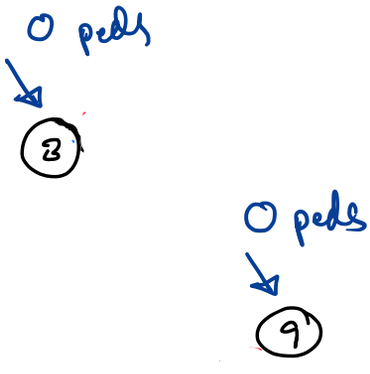
0	1	2	3	4	5	6	7	8	9
-	-	-	1	0	-	-	-	0	1

Topological order

0	1	2	3	4	5	6	7	8	9

Queue

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



PredCount

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

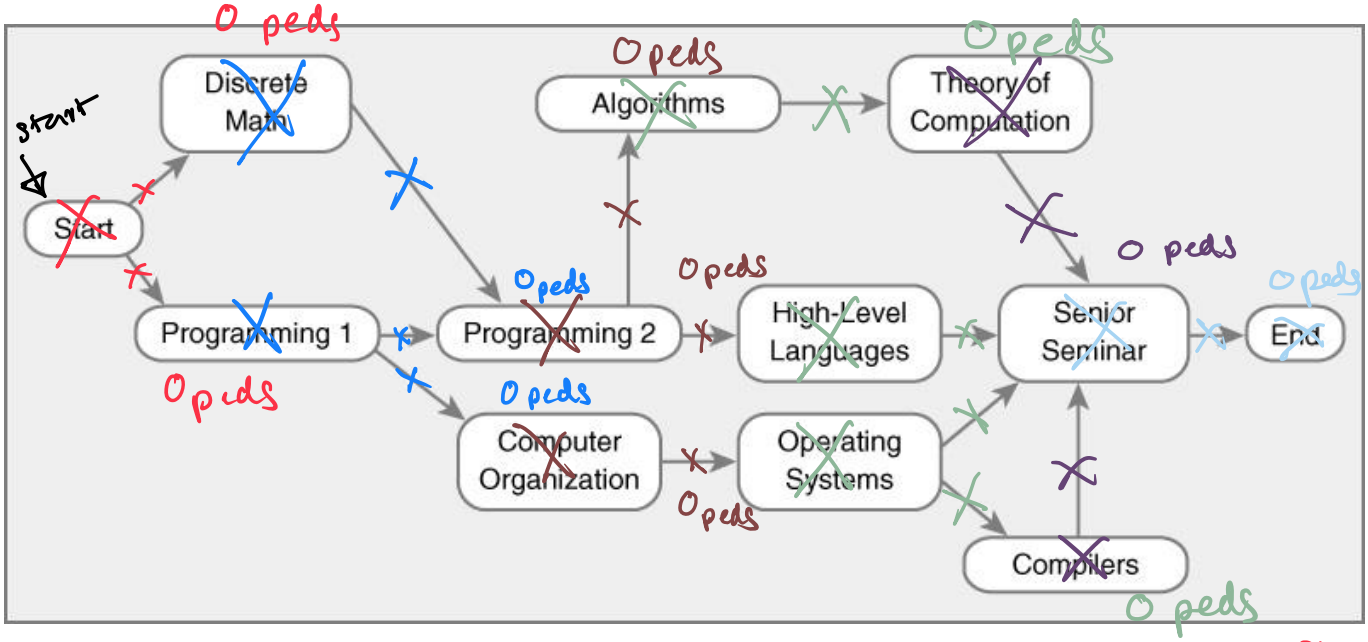
Topological order

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

Queue

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

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



Start (0 preds)

↓

discrete Math

↓

Programming 1

↓

programming 2

↓

computer organization

↓

Algorithms

↓

high-level languages

↓

operating systems

↓

compilers

↓

Theory of computation

↓

Senior Seminar

↓

end

1st step

2nd step

3rd step

4th step

5th step

6th step