CSC 323 Algorithm Design and Analysis
Spring 2017, Instructor: Dr. Natarajan Meghanathan
Student Feedback Survey

Assessment of Course Outcomes

On a scale of 1 through 4 (1 being Poor and 4 being Excellent), please rate your ability to perform on each of the following course outcomes before and after taking the course:

Course Outcomes	Before	After
CO-1: Analyze the time complexity of recursive and non-recursive algorithms with respect to the asymptotic order of growth		
CO-2: Prove or justify the correctness of algorithms and their properties through formal or informal analysis		
CO-3: Design and analyze algorithms to solve optimization problems using general techniques such as brute-force, divide-and-conquer, decrease-and-conquer as well as transform-and-conquer		
CO-4: Reduce one NP-complete problem to another NP-complete problem in polynomial-time as well as design and analyze polynomial-time heuristics to approximate solutions for NP-complete problems		
CO-5: Discuss efficient algorithms for various graph theory problems (traversal, topological sort, shortest paths and minimum spanning trees) based on different design techniques		
CO-6: Design and analyze algorithms to solve combinatorial problems using advanced techniques such as dynamic programming and greedy strategies		
CO-7: Develop and evaluate efficient implementations of algorithms, based on the different design techniques, and their associated run-time complexity through experimental analysis		
Overall knowledge of the materials taught in the CSC 323 course		

In a scale of 1 through 4 (1 being Least Helpful and 4 being Most Helpful), please rate and comment on the usefulness of the following:

Item	Rating [1 - Least Helpful and 4 - Most Helpful]
Question Bank and Solutions	
Quizzes and Solutions	
Help Videos on Selected Lecture Topics Recorded by the Instructor Offline and Posted in YouTube	
Video recording-based project submissions	
Open Notes for exams	
Individualized Take Home Exams and Quizzes	

Please write your comments on any aspect of the course that you rated above, as well as any other comment you want to mention about the course that will make it better [Continue on reverse side].

Name: ________________________________ J#: ________________________

Jackson State University
CSC 323 Algorithm Design and Analysis, Spring 2017
Instructor: Dr. Natarajan Meghanathan
Exam 3 (FINAL EXAM)

Maximum Points: 150 **Due on: April 25:** **<u>1 PM to 3 PM</u>** **at my office, ENB 275**

Submissions will NOT be accepted after 3 PM on April 25.

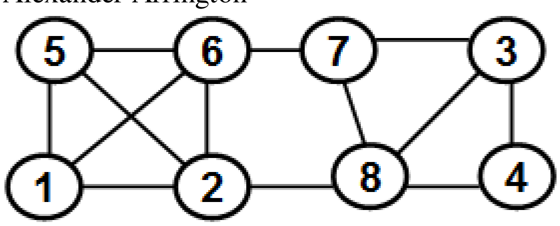
<u>Print this exam and answer in the blank space/page provided after each question. You should staple your exam.</u>

Q1: 35 pts) For the graph assigned to you, find the following using the approximation heuristics discussed in class.

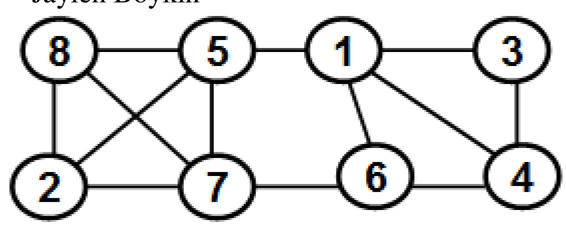
(a) Maximal Independent Set (b) Minimal Vertex Cover (c) Maximal Clique and (d) Minimum Connected Dominating Set

Show all the work for each.

