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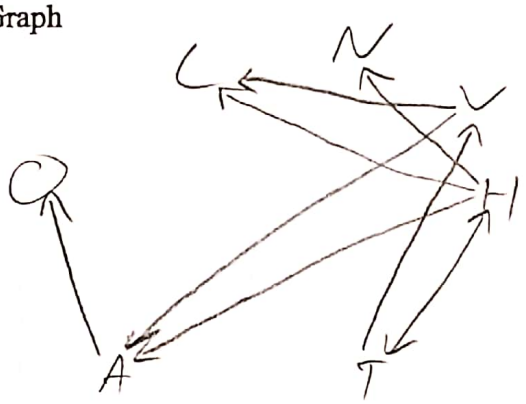
CMSC204
Prof. Marsh!

100

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



A, C, H, N, O, T, V

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

   V(StateGraph) =

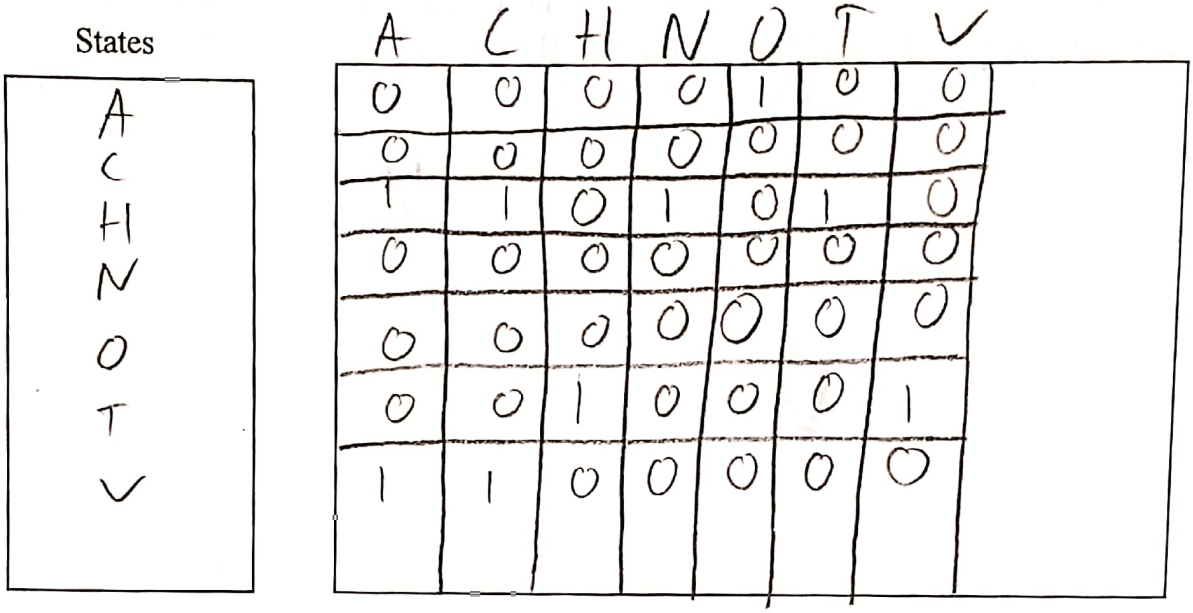
   E(StateGraph) =

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

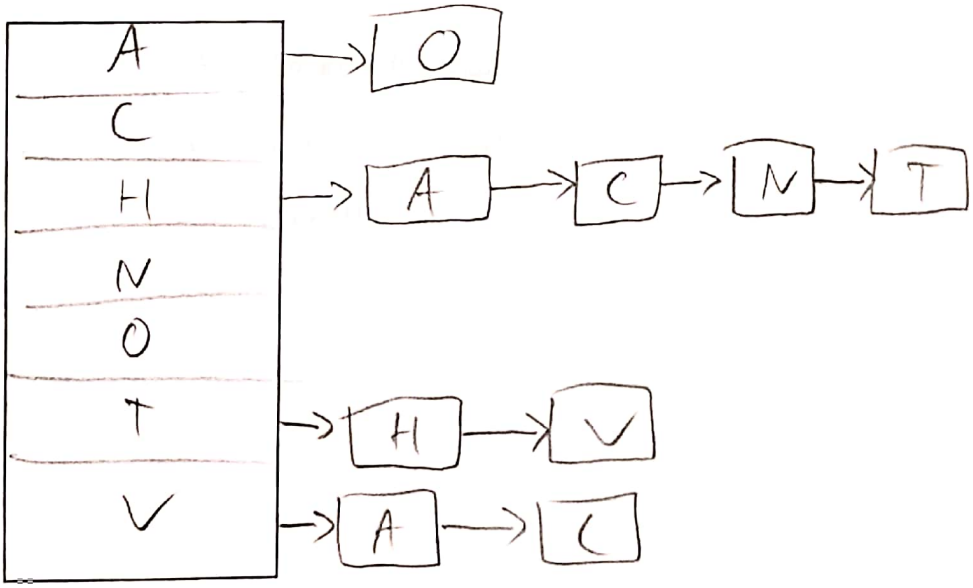
   b. Is there a path from Hawaii to every other state in the graph? yes (can be transitive)

