

CSC 228 Data Structures and Algorithms, Spring 2020

Instructor: Dr. Natarajan Meghanathan

Exam 4 (Take Home)

Max. Points: 100

Due on: April 28th, by 11.59 PM in Canvas. Late submissions will NOT be accepted.

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

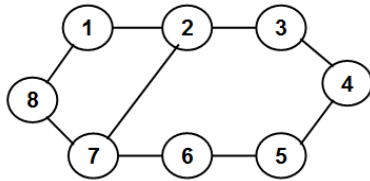
(b) Use the space provided to type the solutions, save the file to a word or PDF and upload or

(c) Write the solutions for some questions by hand (make sure it is readable) and type the solutions for some other questions. In this case, you should scan (or take a photo) the written text, merge it with the PDF file for the typed content and submit everything together as a single PDF file.

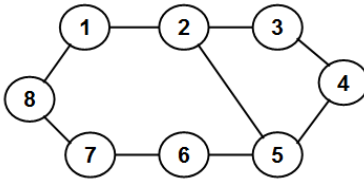
Note: For each question, each student is assigned a graph (the student name is below the graph). You should show your work only for the graph assigned to you. If you show your work for a graph that is not assigned to you, you will get a ZERO for that question, even if the answer is correct.

Q1 - 15 pts) The graph given here is bipartite. Run the Breadth First Search (BFS) algorithm on the graph: indicate the level numbers of the vertices and identify the tree edges and cross edges, using all of which determine the two partitions of the graph.

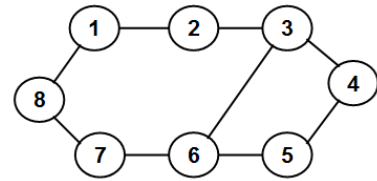
Show all the work. You will get a zero if you just draw the two partitions of the graph.



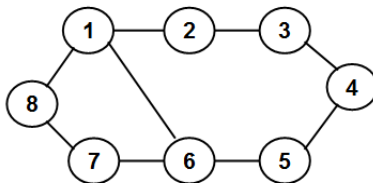
Kenneth Allen



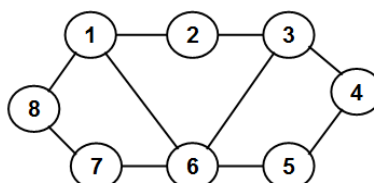
Laura Allen



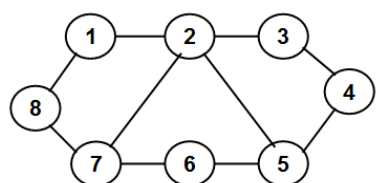
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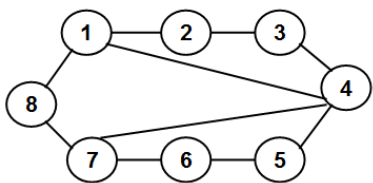
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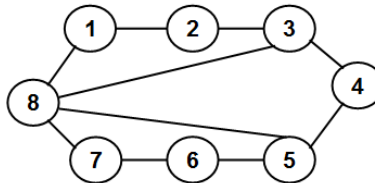
Antonio Harper



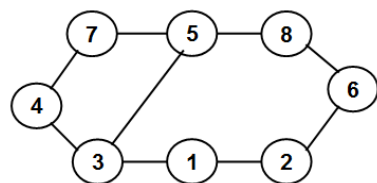
Morenike Irving



Jarmira Jackson



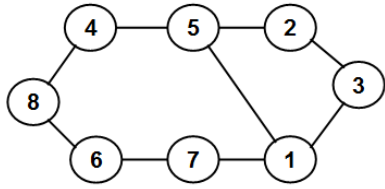
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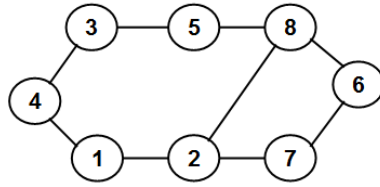
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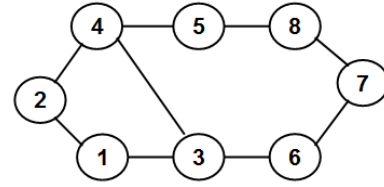
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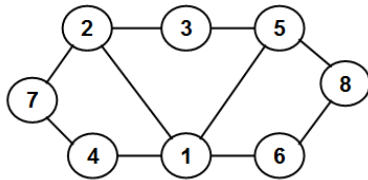
Dwayne Mcmorris



