Name: _____ J#: _____

Jackson State University
CSC 323 Algorithm Design and Analysis, Spring 2020
Instructor: Dr. Natarajan Meghanathan
Exam 4 (Take Home)
Maximum Points: 100 **Due on: April 28th, 2019: 11.59 PM in Canvas**

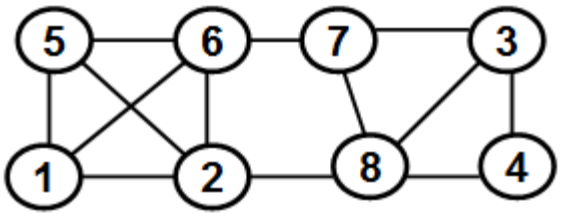
Submission Options (choose one of the three): You can either
(a) Print this exam, write the solutions in the space provided, scan and upload as a PDF file or
(b) Use the space provided to type the solutions, save the file to a word or PDF and upload or
(c) Use the space provided to write the solutions for some questions by hand and type the solutions for some other questions. In this case, you should scan the written text to a PDF file, merge it with the PDF file for the typed content and submit everything together as a single PDF file.

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

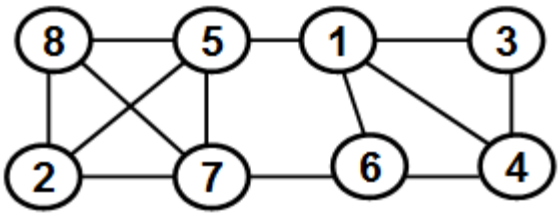
(a-7) Maximal Independent Set (b-2) Minimal Vertex Cover (c-8) Maximal Clique (d-8) Minimum Connected Dominating Set

Show all the work for each.