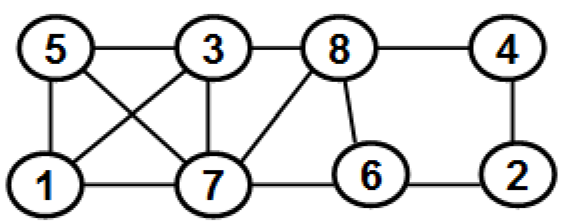
Alexander Arrington



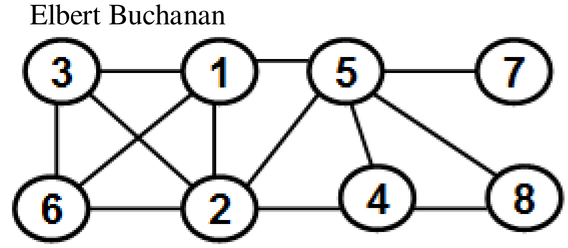
Jaylen Boykin



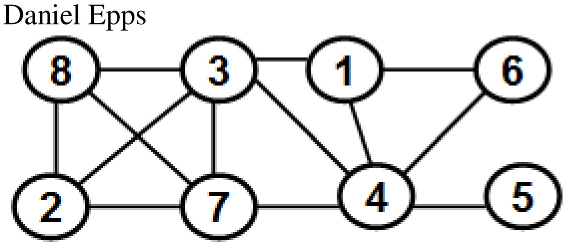
Jason Bruno



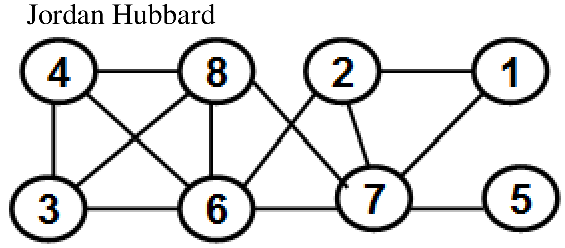
Elbert Buchanan



Daniel Epps

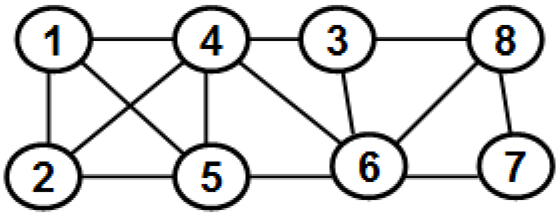


Jordan Hubbard

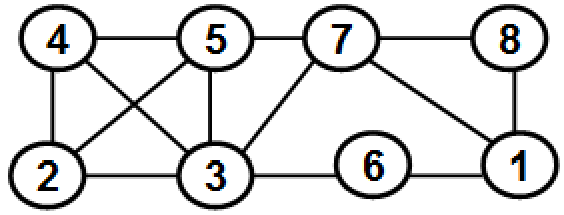


Name: ______________________________ J#: ______________________

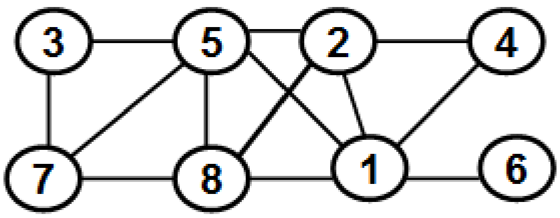
Kayla Johnson



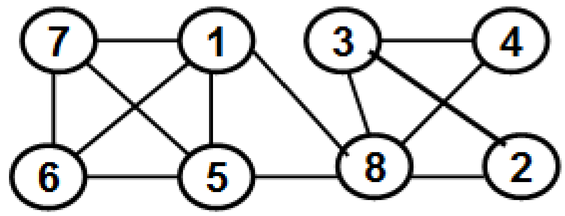
Bria McCutcheon



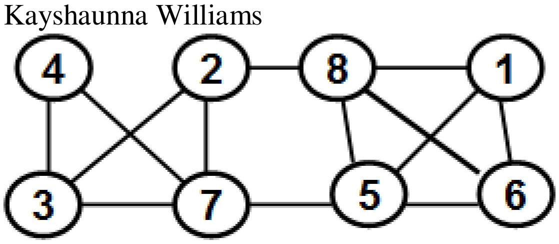
Darren McGee



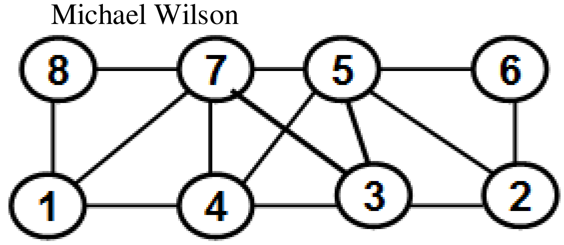
Justin McGuffee



Kayshaunna Williams



Michael Wilson



Name: ________________________________ J#: _______________________

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.