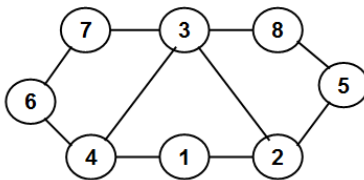
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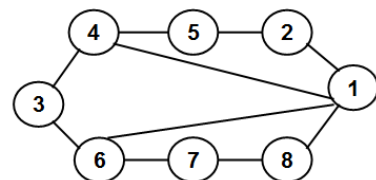
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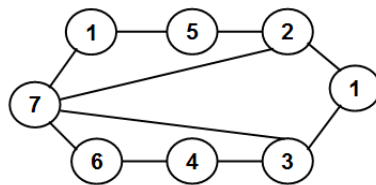
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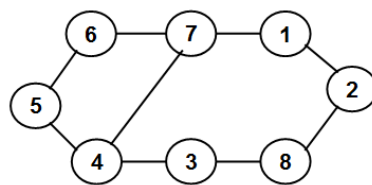
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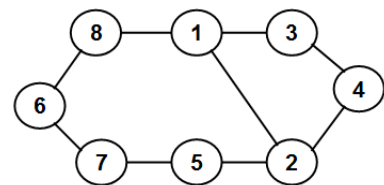
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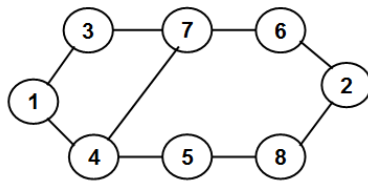
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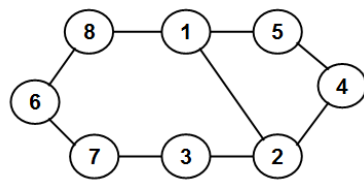
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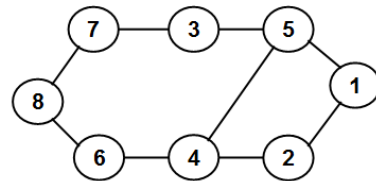
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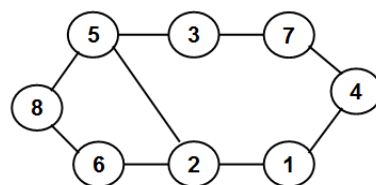
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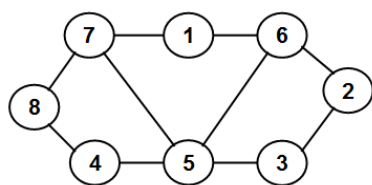
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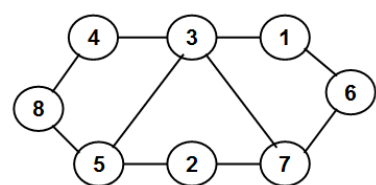
Nicholas Williams



Nicholas Williams



Opeoluwa Williams



Kyla Wilson

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J#: _____

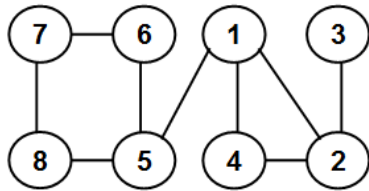
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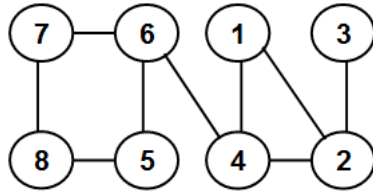
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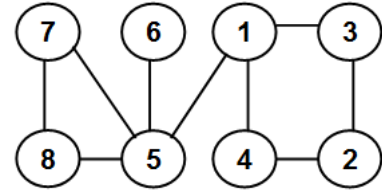
Q2 - 17 pts) For the given graph, run the Depth First Search (DFS) algorithm to identify the articulation points and bridge edges. Merely guessing and writing an answer will get you only ZERO points.



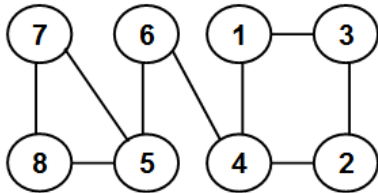
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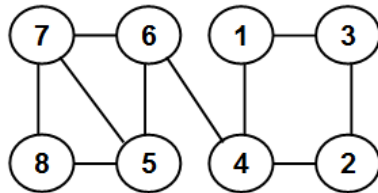
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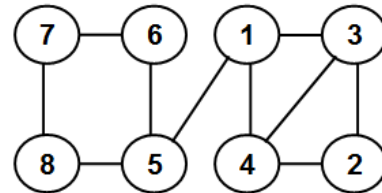
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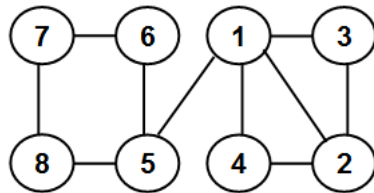
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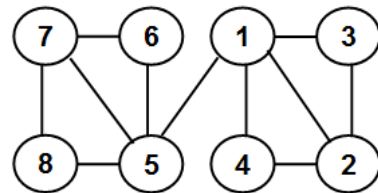
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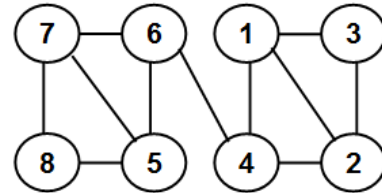
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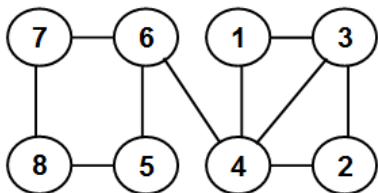
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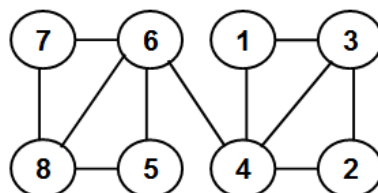
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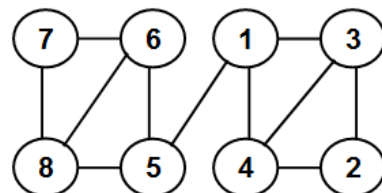
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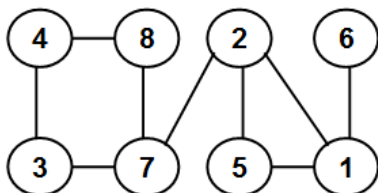
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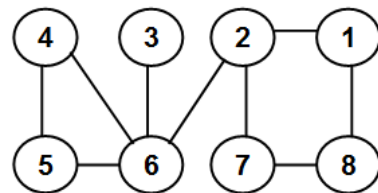
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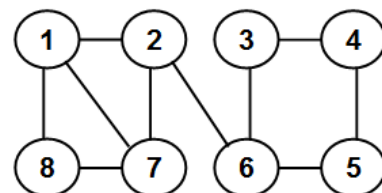
Vincent Price