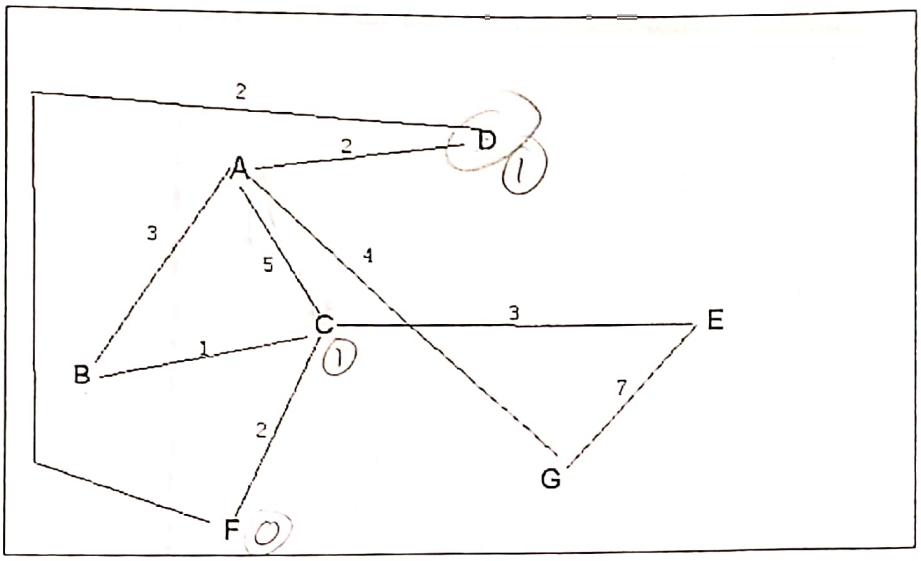
   c. From which state(s) in the graph is there a path to Hawaii? T

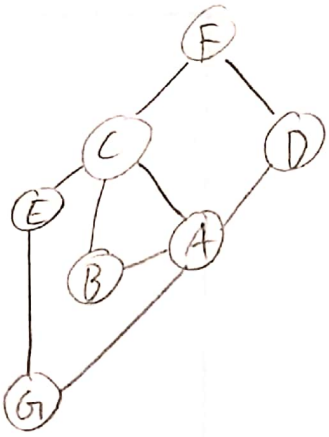
3. a. Show the adjacency matrix that would describe the edges in the graph. Store the vertices in alphabetical order