Alexander Arrington

	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

Jaylen Boykin

	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

Jason Bruno

	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

Elbert Buchanan

	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

Daniel Epps

	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

Jordan Hubbard

	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

Kayla Johnson

	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

Bria McCutcheon

	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

Darren McGee

	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

Justin McGuffee

	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#: ______________________

Kayshaunna Williams

	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 Wilson

	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

Name: ________________________________ J#: ________________________

Name: ______________________________ J#: ______________________

Q3: 30 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.

Alexander Arrington

	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

Jaylen Boykin

	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

Jason Bruno

	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

Elbert Buchanan

	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

Daniel Epps

	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

Jordan Hubbard

	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

Kayla Johnson

	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

Bria McCutcheon

	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#: ______________________

Darren McGee

	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

Justin McGuffee

	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

Kayshaunna Williams

	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 Wilson

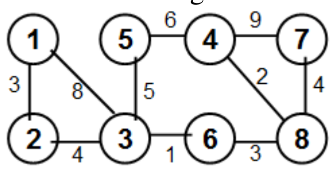
	V1	V2	V3	V4	V5
V1	0	1	11	6	∞
V2	1	0	10	∞	12
V3	14	∞	0	10	6
V4	2	2	1	0	∞
V5	15	∞	3	15	0

Name: ________________________________ J#: ________________________

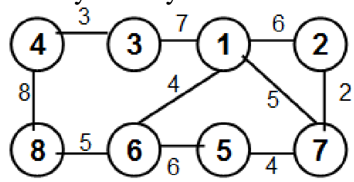
Name: ______________________________ J#: ______________________

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.