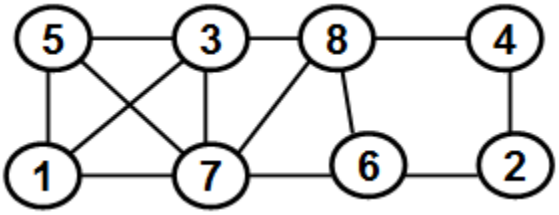
Abate, Biruk



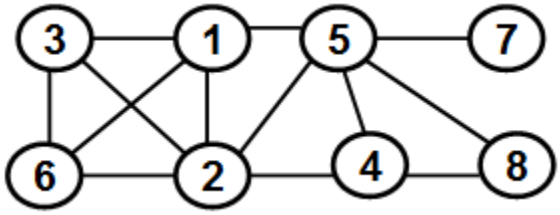
Akintade, Oluwaseun



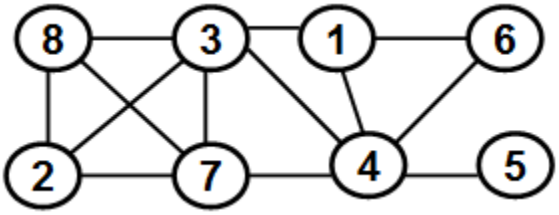
Alharbi, Abdullah



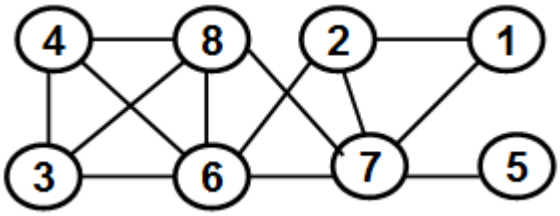
Alharbi, Abdulmajeed



Atkins, Nayaa

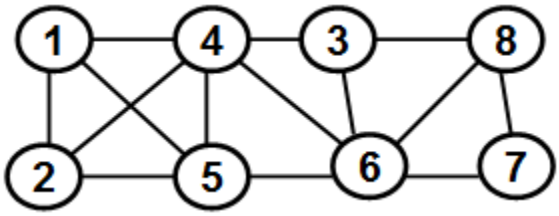


Barnett, Isaiah

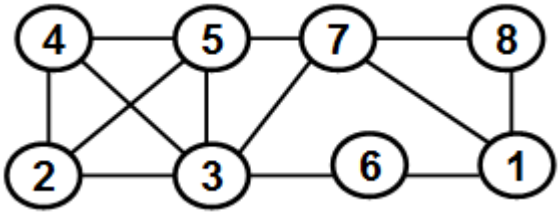


Name: _____ J#: _____

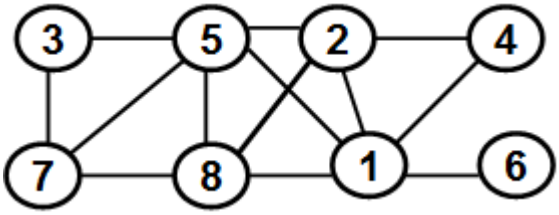
Dent, Kaitlyn



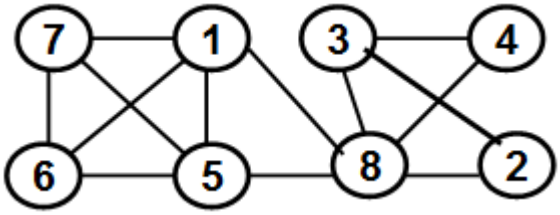
Drake, Keilah



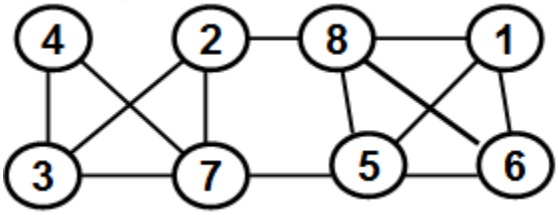
Harris, Chawne



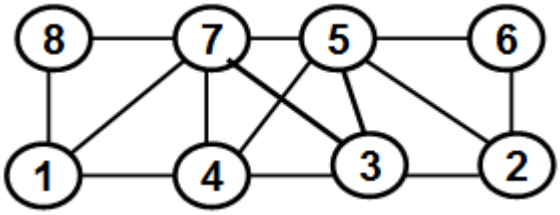
McGee, Bria



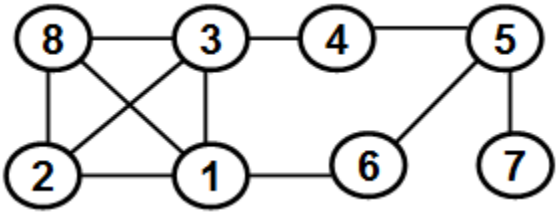
Redmond, Brandon



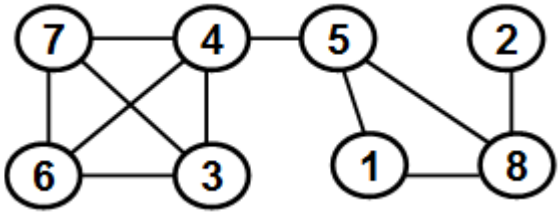
Roberts, Cambria



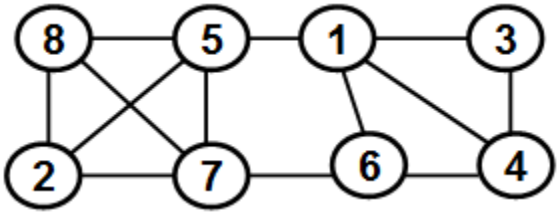
Stubbs, Jasmine



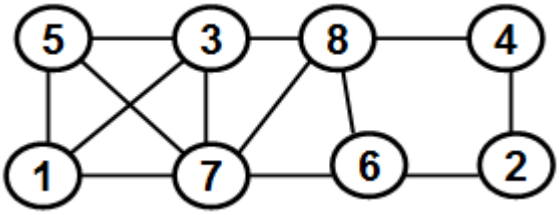
Swami, Shaurya



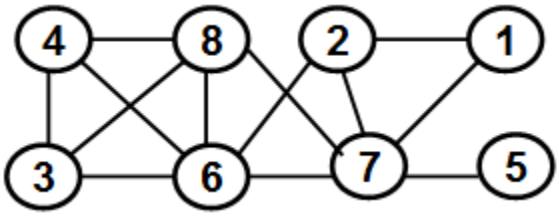
Tchakoua, Landrie



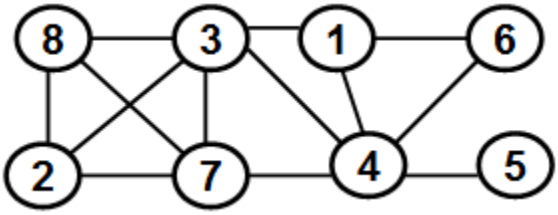
Teshome, Nahom



Triplett, Marzell



Wilkes, Kyla



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Q2: 25 pts) You are assigned the edge weight matrix for a complete graph. Determine an **approximation to the minimum weight tour** using the (i-7) Nearest neighbor heuristic (ii-10) Twice around the tree heuristic.

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

(2 pts) Using the result of the Twice around the tree heuristic, determine what could be the minimum possible weight of an optimal tour for the graph assigned to you.

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.

Abate, Biruk

	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

Akintade, Oluwaseun

	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

Alharbi, Abdullah

	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

Alharbi, Abdulmajeed

	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

Atkins, Nayaa

	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

Barnett, Isaiah

	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

Dent, Kaitlyn

	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

Drake, Keilah

	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

Name: _____ J#: _____

Harris, Chawne

	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

McGee, Bria

	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

Redmond, Brandon

	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

Roberts, Cambria

	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

Stubbs, Jasmine

	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

Swami, Shaurya

	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

Tchakoua, Landrie

	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

Teshome, Nahom

	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

Triplett, Marzell

	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

Wilkes, Kyla

	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

Name: ________________________________ J#: _______________________

Name: ______________________________ J#: ______________________

Name: _____ J#: _____

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.

Abate, Biruk

	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