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





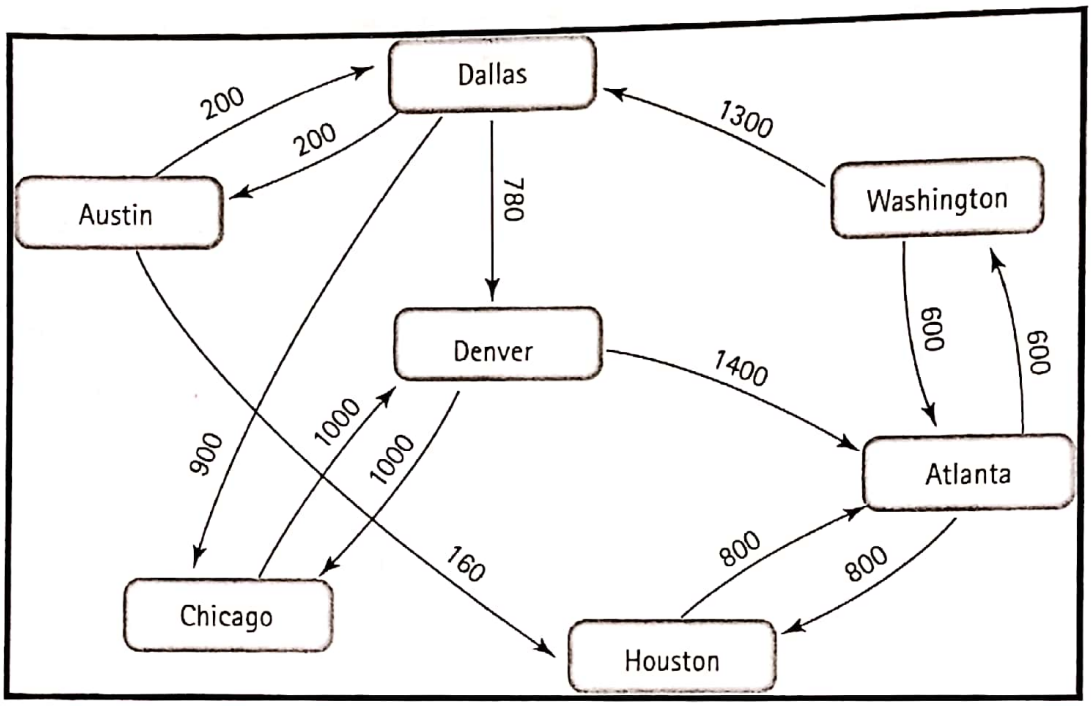


4 a. Which of the following lists the graph nodes in depth first order beginning with E?

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

Specify path

ATL -> WSH: ATL-WSH
600

ATL -> HOU: ATL-HOU
800

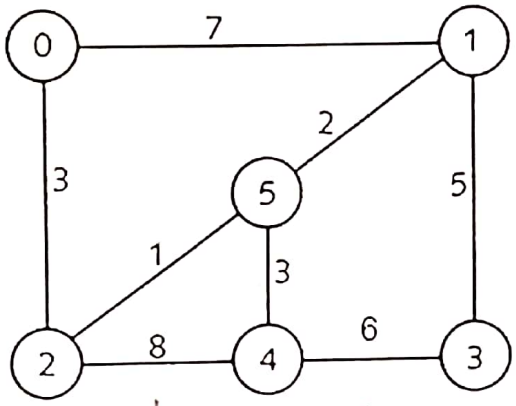
ATL -> DAL: ATL - WSH, WSH - DAL
600 + 1300 = 1900

ATL -> AST: ATL-WSH, WSH - DAL, DAL-AST
600 + 1300 + 200 = 2100

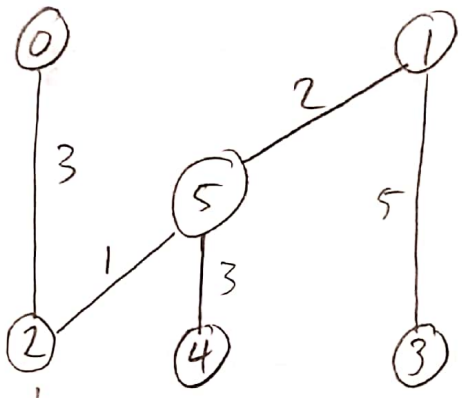
ATL -> DEN: ATL-WSH, WSH-DAL, DAL-DEN
600 + 1300 + 780 = 2680

ATL -> CHI: ATL-WSH, WSH-DAL, DAL-CHI
600 + 1300 + 900 = 2800

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



min spanning tree



$\sum w = 14$

1. $V = \{0\}$
$E = \{\}$
$N = \{1,2,3,4,5\}$

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

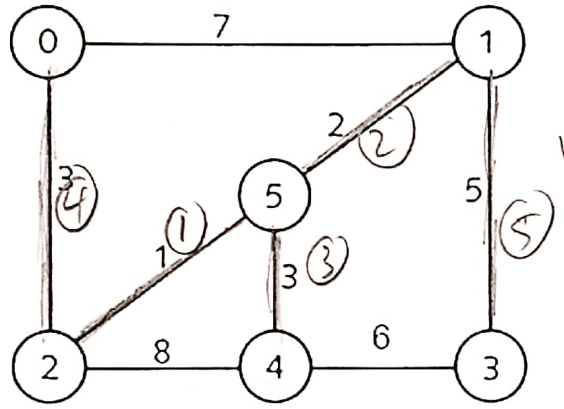
3. $V = \{0,2,5\}$
$E = \{(0,2),(2,5)\}$
$N = \{1,3,4\}$

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

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

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

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



weights: 1, 2, 3, 5, 6, 7, 8
(2,5) (5,1) (5,4) (1,3) (4,3)
(0,2) (0,1)
(2,4)

