Raymond Lanesman
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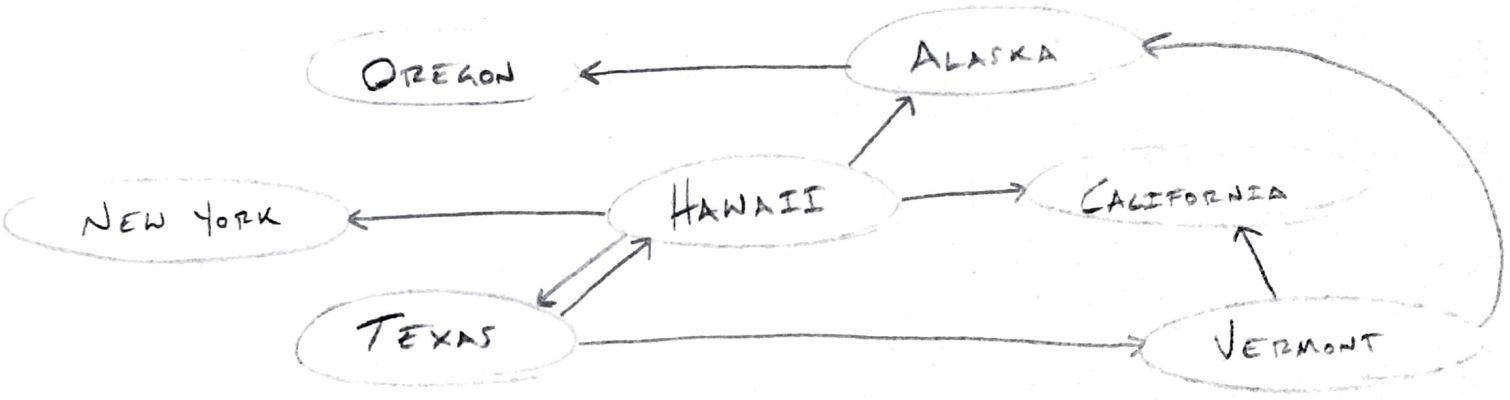
CMSC-204-3305

CMSC204

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}

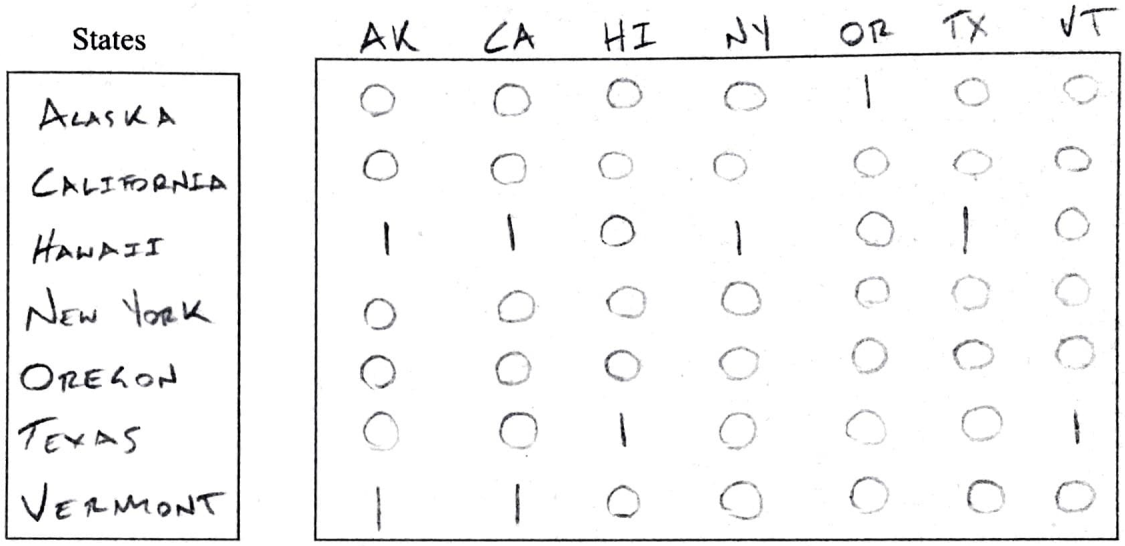
E(StateGraph) = {(Alaska, Oregon), (Hawaii, Alaska), (Hawaii, Texas), (Texas, Hawaii), (Hawaii, California), (Hawaii, New York), (Texas, Vermont), (Vermont, California), (Vermont, Alaska)}