Godfrey Robinson



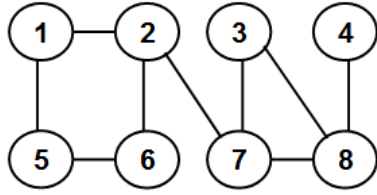
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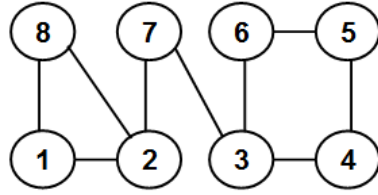
Kandice Sims

Student Name: _____

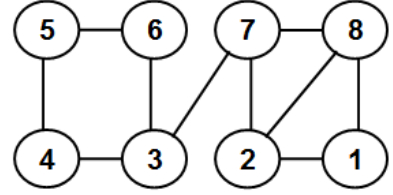
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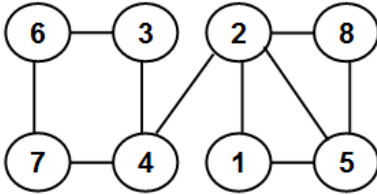
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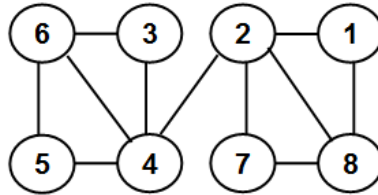
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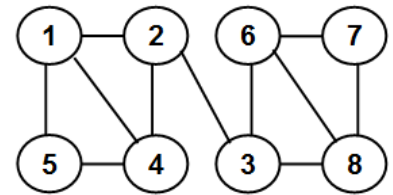
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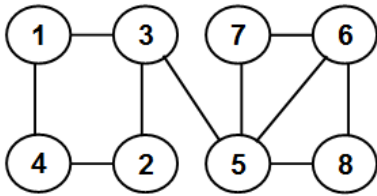
Justin Walls



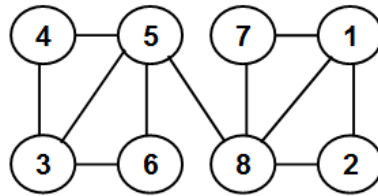
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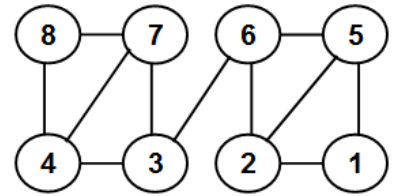
Nicholas Williams



Nicholas Williams



Opeoluwa Williams



Kyla Wilson

Student Name: _____

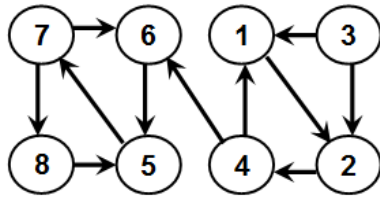
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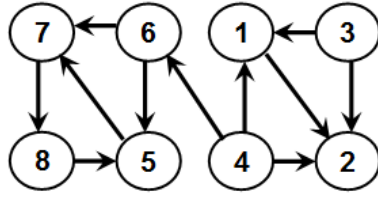
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Q3 - 23 pts) Run the Depth First Search (DFS) algorithm on the given directed graph.

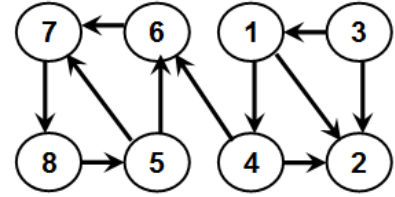
- (a) Identify the different types of edges as part of DFS.
- (b) Determine the push and pop order of the vertices.
- (c) Determine the strongly connected component(s) of the graph
- (d) Determine the weakly connected component(s) of the graph



