Name: _____ J#: _____

Jackson State University
CSC 323 Algorithm Design and Analysis, Fall 2016
Instructor: Dr. Natarajan Meghanathan
Exam 3 (Take Home Part)

Maximum Points: 140 **Due on: December 6, 2016: 9 AM**

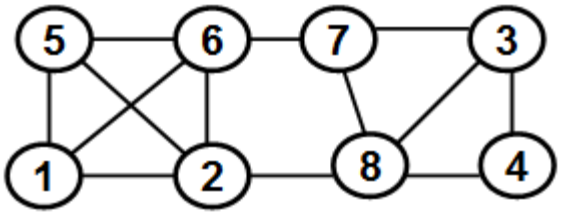
Print this exam and answer in the blank space/page provided after each question. You should staple your exam. Submit on-time at 9 AM

Q1: 25 pts) For the graph assigned to you, find the following using the approximation heuristics discussed in class.

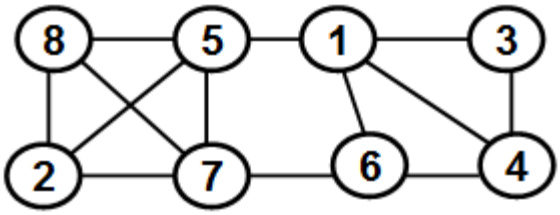
(a) Maximal Independent Set (b) Minimal Vertex Cover (c) Maximal Clique

Show all the work for each.