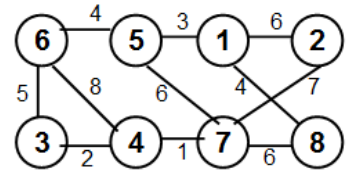
Alexander Arrington



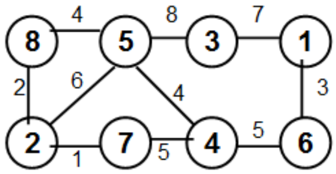
Jaylen Boykin



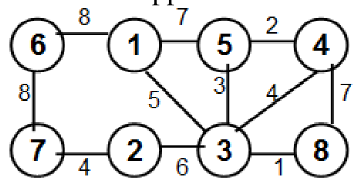
Jason Bruno



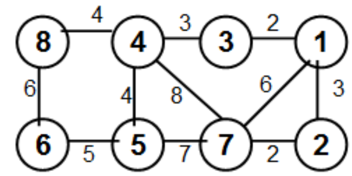
Elbert Buchanan



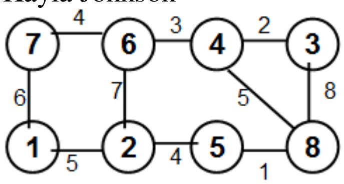
Daniel Epps



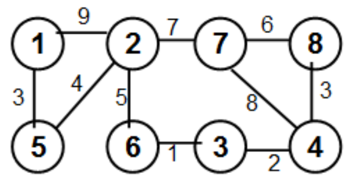
Jordan Hubbard



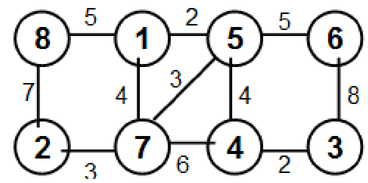
Kayla Johnson



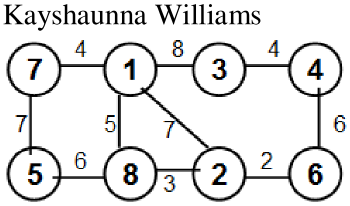
Bria McCutcheon



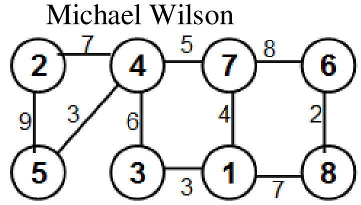
Darren McGee



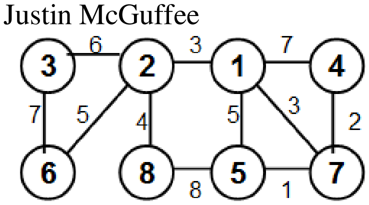
Kayshaunna Williams



Michael Wilson

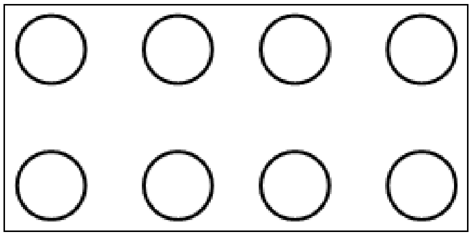


Justin McGuffee

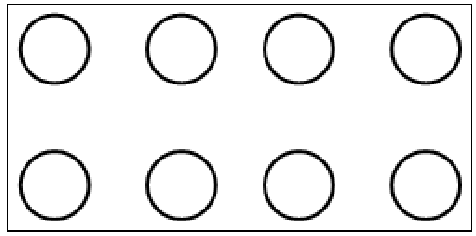


Name: ______________________________ J#: ______________________

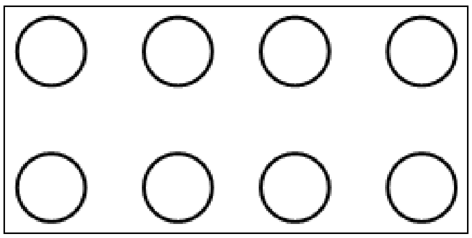
Skeletal Graphs (Iterations)