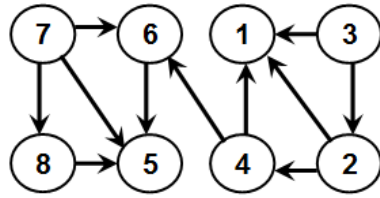
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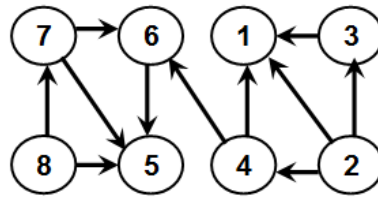
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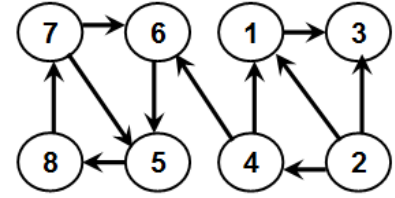
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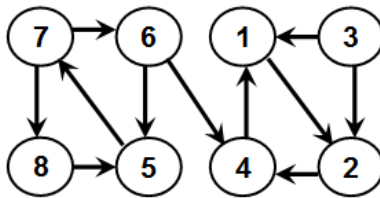
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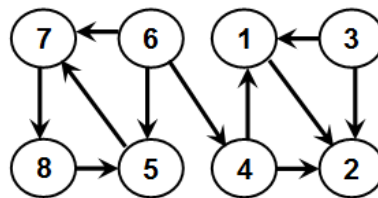
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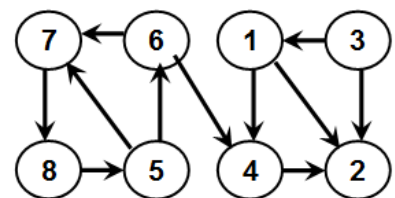
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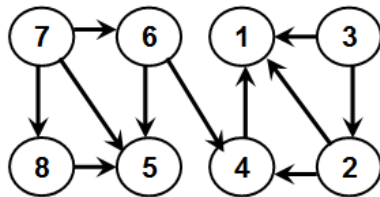
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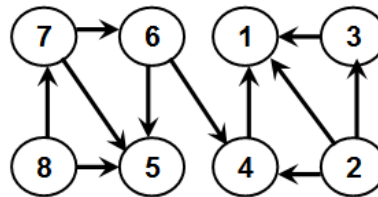
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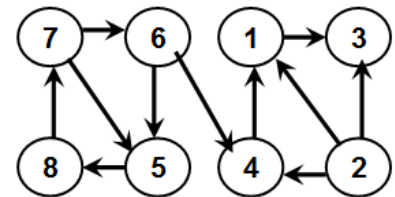
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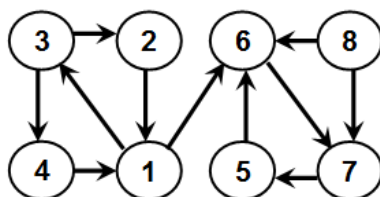
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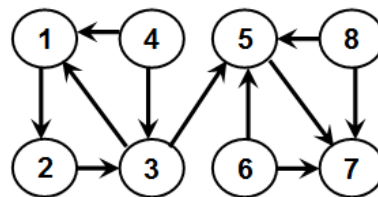
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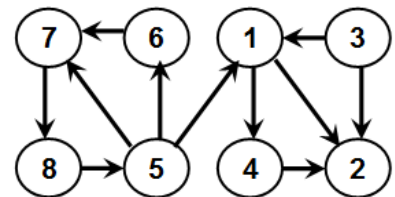
Vincent Price



Godfrey Robinson



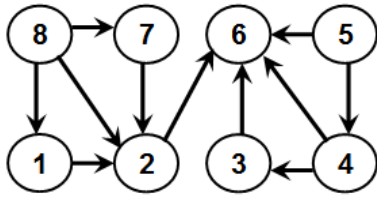
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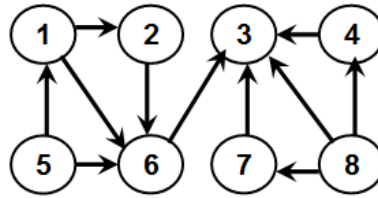
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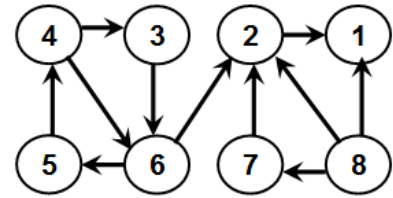
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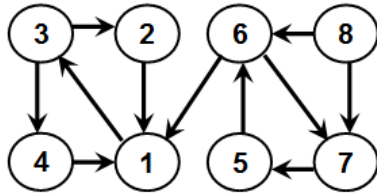
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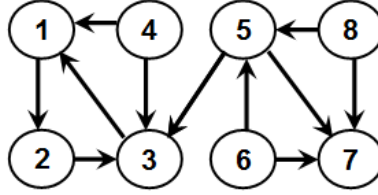
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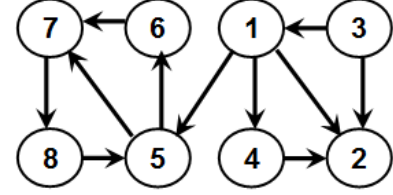
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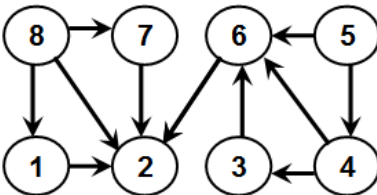
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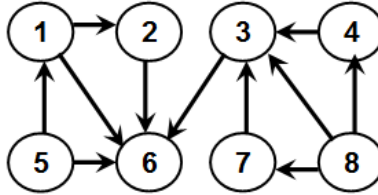
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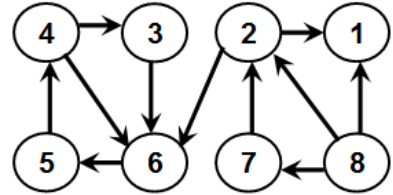
Nicholas Williams