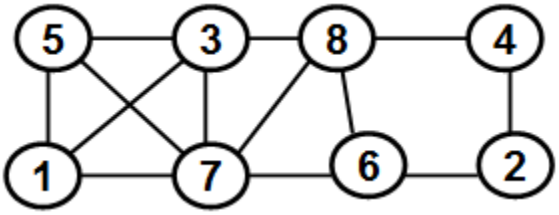
Kirubel Benalfew



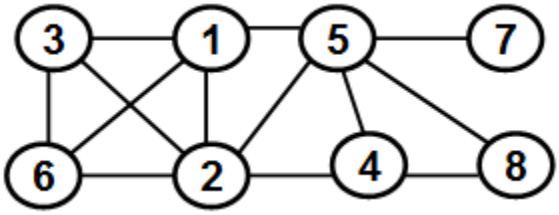
Yosef Getachew



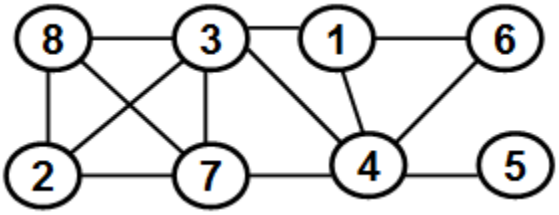
Quavanti Hart



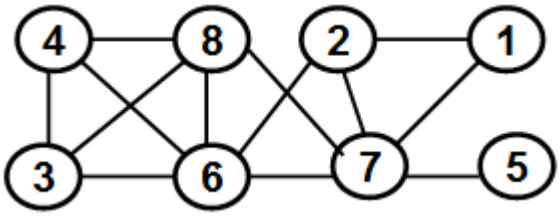
Deonta Kilpatrick



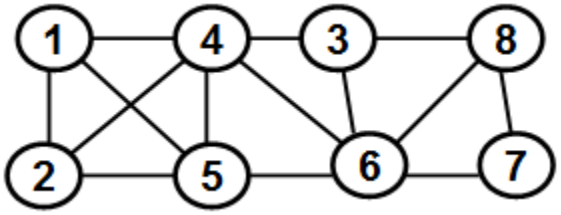
Kabinad Melaku



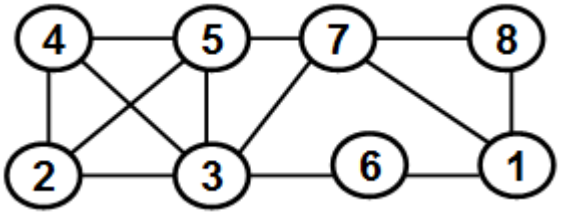
Shawndon Portis



Nicholas Whitfield

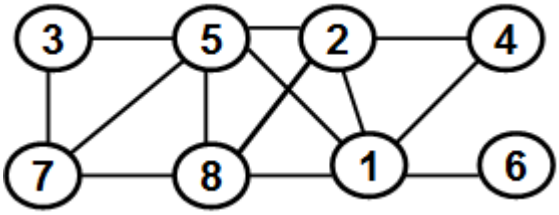


Ladarius Felix

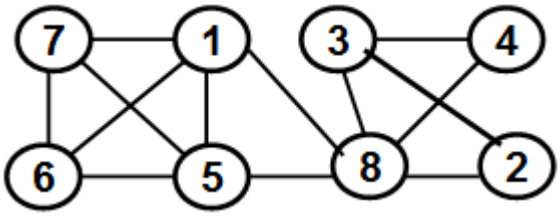


Name: _____ J#: _____

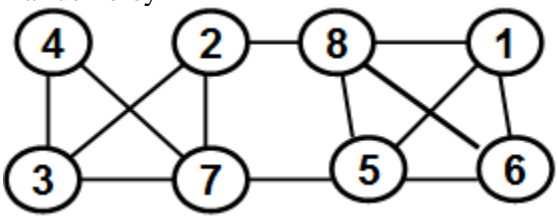
Alishia Harmon



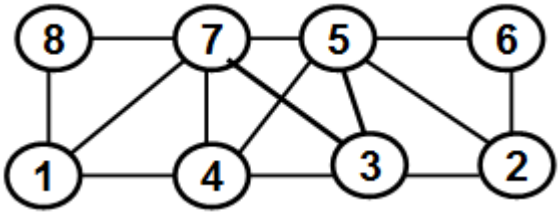
Algesa Haywood



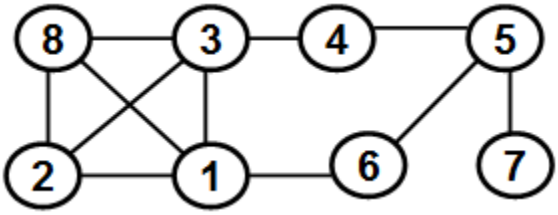
Darius Leroy



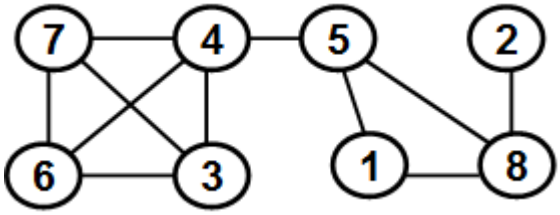
Michael Moore



Karmeen Powell



Brian Williams



Name: _____ J#: _____

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Q2: 30 pts) You are assigned the edge weight matrix for a complete graph. Determine an approximation to the minimum weight tour using the (i) Nearest neighbor heuristic (ii) Twice around the tree heuristic.

Also, show one attempt of reducing the tour weight using the 2-change heuristic for the tour obtained with each of the two heuristics.

Show all the work as well as clearly indicate the tour and its weight before and after the attempt of using the 2-change heuristic in each case.

Kirubel Benalfew

	V1	V2	V3	V4	V5	V6
V1	0	9	15	1	8	6
V2	9	0	15	10	4	6
V3	15	15	0	9	13	4
V4	1	10	9	0	13	5
V5	8	4	13	13	0	13
V6	6	6	4	5	13	0

Yosef Getachew

	V1	V2	V3	V4	V5	V6
V1	0	9	10	4	6	15
V2	9	0	3	1	7	2
V3	10	3	0	8	11	14
V4	4	1	8	0	11	15
V5	6	7	11	11	0	5
V6	15	2	14	15	5	0

Quavanti Hart

	V1	V2	V3	V4	V5	V6
V1	0	8	6	2	9	14
V2	8	0	4	14	5	9
V3	6	4	0	5	15	10
V4	2	14	5	0	12	10
V5	9	5	15	12	0	3
V6	14	9	10	10	3	0

Deonta Kilpatrick

	V1	V2	V3	V4	V5	V6
V1	0	10	2	14	12	14
V2	10	0	7	8	15	7
V3	2	7	0	7	14	12
V4	14	8	7	0	2	14
V5	12	15	14	2	0	14
V6	14	7	12	14	14	0

Kabinad Melaku

	V1	V2	V3	V4	V5	V6
V1	0	2	10	15	14	6
V2	2	0	7	3	14	8
V3	10	7	0	12	3	15
V4	15	3	12	0	5	10
V5	14	14	3	5	0	8
V6	6	8	15	10	8	0

Shawndon Portis

	V1	V2	V3	V4	V5	V6
V1	0	4	8	14	1	12
V2	4	0	4	7	14	15
V3	8	4	0	13	11	9
V4	14	7	13	0	5	6
V5	1	14	11	5	0	13
V6	12	15	9	6	13	0

