Hanoi University

Faculty of Information Technology

Department of Computer Science

HOMEWORK

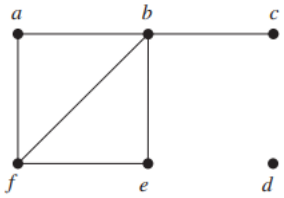
DISCRETE MATHEMATICS

PROBLEM SET 09 – GRAPH PART 1

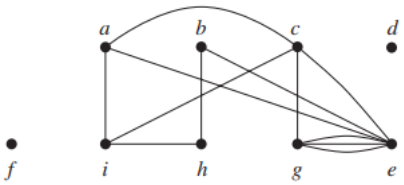
Semester: Fall 2021

PROBLEM SET 9

Problem 1: Find the number of vertices, the number of edges, and the degree of each vertex in the given undirected graph. Then find the sum of the degrees of the vertices of each graph and verify that it equals twice the number of edges in the graph.



G

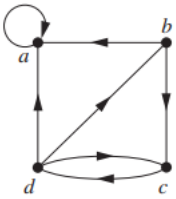


H

Problem 2: Can a simple graph exist with 15 vertices each of degree five?

Problem 3: Show that in a simple graph with at least two vertices there must be two vertices that have the same degree.

Problem 4: Determine the number of vertices and edges and find the in-degree and out-degree of each vertex for the given directed multigraphs.



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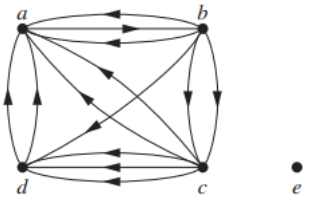

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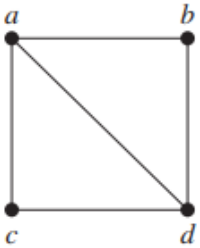
Problem 5: Use adjacency lists to represent the given graphs:



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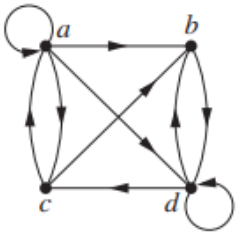


H

Problem 6: Draw graphs represented by the given adjacency matrices.

a.

$$\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

b. Undirected graph

$$\begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 0 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

c.

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 0 & 0 \\ 0 & 2 & 2 \end{bmatrix}$$

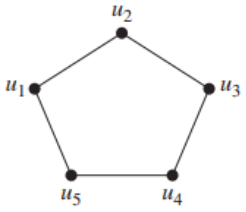
Problem 7: What is the sum of the entries in a column of the adjacency matrix for an undirected graph? For a directed graph?

Problem 8: Determine whether the given pairs of graphs are isomorphic.

Pair 1: G and H

Pair 2: P and Q

Pair 3: R and S



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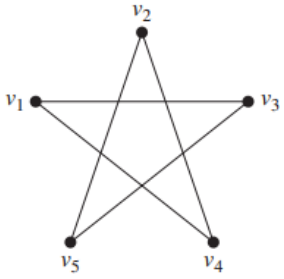

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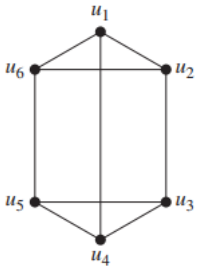
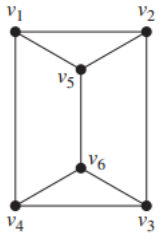
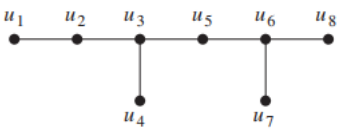


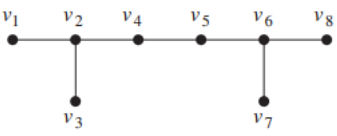
P



Q



R



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