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

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

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

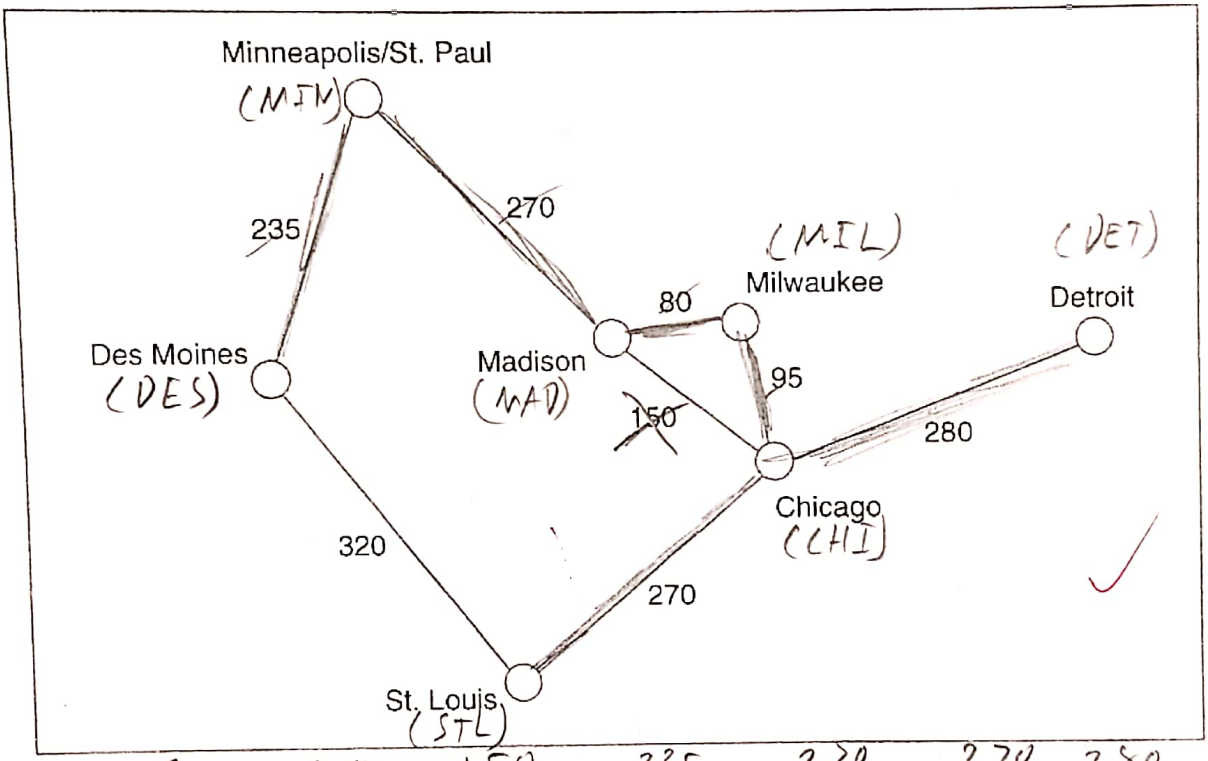
④ $E = \{(2,5), (5,1), (5,4), (0,2)\}$
$V = \{3\}$
$w = \{1, 2, 3, 3\}$

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

$\Sigma w = 14$

Kruskal's

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



$w_A = \{80, 95, 150, 235, 270, 270, 280, 320\}$

$E_A = \{(MAD, MIL), (MIL, CHI), (MAD, CHI), (DES, MIN), (STL, CHI), (MIN, MAD), (CHI, DET), (DES, STL)\}$

① $E = \{(MAD, MIL)\}$
$V = \{MIN, DES, STL, CHI, DET\}$
$w = \{80\}$ span? no. continue

② $E = \{(MAD, MIL), (MIL, CHI)\}$
$V = \{MIN, DES, STL, DET\}$
$w = \{80, 95\}$ span? no. continue

③ $E = \{(MAD, MIL), (MIL, CHI), (MAD, CHI)\}$ forms cycle

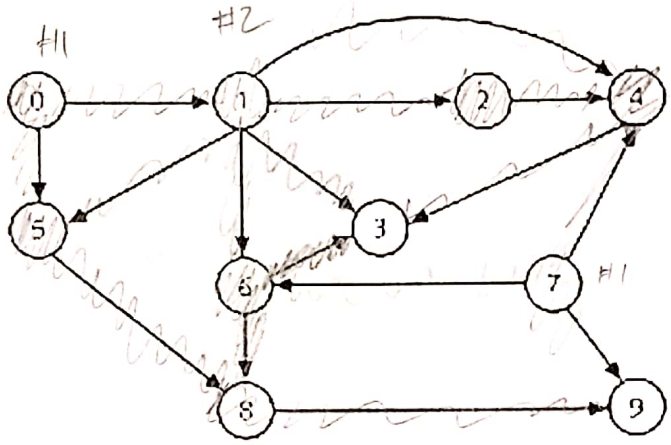
④ $E = \{(MAD, MIL), (MIL, CHI), (DES, MIN)\}$
$V = \{STL, DET\}$
$w = \{80, 95, 235\}$
span? no. continue