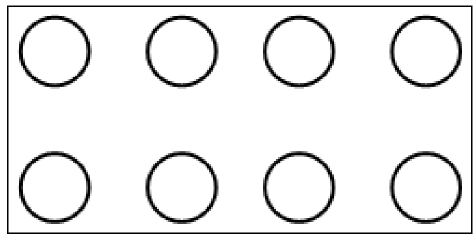
Given Graph



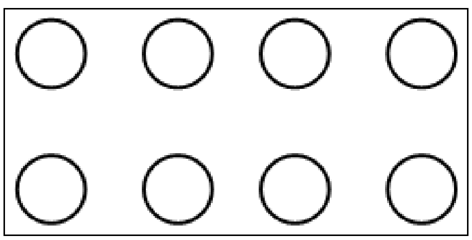
Initialization



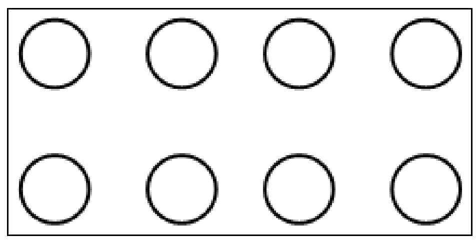
Iteration 1



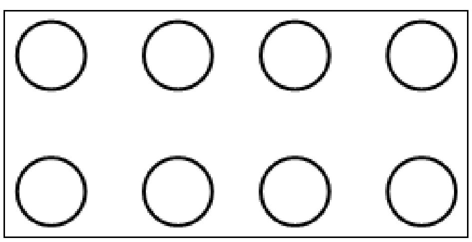
Iteration 2



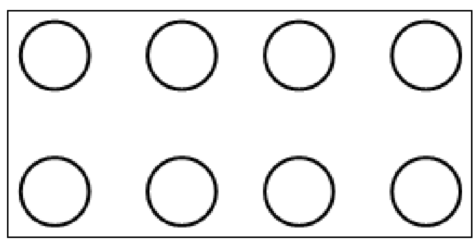
Iteration 3



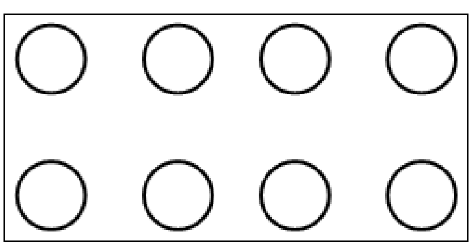
Iteration 4



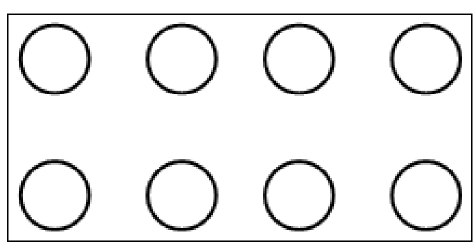
Iteration 5



Iteration 6



Iteration 7



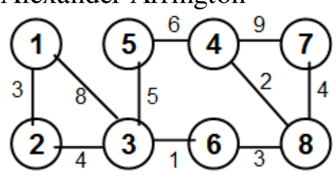
Shortest Path Tree

Sum of the Weights of the Shortest Path Tree: _________

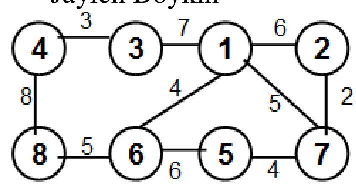
Name: ________________________________ J#: ______________________

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.