Nicholas Whitfield

	V1	V2	V3	V4	V5	V6
V1	0	14	10	2	9	7
V2	14	0	1	2	13	12
V3	10	1	0	13	2	5
V4	2	2	13	0	15	3
V5	9	13	2	15	0	2
V6	7	12	5	3	2	0

Ladarius Felix

	V1	V2	V3	V4	V5	V6
V1	0	11	5	5	6	14
V2	11	0	5	9	10	9
V3	5	5	0	2	6	12
V4	5	9	2	0	6	13
V5	6	10	6	6	0	2
V6	14	9	12	13	2	0

Alishia Harmon

	V1	V2	V3	V4	V5	V6
V1	0	6	12	15	15	12
V2	6	0	11	4	6	3
V3	12	11	0	3	5	12
V4	15	4	3	0	13	3
V5	15	6	5	13	0	3
V6	12	3	12	3	3	0

Algesa Haywood

	V1	V2	V3	V4	V5	V6
V1	0	2	1	12	11	13
V2	2	0	7	12	8	6
V3	1	7	0	11	8	8
V4	12	12	11	0	6	12
V5	11	8	8	6	0	8
V6	13	6	8	12	8	0

Name: _____ J#: _____

Darius Leroy

	V1	V2	V3	V4	V5	V6
V1	0	3	7	2	2	3
V2	3	0	9	13	6	4
V3	7	9	0	12	7	9
V4	2	13	12	0	9	9
V5	2	6	7	9	0	9
V6	3	4	9	9	9	0

Michael Moore

	V1	V2	V3	V4	V5	V6
V1	0	8	14	4	10	15
V2	8	0	7	4	9	8
V3	14	7	0	5	12	14
V4	4	4	5	0	4	10
V5	10	9	12	4	0	2
V6	15	8	14	10	2	0

Karmeen Powell

	V1	V2	V3	V4	V5	V6
V1	0	6	15	12	10	7
V2	6	0	11	12	8	1
V3	15	11	0	4	3	9
V4	12	12	4	0	6	13
V5	10	8	3	6	0	13
V6	7	1	9	13	13	0

Brian Williams

	V1	V2	V3	V4	V5	V6
V1	0	6	8	4	2	5
V2	6	0	15	12	1	1
V3	8	15	0	8	15	4
V4	4	12	8	0	10	4
V5	2	1	15	10	0	6
V6	5	1	4	4	6	0

Name: _____ J#: _____

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Q3: 25 pts) For the edge weight matrix assigned to you for a directed graph, determine the shortest path weights between any two vertices of the graph using the **Floyd-Warshall algorithm.**

Show clearly the distance matrix and the predecessor matrix for each iteration.

Also, extract a path of length two or above between any two vertices of your choice. Clearly show the path extraction steps, as shown in the slides.