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

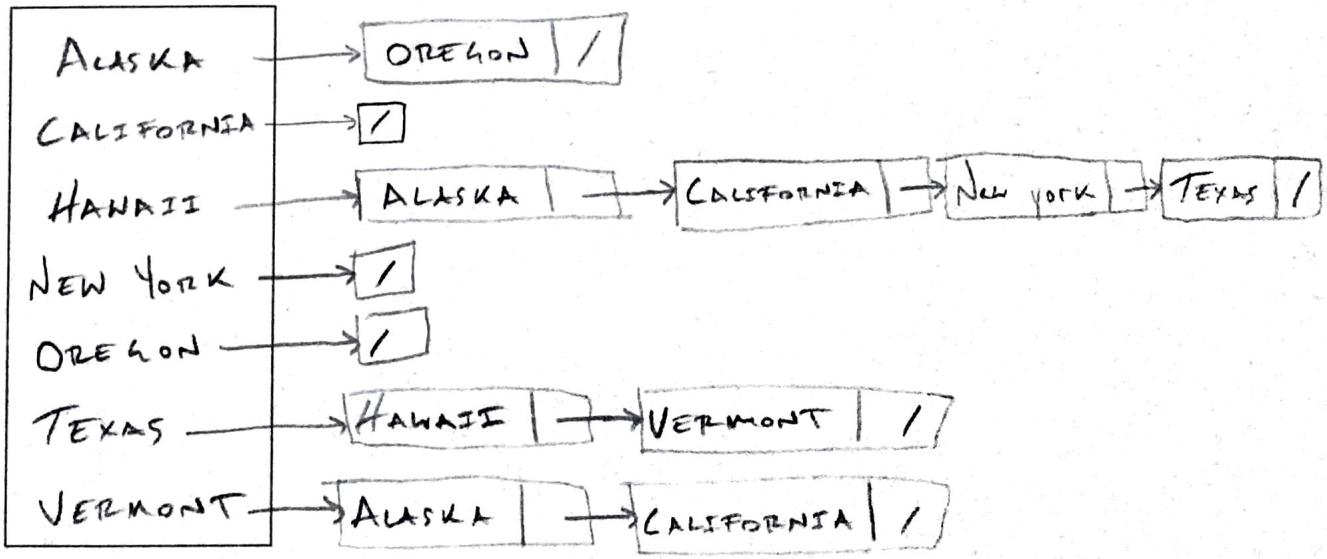
   b. Is there a path from Hawaii to every other state in the graph? Yes

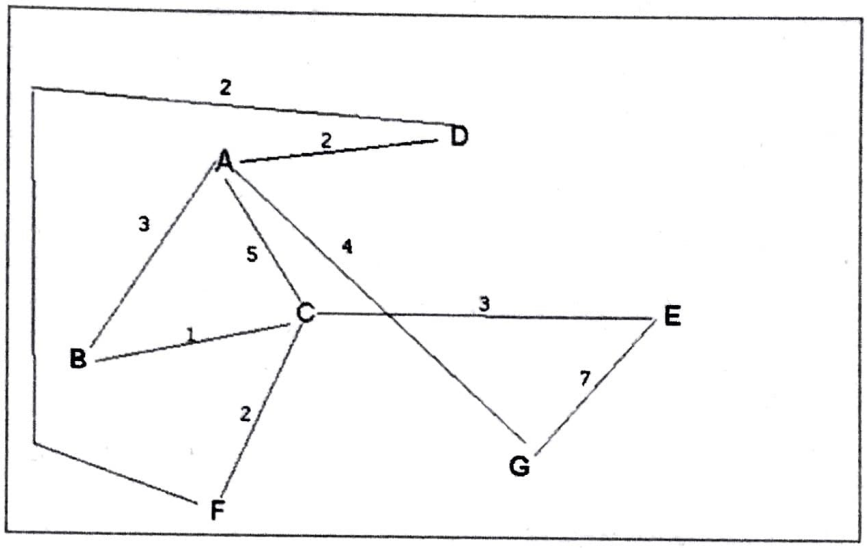
   c. From which state(s) in the graph is there a path to Hawaii? Texas