Nicholas Williams



Opeoluwa Williams



Kyla Wilson

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J#: _____

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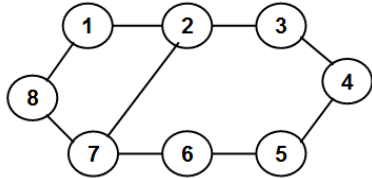
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Q4 - 15 pts) Consider the undirected graph shown below. Run Depth First Search (DFS) algorithm.

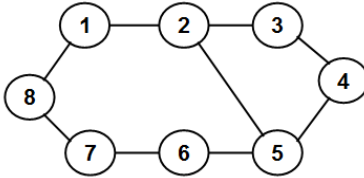
(a) Draw the DFS tree with tree edges and back edges as well as show the push and pop orders of the vertices.

(b) Use the results of (a) to assign directions to the edges such that the resulting directed graph has all the vertices in one strongly connected component.

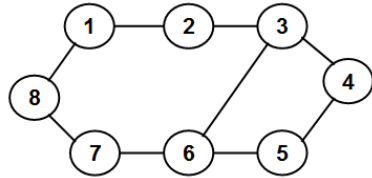
(c) Use the results of (a) to assign directions to the edges such that the resulting directed graph is a directed acyclic graph (DAG).



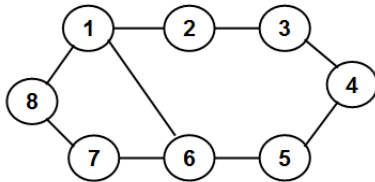
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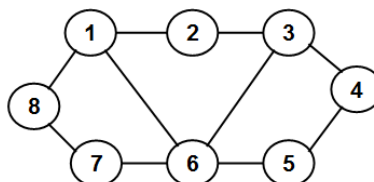
Laura Allen



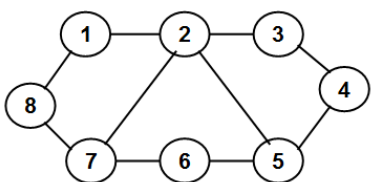
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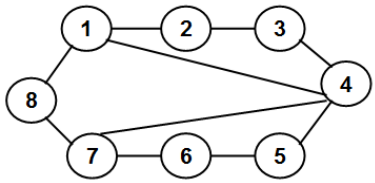
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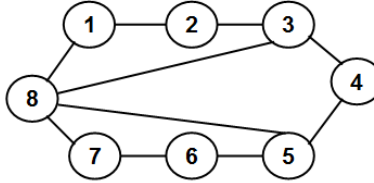
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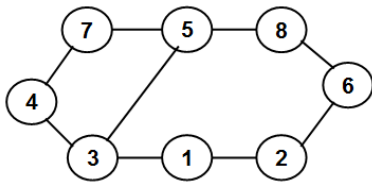
Morenike Irving



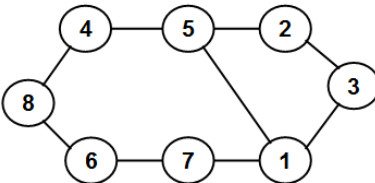
Jarmira Jackson



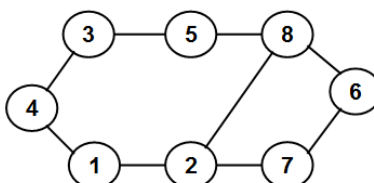
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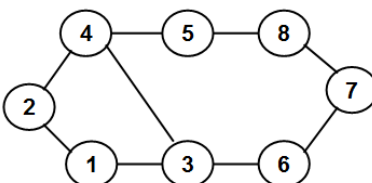
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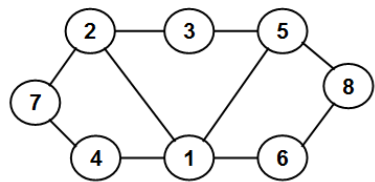
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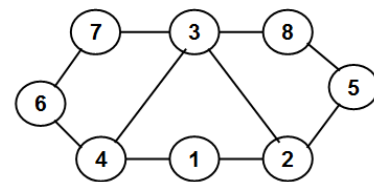
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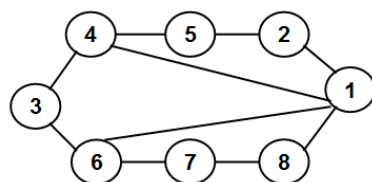
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Godfrey Robinson