Kirubel Benalfew

	V1	V2	V3	V4	V5
V1	0	7	14	∞	3
V2	∞	0	9	3	1
V3	12	∞	0	10	9
V4	∞	9	10	0	12
V5	3	3	∞	4	0

Yosef Getachew

	V1	V2	V3	V4	V5
V1	0	7	5	3	∞
V2	∞	0	4	12	14
V3	4	3	0	9	∞
V4	1	6	5	0	∞
V5	∞	3	11	9	0

Quavanti Hart

	V1	V2	V3	V4	V5
V1	0	∞	2	4	11
V2	1	0	8	∞	1
V3	4	∞	0	8	3
V4	10	7	5	0	∞
V5	∞	15	10	9	0

Deonta Kilpatrick

	V1	V2	V3	V4	V5
V1	0	1	11	∞	9
V2	10	0	9	∞	10
V3	∞	5	0	5	14
V4	14	∞	13	0	11
V5	8	12	13	∞	0

Kabinad Melaku

	V1	V2	V3	V4	V5
V1	0	∞	8	4	10
V2	8	0	14	4	∞
V3	14	12	0	5	∞
V4	2	∞	13	0	2
V5	3	∞	12	13	0

Shawndon Portis

	V1	V2	V3	V4	V5
V1	0	∞	13	2	13
V2	8	0	15	12	0
V3	9	∞	0	2	5
V4	14	∞	10	0	4
V5	3	6	12	∞	0

Nicholas Whitfield

	V1	V2	V3	V4	V5
V1	0	∞	7	10	7
V2	2	0	15	15	∞
V3	∞	2	0	7	8
V4	4	15	2	0	∞
V5	9	15	∞	5	0

Ladarius Felix

	V1	V2	V3	V4	V5
V1	0	1	14	12	∞
V2	6	0	∞	11	1
V3	∞	10	0	9	5
V4	∞	9	15	0	4
V5	10	6	7	∞	0

Name: _____ J#: _____

Alishia Harmon

	V1	V2	V3	V4	V5
V1	0	5	4	∞	15
V2	∞	0	12	8	7
V3	3	10	0	1	∞
V4	6	6	∞	0	4
V5	8	∞	3	13	0

Algesa Haywood

	V1	V2	V3	V4	V5
V1	0	∞	9	14	8
V2	7	0	∞	13	1
V3	10	13	0	∞	15
V4	7	3	1	0	∞
V5	12	9	6	∞	0

Darius Leroy

	V1	V2	V3	V4	V5
V1	0	3	2	∞	9
V2	∞	0	5	8	6
V3	9	6	0	∞	7
V4	∞	13	14	0	8
V5	3	2	∞	6	0

Michael Moore

	V1	V2	V3	V4	V5
V1	0	1	11	6	∞
V2	1	0	10	∞	12
V3	14	∞	0	10	6
V4	2	2	1	0	∞
V5	15	∞	3	15	0

Karmeen Powell

	V1	V2	V3	V4	V5
V1	0	∞	8	9	9
V2	2	0	∞	4	13
V3	10	3	0	2	∞
V4	1	∞	1	0	5
V5	6	9	13	∞	0

Brian Williams

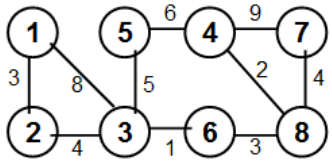
	V1	V2	V3	V4	V5
V1	0	12	1	∞	13
V2	10	0	3	∞	15
V3	8	1	0	∞	1
V4	10	8	6	0	∞
V5	7	∞	6	8	0

Name: _____ J#: _____

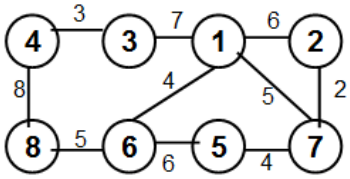
Name: _____ J#: _____

Q4: 25 pts) Run the Dijkstra's shortest path algorithm on the graph assigned to you, starting from Vertex 1, and determine the shortest path tree rooted from Vertex 1 to the rest of the vertices. If any edge does not have weight assigned, assume the weight of that edge to be 5. Show your work for each iteration in the skeletal graphs (see next page). For each skeletal graph, indicate the vertices and all the edges that are selected as part of the particular iteration as well as carried over from the previous iterations. Show all the steps.