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



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



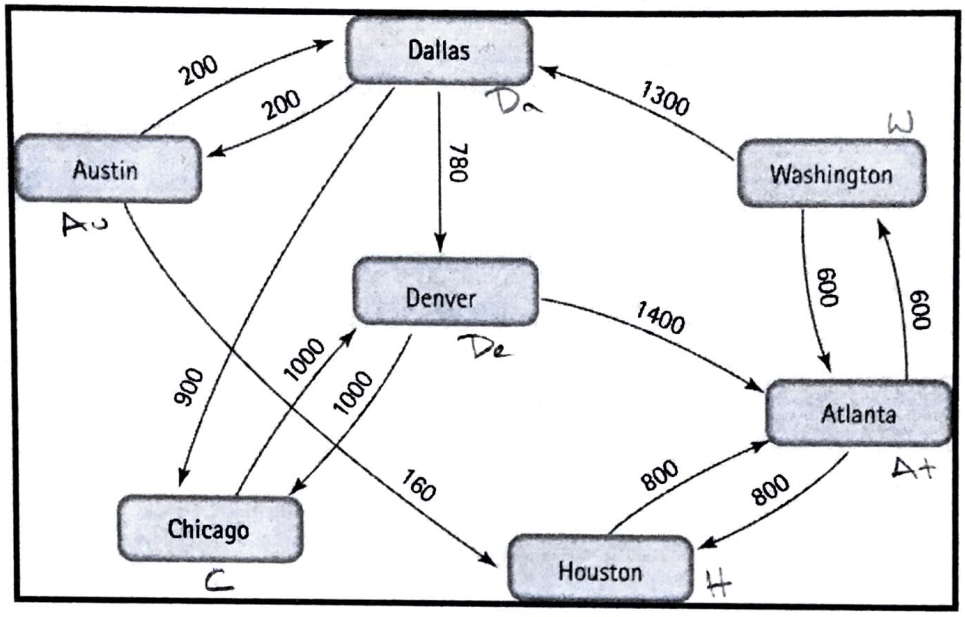


4 a. Which of the following lists the graph nodes in depth first order beginning with E?

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

Iteration	Unsettled	Settled	Evaluation Node	At	Au	C	Da	De	H	W
1	At	—	At	0	∞	∞	∞	∞	800 At	600 At
2	H, W	At	H	0	∞	∞	∞	∞	800 At	600 At
3	W	At, H	W	0	∞	∞	1900 W	∞	800 At	600 At
4	Da	At, H, W	Da	0	2100 Da	2800 Da	1900 W	2680 Da	800 At	600 At
5	Au, C, De	At, H, W, Da	Au	"						"
6	C, De	At, H, W, Da, Au	C	"						"
7	De	At, H, W, Da, Au, C	De	"						"
8	—	ALL	—	0	2100 Da	2800 Da	1900 W	2680 Da	800 At	600 At

Atlanta → Austin: 2100 (At → W → Da → Au)

Atlanta → Chicago: 2800 (At → W → Da → C)

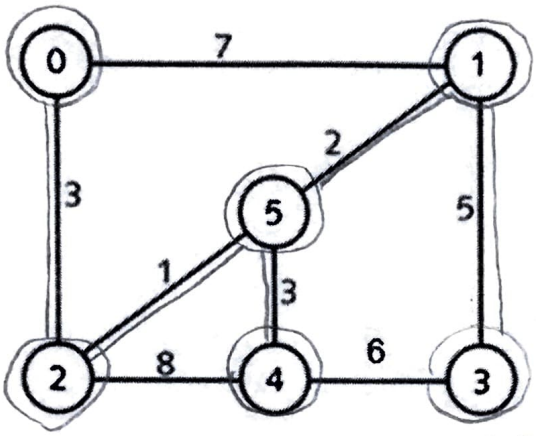
Atlanta → Dallas: 1900 (At → W → Da)

Atlanta → Denver: 2680 (At → W → Da → De)

Atlanta → Houston: 800 (Direct)

Atlanta → Washington: 600 (Direct)