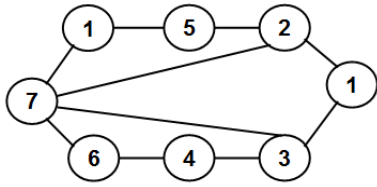
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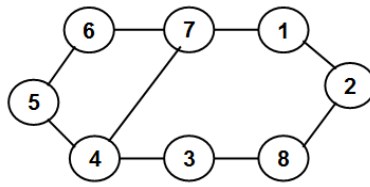
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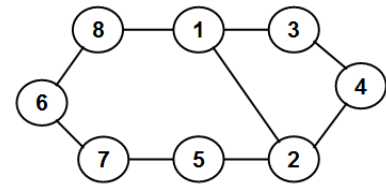
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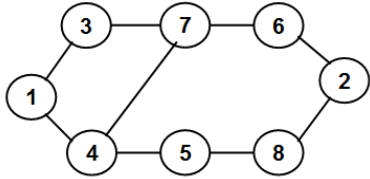
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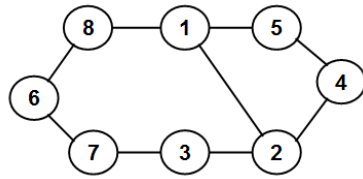
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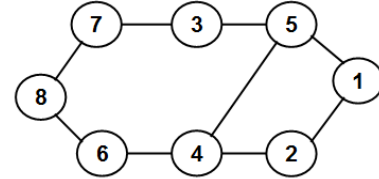
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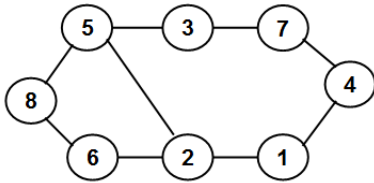
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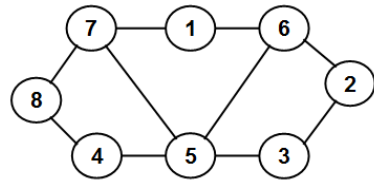
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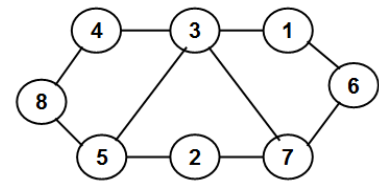
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Nicholas Williams



Opeoluwa Williams



Kyla Wilson

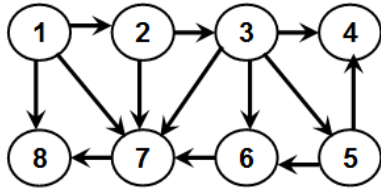
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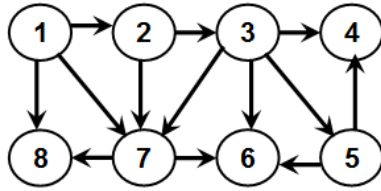
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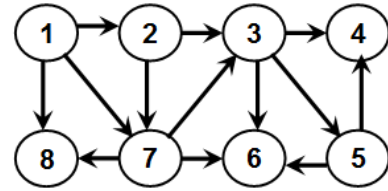
Q5 - 15 pts) Run the Depth First Search algorithm on the following directed acyclic graph (DAG) and determine a topological sort of the vertices as well as identify the tree edges, forward edges and cross edges.



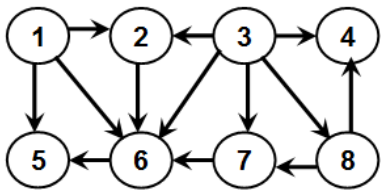
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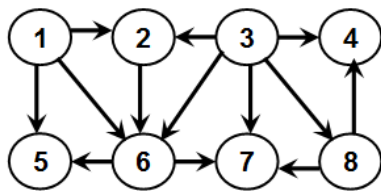
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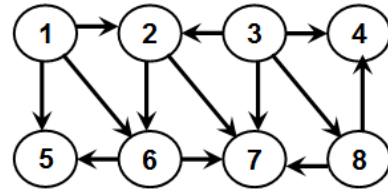
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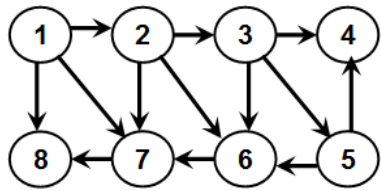
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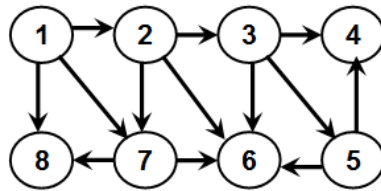
Antonio Harper