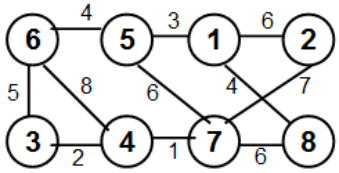
Kirubel Benalfew



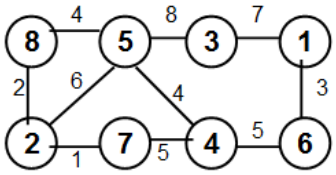
Ladarius Felix



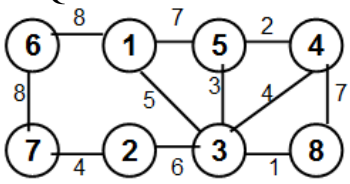
Yosef Getachew



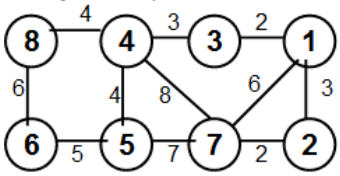
Alishia Harmon



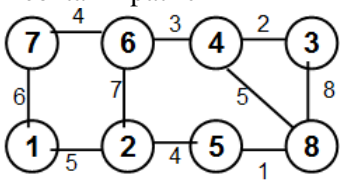
Quavanti Hart



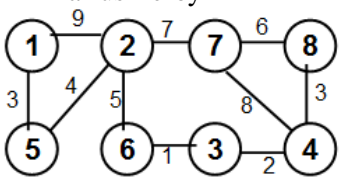
Algesa Haywood



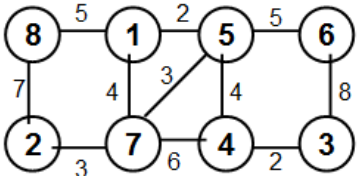
Deonta Kilpatrick



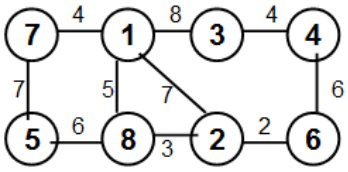
Darius Leroy



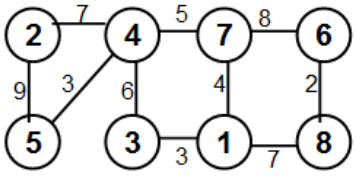
Michael Moore



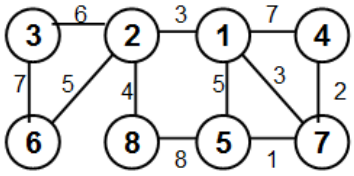
Shawndon Portis



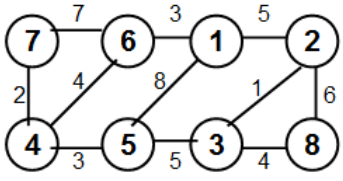
Karmeen Powell-Childress



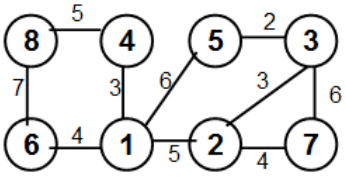
Nicholas Whitfield



Brian Williams

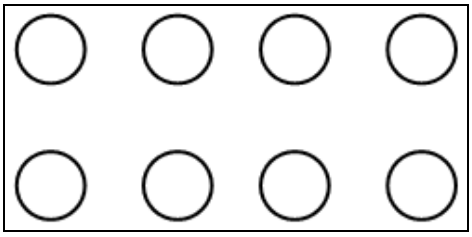


Kabinad Melaku

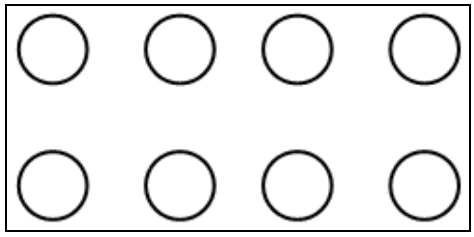


Name: _____ J#: _____

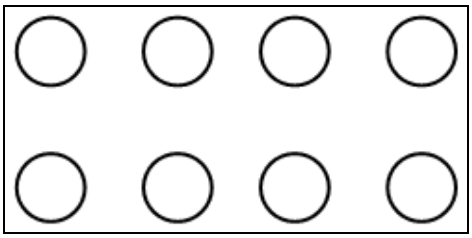
Skeletal Graphs (Iterations)



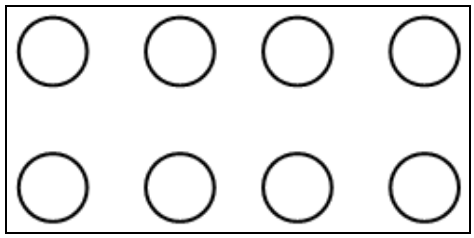
Given Graph



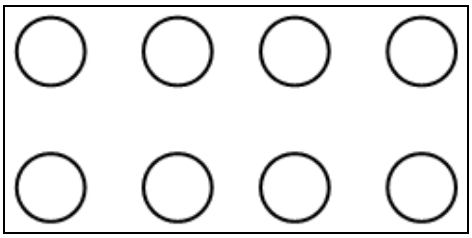
Initialization



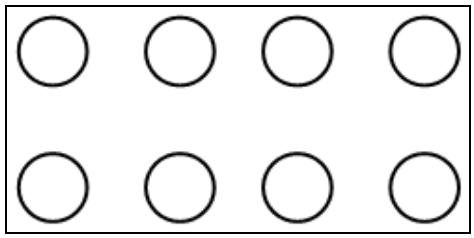
Iteration 1



Iteration 2



Iteration 3



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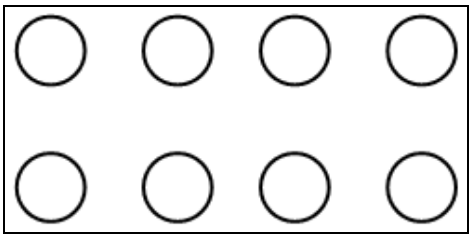

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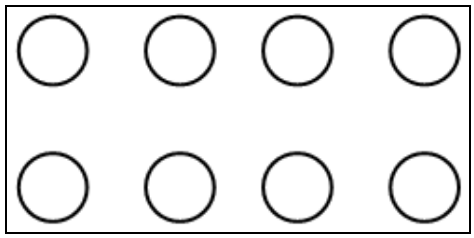
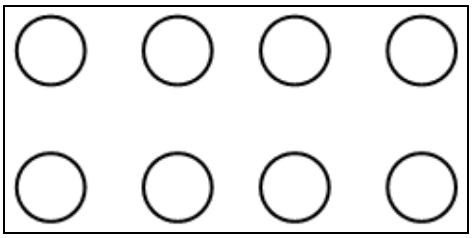
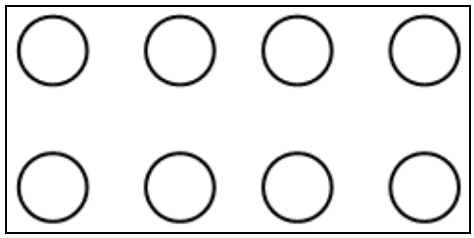