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



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

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

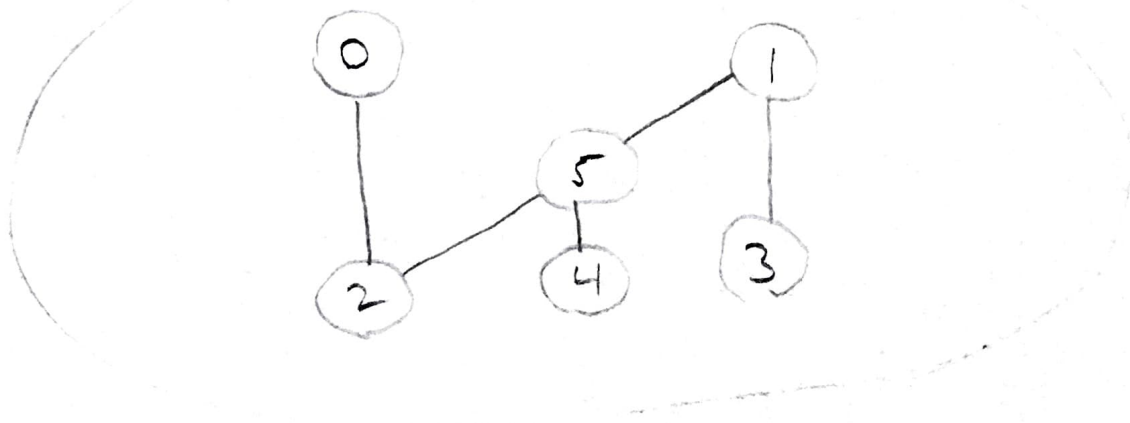
$V(T) = \{0, 2\}$
$E(T) = \{(0, 2)\}$
$N = \{1, 3, 4, 5\}$

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

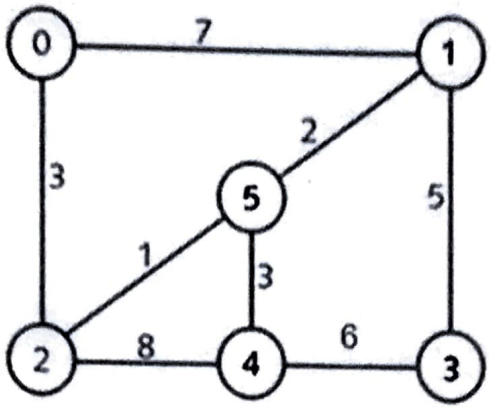
$V(T) = \{0, 2, 5, 1\}$
$E(T) = \{(0, 2), (2, 5), (5, 1)\}$
$N = \{3, 4\}$