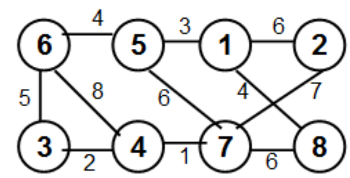
Alexander Arrington



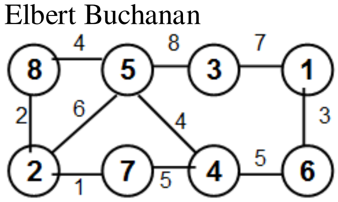
Jaylen Boykin



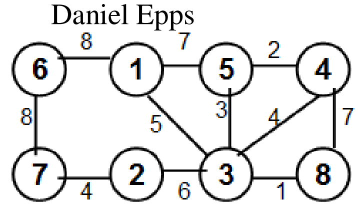
Jason Bruno



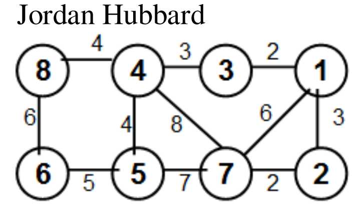
Elbert Buchanan



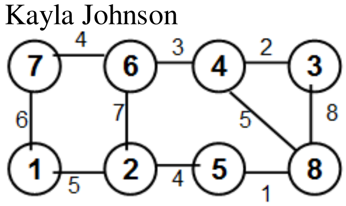
Daniel Epps



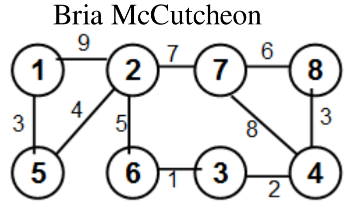
Jordan Hubbard



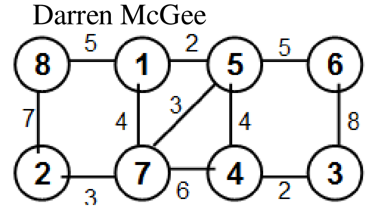
Kayla Johnson



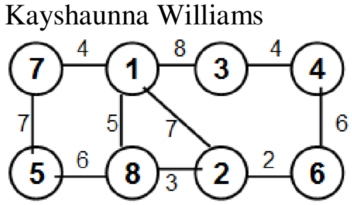
Bria McCutcheon



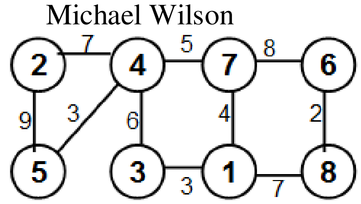
Darren McGee



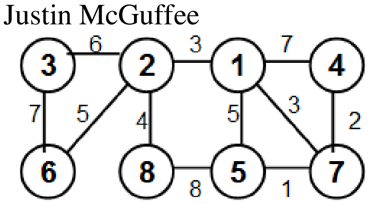
Kayshaunna Williams



Michael Wilson

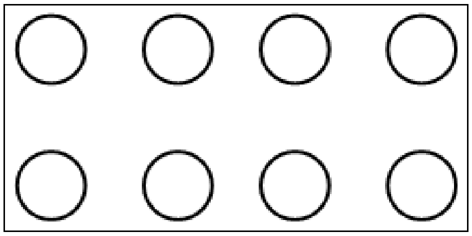


Justin McGuffee

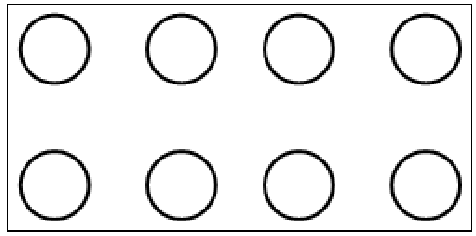


Name: ________________________________ J#: ________________________

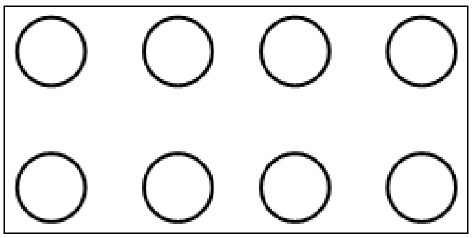
Skeletal Graphs (Iterations)