Iteration 6



Iteration 7



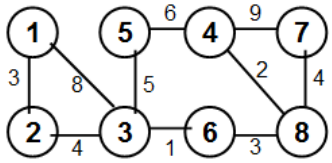
Shortest Path Tree

Sum of the Weights of the Shortest Path Tree: _____

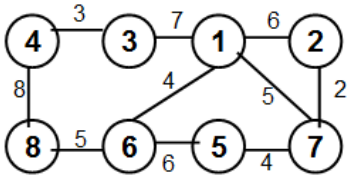
Name: _____ J#: _____

Q5: 15 pts) Run the Kruskal's algorithm for **minimum weight spanning tree** on the graph assigned to you. If any edge does not have weight assigned, assume the weight of that edge to be 5. Show your work for each iteration in the skeletal graphs (see next page). For each skeletal graph, indicate the vertices and all the edges that are selected as part of the particular iteration as well as carried over from the previous iterations. Show all the steps.

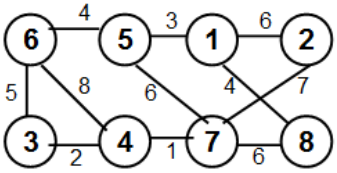
Kirubel Benalfew



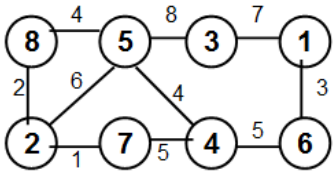
Ladarius Felix



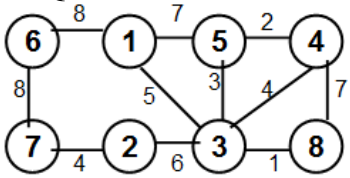
Yosef Getachew



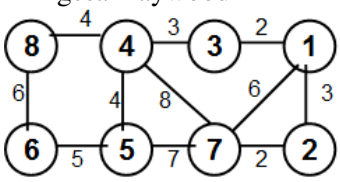
Alishia Harmon



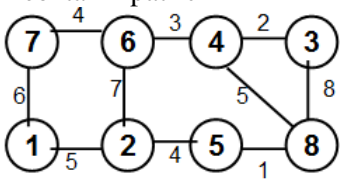
Quavanti Hart



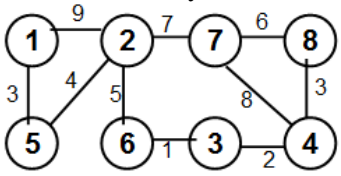
Algesa Haywood



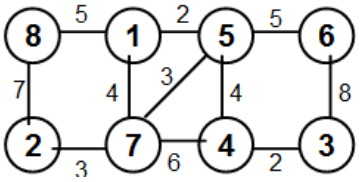
Deonta Kilpatrick