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

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

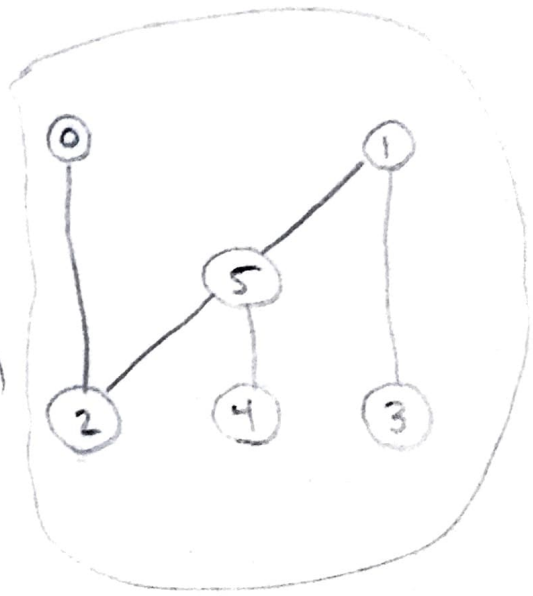


7. Find the minimal spanning tree using Kruskal's algorithm. Show the weights in order and the steps.

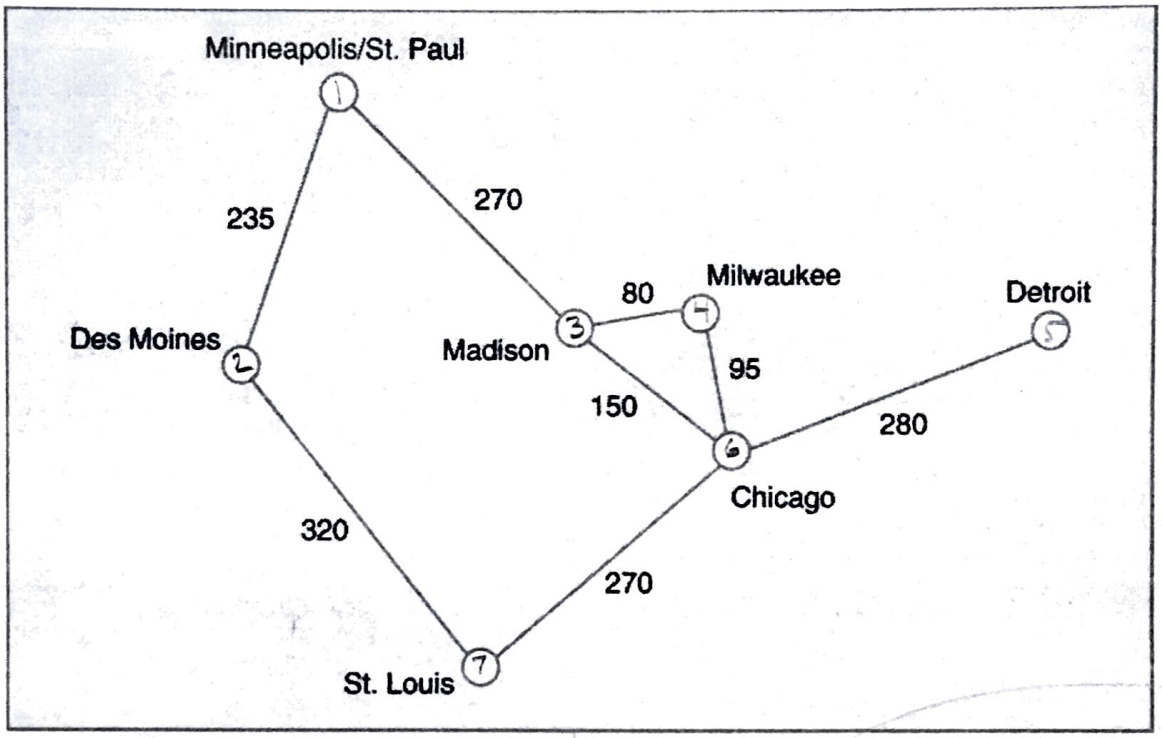


Edge	Weight
0-1	7.
0-2	3.
2-5	1.
2-4	8.
5-4	3.
5-1	2.
4-3	6.
3-1	5.

Edge	Weight	
2-5	1	✓
5-1	2	✓
0-2	3	✓
5-4	3	✓
1-3	5	✓
4-3	6	(all connected)
0-1	7	
2-4	8	



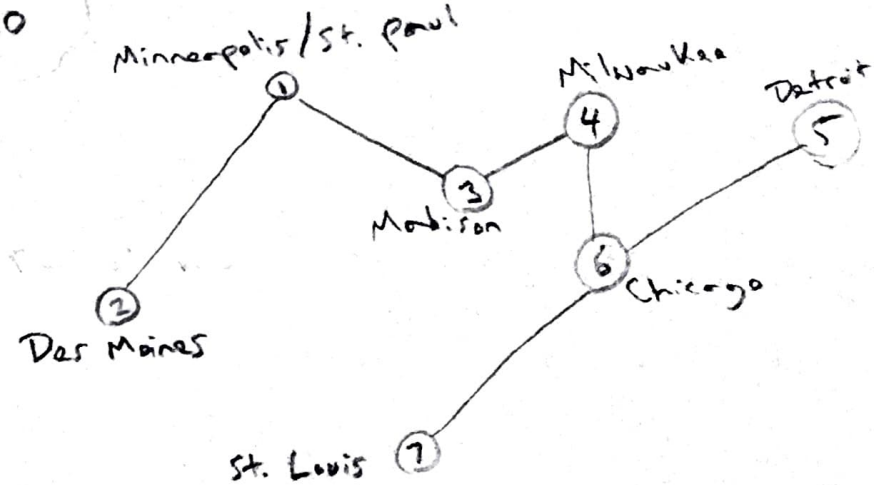
8. Find the minimal spanning tree using the algorithm you prefer. Use Minneapolis/St. Paul as the source vertex



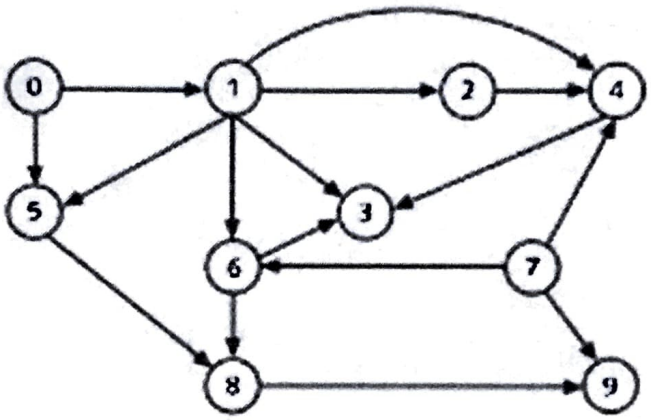
Edge	Weight
1-2	235
1-3	270
2-7	320
7-6	270
3-6	150
3-4	80
4-6	95
5-6	280