Akintade, Oluwaseun

	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

Alharbi, Abdullah

	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

Alharbi, Abdulmajeed

	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

Atkins, Nayaa

	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

Barnett, Isaiah

	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

Dent, Kaitlyn

	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

Drake, Keilah

	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#: _____

Harris, Chawne

	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

McGee, Bria

	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

Redmond, Brandon

	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

Roberts, Cambria

	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

Stubbs, Jasmine

	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

Swami, Shaurya

	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

Tchakoua, Landrie

	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

Teshome, Nahom

	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

Triplett, Marzell

	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

Wilkes, Kyla

	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

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Q4: 25 pts) For the edge weight matrix assigned to you for a directed graph, determine the shortest path weights from vertex V1 to every other vertex using the **Bellman-Ford algorithm.**

Show clearly the table (with the distance estimate and predecessor) for each iteration, as discussed in the slides.

Also, extract the shortest paths from V1 to every other vertex in the graph, as shown in the slides. Clearly show the path extraction steps.

Abate, Biruk

	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

Akintade, Oluwaseun

	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

Alharbi, Abdullah

	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

Alharbi, Abdulmajeed

	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

Atkins, Nayaa

	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

Barnett, Isaiah

	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

Dent, Kaitlyn

	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

Drake, Keilah

	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#: _____

Harris, Chawne

	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

McGee, Bria

	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

Redmond, Brandon

	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

Roberts, Cambria

	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

Stubbs, Jasmine

	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

Swami, Shaurya

	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

Tchakoua, Landrie

	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

Teshome, Nahom

	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

Triplett, Marzell

	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

Wilkes, Kyla

	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

Name: _____ J#: _____

Name: _____ J#: _____

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