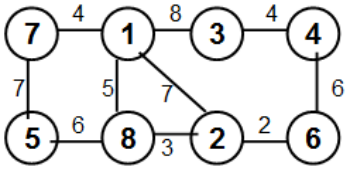
Darius Leroy



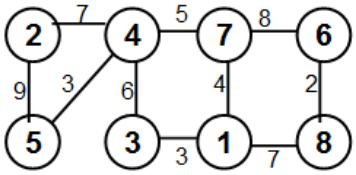
Michael Moore



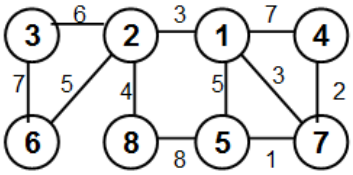
Shawndon Portis



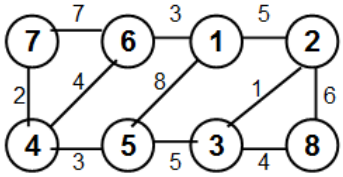
Karmeen Powell-Childress



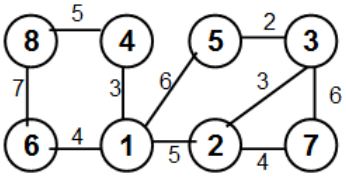
Nicholas Whitfield



Brian Williams

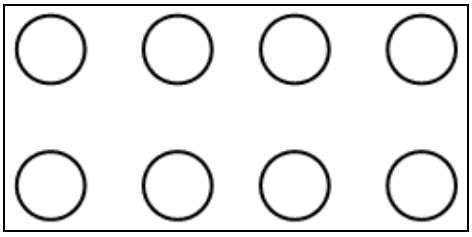


Kabinad Melaku

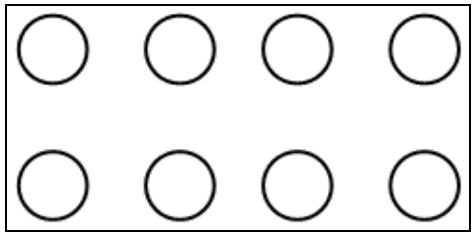


Name: _____ J#: _____

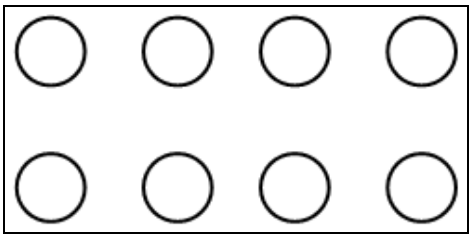
Skeletal Graphs (Iterations)



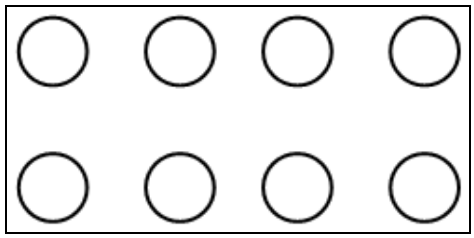
Given Graph



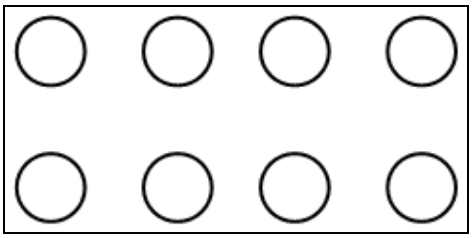
Initialization



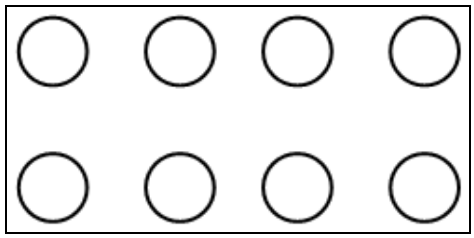
Iteration 1



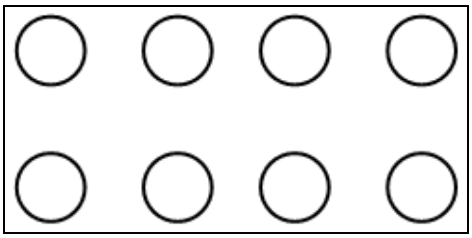
Iteration 2



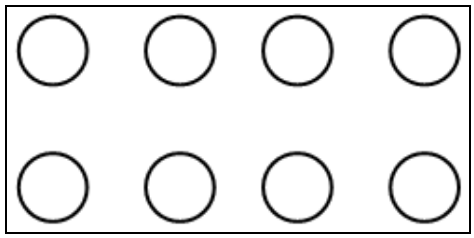
Iteration 3



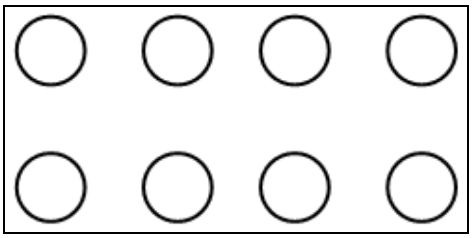
Iteration 4



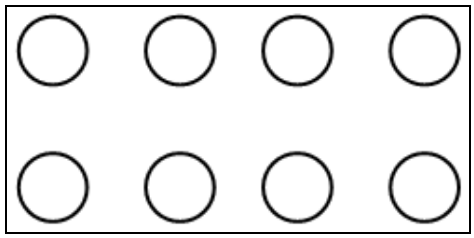
Iteration 5



Iteration 6



Iteration 7

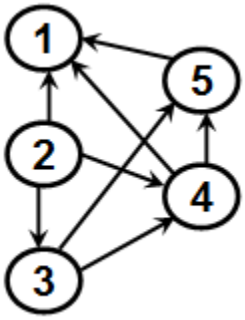


Minimum Weight Spanning Tree

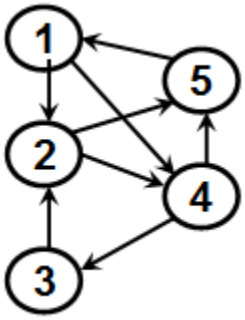
Sum of the weights of the Minimum Weight Spanning Tree: _____