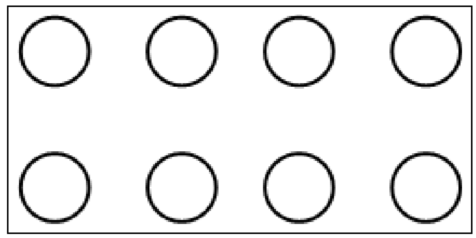
Given Graph



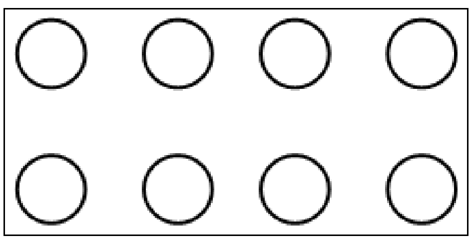
Initialization



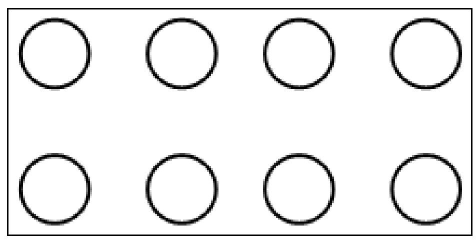
Iteration 1



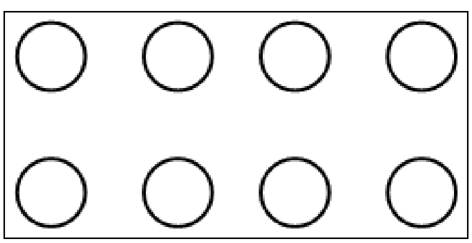
Iteration 2



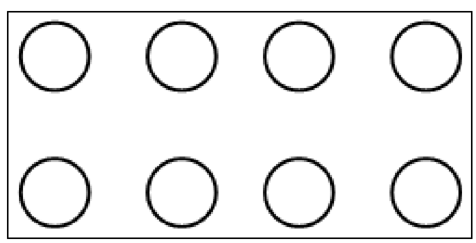
Iteration 3



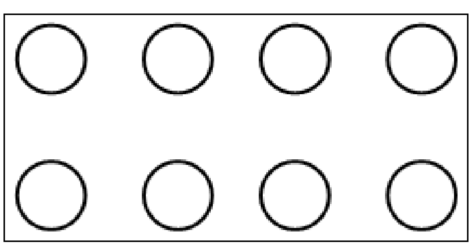
Iteration 4



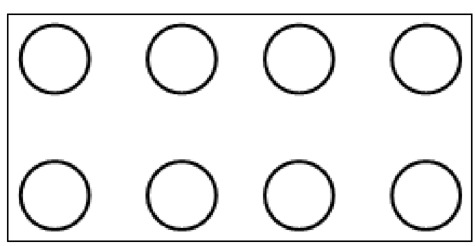
Iteration 5



Iteration 6



Iteration 7



Minimum Weight Spanning Tree

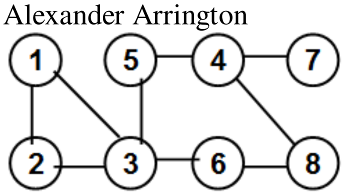
Sum of the weights of the Minimum Weight Spanning Tree: ________________

Name: ______________________________ J#: ______________________

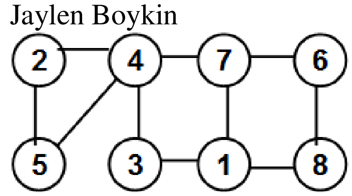
Q6: 15 pts) Run a Breadth First Search (BFS) on the graph and find the level numbers of the vertices as well as identify the tree edges and cross edges.

Use the results to determine whether the graph is bipartite (2-colorable) or not. If the graph is bipartite, identify the two partitions of the graph. If the graph is not bipartite, identify the edges that prevent the graph from being bipartite.

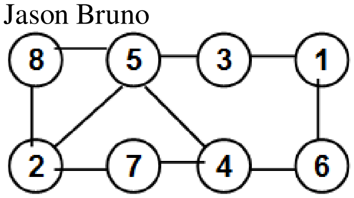
Alexander Arrington



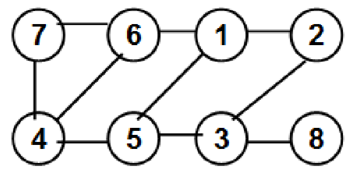
Jaylen Boykin



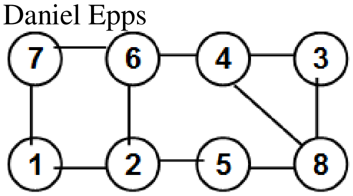
Jason Bruno



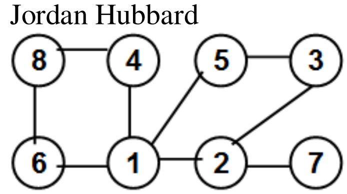
Elbert Buchanan



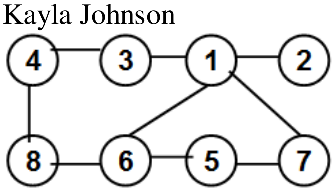
Daniel Epps



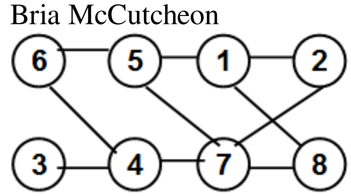
Jordan Hubbard



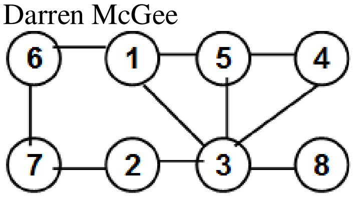
Kayla Johnson



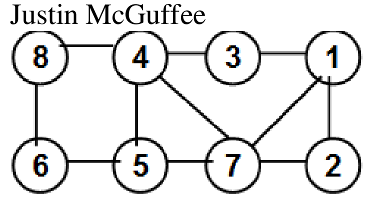
Bria McCutcheon



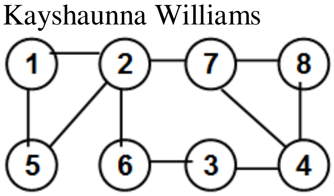
Darren McGee



Justin McGuffee



Kayshaunna Williams



Michael Wilson