**COSC 335 Discrete Structures**

Homework 9

**1**. Draw a simple graph with the set V of vertices, the set E of edges, find its adjacency matrix, find degrees of all its vertices and verify the Handshaking Theorem and the Theorem about an adjacency matrix.



0 1 0 1 1 0

1 0 1 0 0 0

0 1 0 1 0 0

1 0 1 0 1 1

1 0 0 1 0 0

0 0 0 1 0 0

deg(A) = 3

deg(B) = 2

deg(C) = 2

deg(D) = 4

deg(E) = 2

deg(F) = 1

Ag =

The Handshaking Theorem:

∑ deg(V)=2E

14 = 2(7)

14 = 14 ✓

Theorem about an adjacency matrix:

The sum of the entries in row i of the adjacency matrix of a simple graph is the degree of the i^th vertex.

0 1 0 1 1 0

1 0 1 0 0 0

0 1 0 1 0 0

1 0 1 0 1 1

1 0 0 1 0 0

0 0 0 1 0 0

deg(A) = 3; deg(B) = 2; deg(C) = 2; deg(D) = 4; deg(E) = 2; deg(F) = 1

Ag =

**2**. Draw a directed graph with the set V of vertices, the set E of edges, find its adjacency matrix, find in-degrees and out-degrees of all its vertices and verify the Theorem about in-degrees and out-degrees.



0 1 0 0 0 0

0 0 1 0 0 0

0 0 0 1 0 0

1 0 0 0 1 0

1 0 0 0 0 0

0 0 0 1 0 0

Ag =

|  |  |  |
| --- | --- | --- |
| Vertex | Indegree | Outdegree |
| A | 2 | 1 |
| B | 1 | 1 |
| C | 1 | 1 |
| D | 2 | 2 |
| E | 1 | 1 |
| F | 0 | 1 |

Theorem about in-degrees and out-degrees:

∑ deg^-(V) = ∑ deg^+(V) = |E|

1+1+1+2+1+1 = 2+1+1+2+1+0 = |7|

7 = 7 = 7 ✓

**3**. Draw a simple graph with



**4**. Draw a multi (pseudo) graph determined by the following adjacency matrix



**5**. Prove isomorphism of the following two graphs

They are isomorphic because they have a one to one correspondence(bijection) between their vertices which is shown below.

f(A)

f(B)

f(C)

f(D)

B

D

C

A