Name: _____ J#: _____

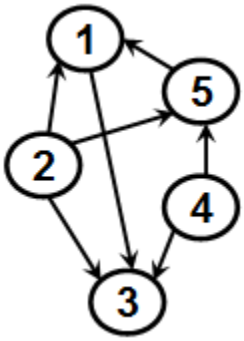
Q6: 20 pts) For the directed graph assigned to you, run the **Depth First Search** algorithm.
(a) Clearly show the order in which the vertices are pushed and popped.
(b) Clearly write the list of edges and their classification into one of the four categories as determined using DFS.
(c) Determine whether the directed graph assigned to you is a DAG or not? If it is a DAG, write the topological sort of the vertices.



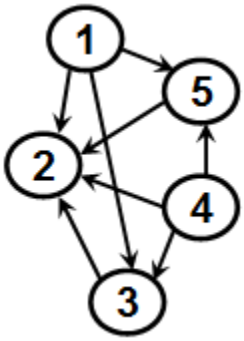
Kirubel Benalfew



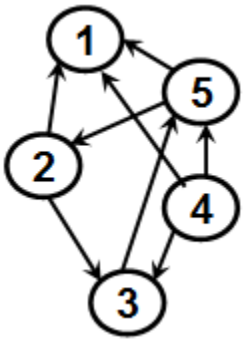
Ladarius Felix



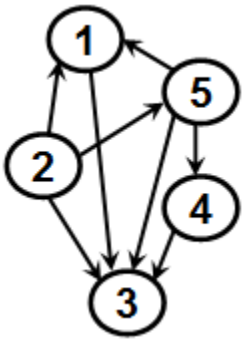
Yosef Getachew



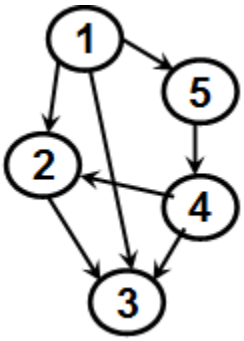
Deonta Kilpatrick



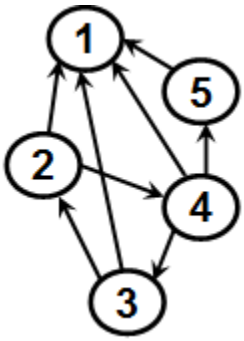
Darius Leroy



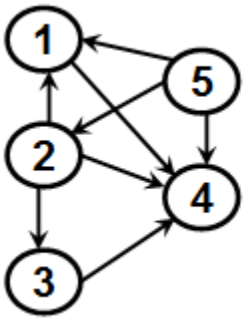
Michael Moore



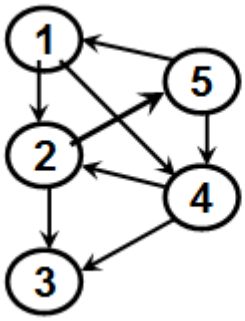
Shawndon Portis



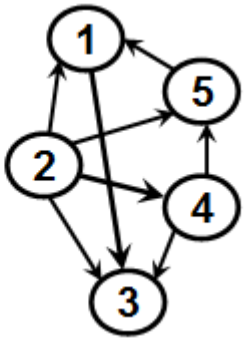
Nicholas Whitfield



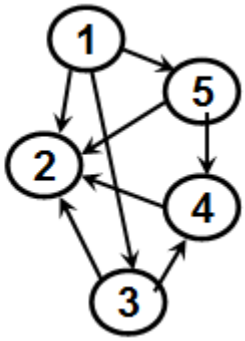
Qauvanti Hart



Brian Williams

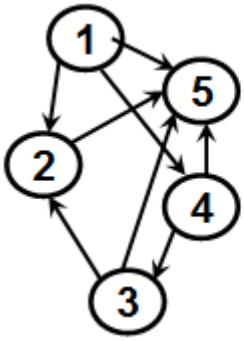


Kabinad Melaku

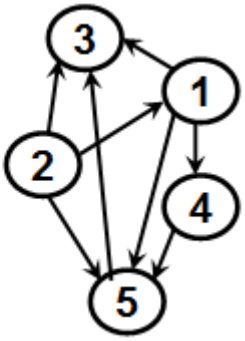


Alishia Harmon

Name: _____ J#: _____



Algesa Haywood



Karmeen Powell-Childress

Name: _____ J#: _____