Edge	Weight	
3-4	80	✓
4-6	95	✓
3-6	150	✗ (cycle)
1-2	235	✓
1-3	270	✓
7-6	270	✓
6-5	280	
2-7	320	

KRUSKAL'S ALGORITHM



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



Topological Order

0	7	1	2	5	6	4	8	3	9

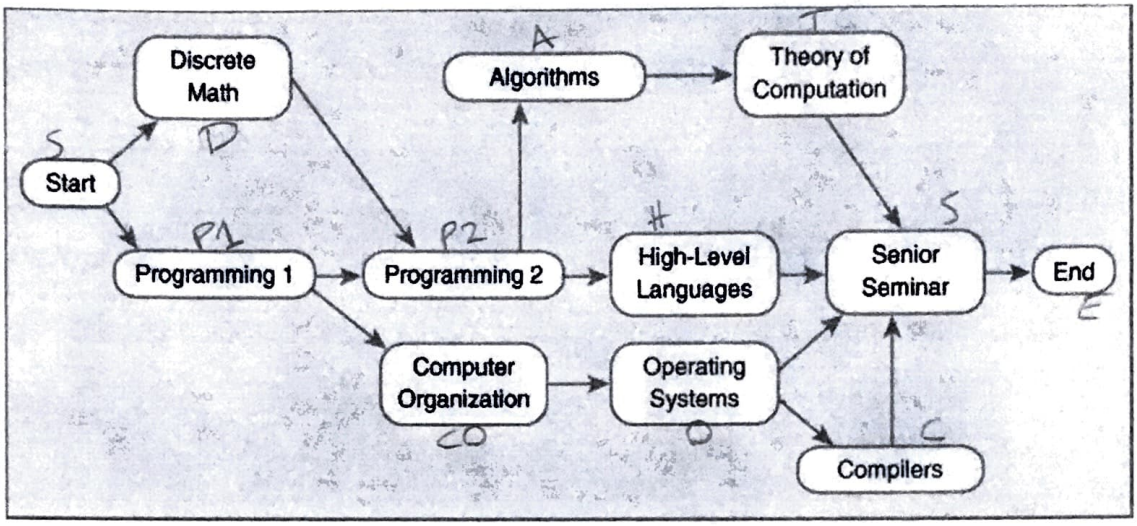
Queue

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

predCount

node / pred	0	1	2	3	4	5	6	7	8	9
	0	1	1	3	3	2	2	0	2	2
(0)	0	0	1	3	3	1	2	0	2	2
(7)	0	0	1	3	2	1	1	0	2	1
(1)	0	0	0	2	1	0	0	0	2	1
(2)	0	0	0	2	0	0	0	0	2	1
(5)	0	0	0	2	0	0	0	0	1	1
(6)	0	0	0	1	0	0	0	0	0	1
(4)	0	0	0	0	0	0	0	0	0	1
(8)	0	0	0	0	0	0	0	0	0	0
(3)										
(9)										

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



Topological Order

S	D	P1	P2	CO	A	H	O	T	C	S	E

Queue

S, D, P1, P2, CO, A, H, O, T, C, S, E

PredCount

node	S	D	P1	P2	CO	A	H	O	T	S	C	E
pred	0	1	1	2	1	1	1	1	1	4	1	1
(S)	0	0	0	2	1	1	1	1	1	4	1	1
(D)	0	0	0	1	1	1	1	1	1	4	1	1
(P1)	0	0	0	0	0	1	1	1	1	4	1	1
(P2)	0	0	0	0	0	0	0	1	1	4	1	1
(CO)	0	0	0	0	0	0	0	0	1	4	1	1
(A)	0	0	0	0	0	0	0	0	0	4	1	1
(H)	0	0	0	0	0	0	0	0	0	3	1	1
(O)	0	0	0	0	0	0	0	0	0	2	0	1
(T)	0	0	0	0	0	0	0	0	0	1	0	1
(C)	0	0	0	0	0	0	0	0	0	0	0	1
(S)	0	0	0	0	0	0	0	0	0	0	0	0
(E)	"		"									