⑤ $E = \{(MAD, MIL), (MIL, CHI), (DES, MIN), (STL, CHI)\}$
$V = \{DET\}$
$w = \{80, 95, 235, 270\}$

⑥ $E = \{(MAD, MIL), (MIL, CHI), (DES, MIN), (STL, CHI), (MIN, MAD)$
$V = \{DET\}$ span? no
$w = \{80, 95, 235, 270, 270\}$

⑦ $V = \{(MAD, MIL), (MIL, CHI), (DES, MIN), (STL, CHI), (CHI, DET)\}$
$V = \{\}$ span? yes
$w = \{80, 95, 235, 270, 270, 280\}$ $\Sigma w = 1,230$

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

predCount
Index

Step	0	1	2	3	4	5	6	7	8	9
#0	0	1	1	3	3	2	2	0	2	2
#1	/	0	1	3	2	1	1	/	2	1
#2	/	/	0	2	1	0	0	/	2	1
#3	/	/	/	1	0	/	/	/	0	1
#4	/	/	/	0	/	/	/	/	/	0
#5	/	/	/	/	/	/	/	/	/	/

Queue

#0 0, 7

#1 1

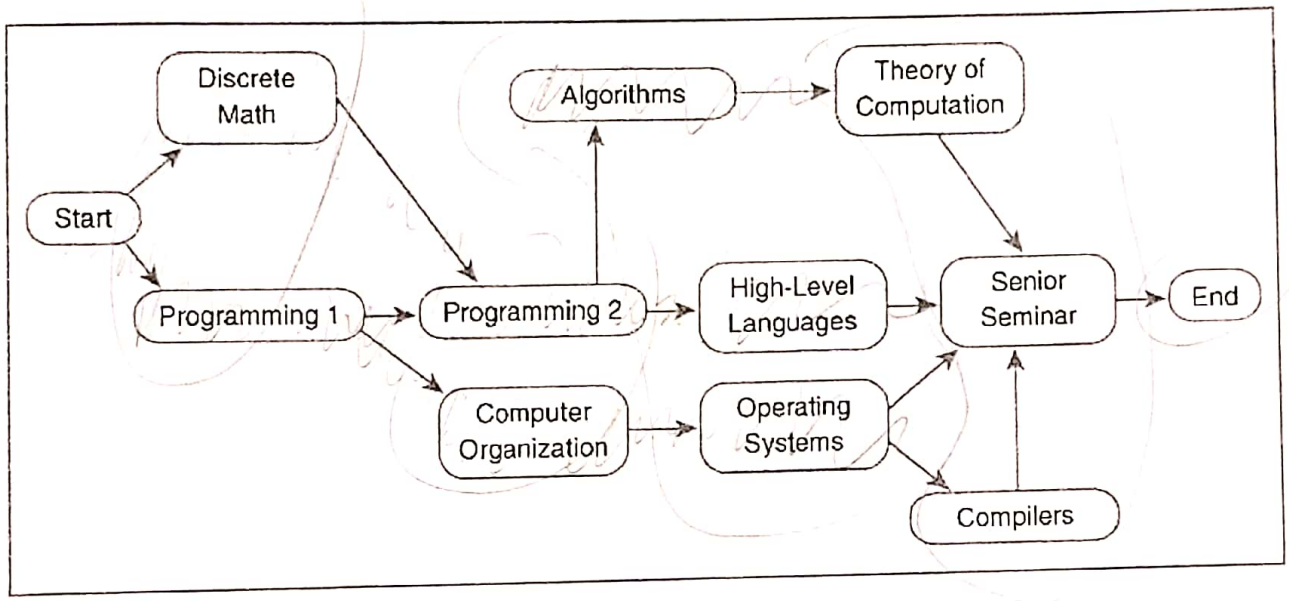
#2 2, 5, 6

#3 4, 8

#4 3

In each step, dequeue repeatedly with each element's pred count (and related elements) decreasing by 1 until queue is empty.

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



Start, Discrete Math, Programming 1, Programming 2, computer organization, Algorithms, High-Level Languages, Operating systems, Theory of Computation, Senior Seminar, END