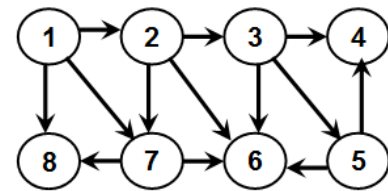
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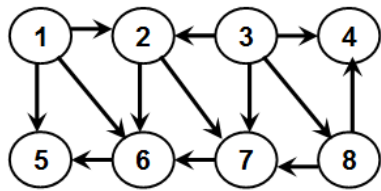
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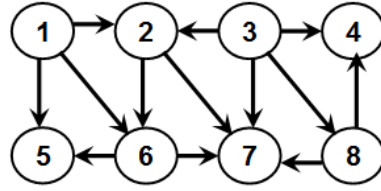
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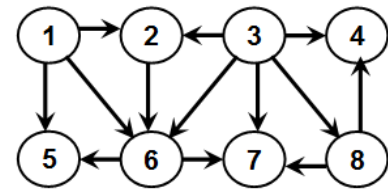
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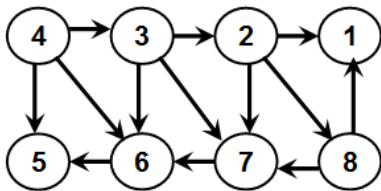
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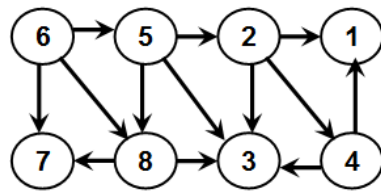
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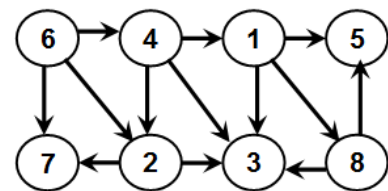
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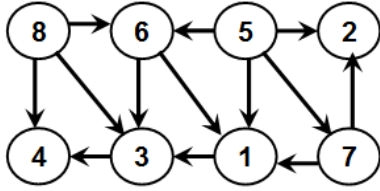
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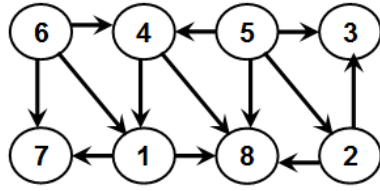
Kandice Sims

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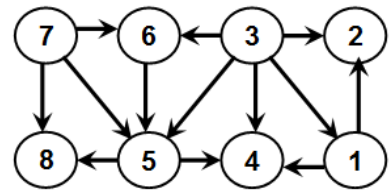
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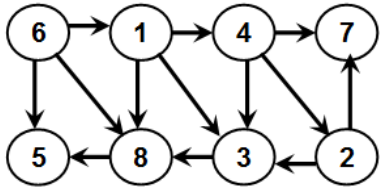
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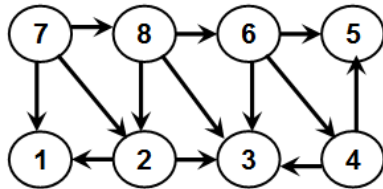
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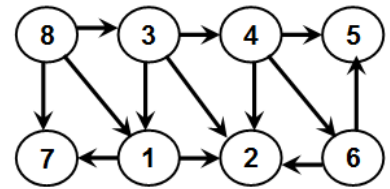
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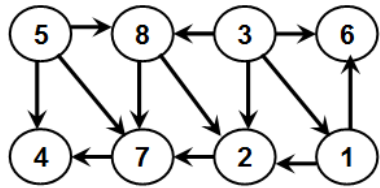
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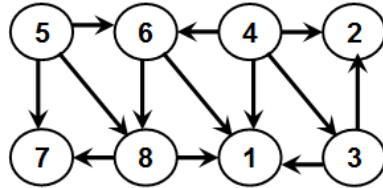
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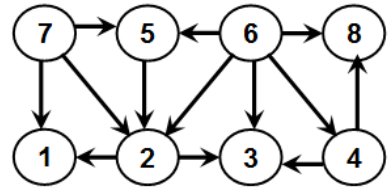
Nicholas Williams



Nicholas Williams



Opeoluwa Williams



Kyla Wilson

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J#: _____

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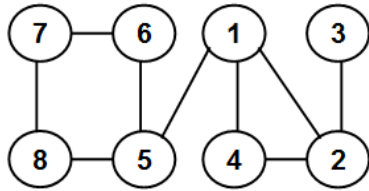
Q6 - 15 pts) Consider the undirected graph shown.

(a) Assign directions to the edges such that the resulting directed graph is a directed acyclic graph with a topological sort given by: **4 8 6 1 3 2 5 7**

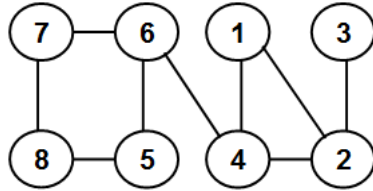
(b) Without running DFS, what can you say about the strongly connected components of the directed graph obtained in (a)?

(c) Determine the average degree of the vertices in the undirected graph assigned to you.

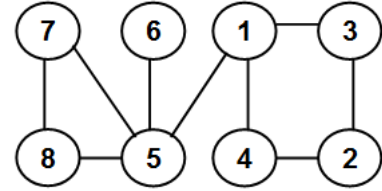
(d) Determine the number of edges in the undirected graph assigned to you based on the degrees of the vertices. Just merely counting the number of edges and presenting the answer will get only ZERO points.



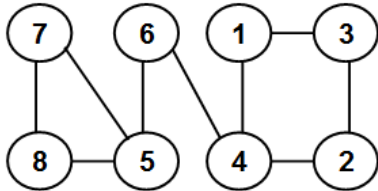
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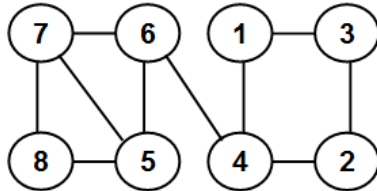
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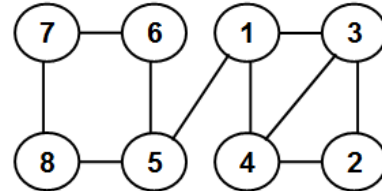
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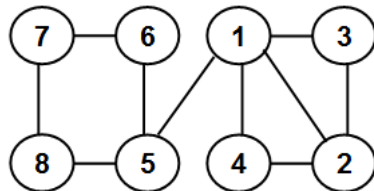
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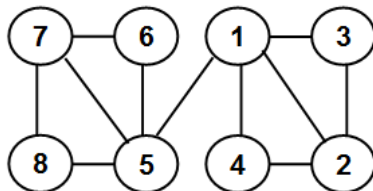
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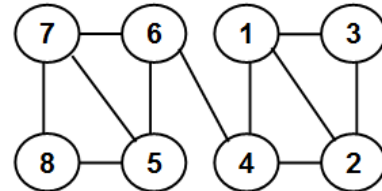
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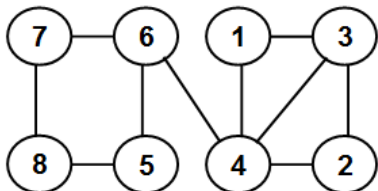
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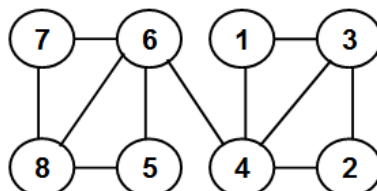
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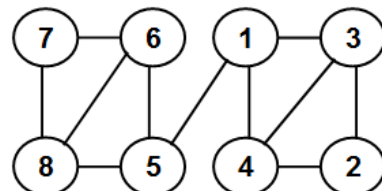
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Dwayne Mcmorris



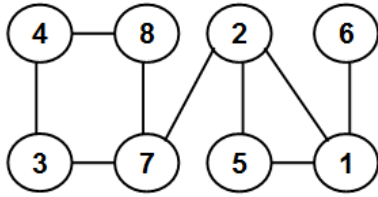
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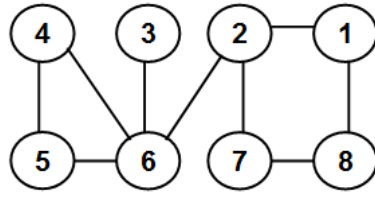
Vincent Price

Student Name: _____

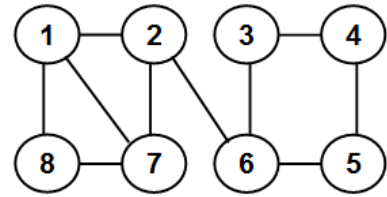
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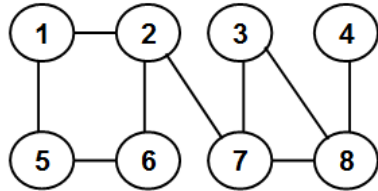
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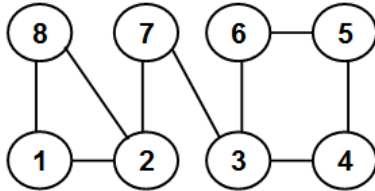
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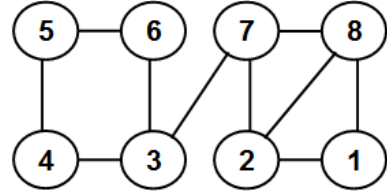
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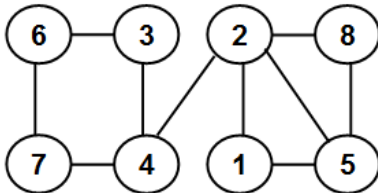
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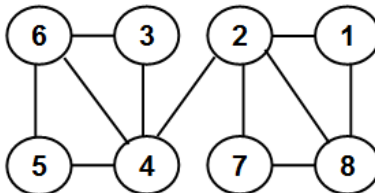
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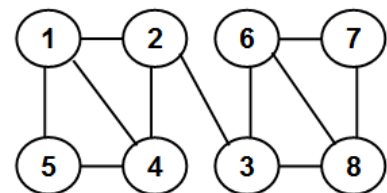
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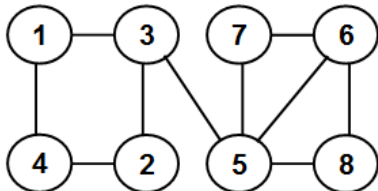
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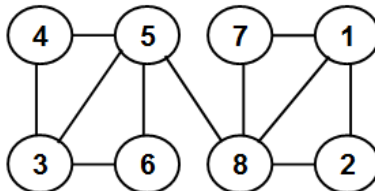
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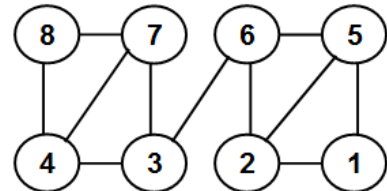
Nicholas Williams



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Opeoluwa Williams



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