DISCRETE STRUCTURE (SECI 1013-03)

SEMESTER 1-2020/2021

ASSIGNMENT 4

GROUP 5

GROUP MEMBERS:

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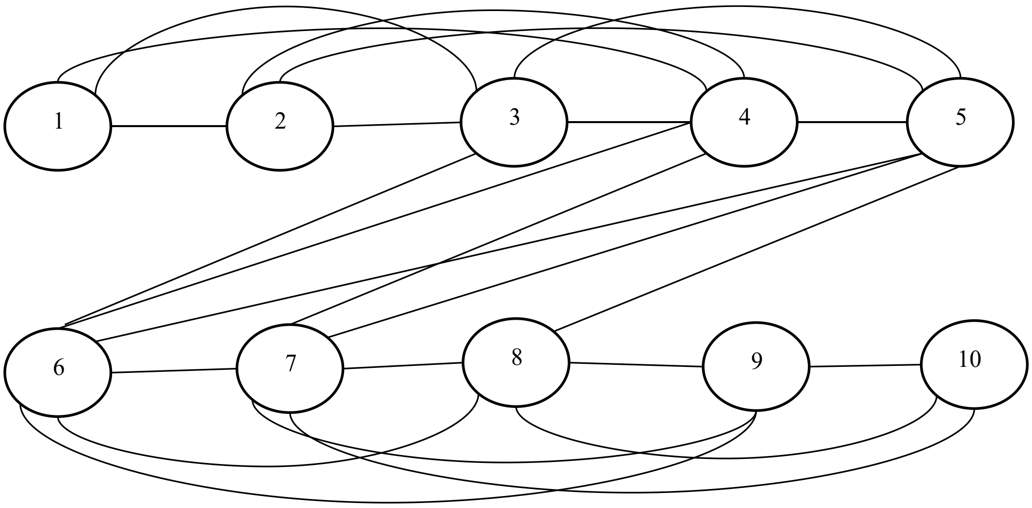
1)



Number of edges = 24

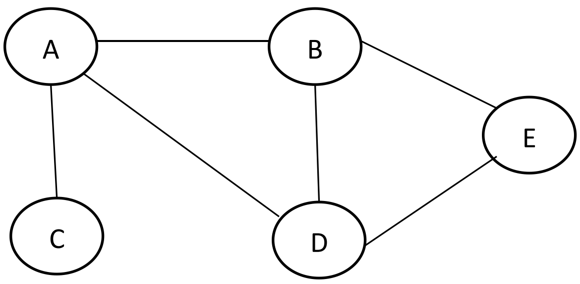
2a) A = Ahmad

B = Bakri

C = Chong

D = David

E = Ehsan



Adjacency matrices

$$\begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{matrix} A & B & C & D & E \end{matrix} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

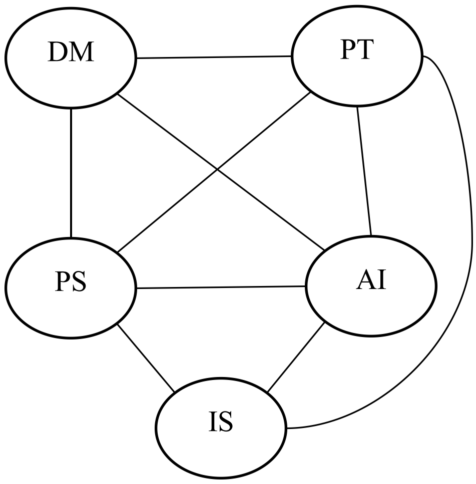
bi) DM = Discrete Mathematics

PT = Programming Technique

AI = Artificial Intelligence

PS = Probability Statistic

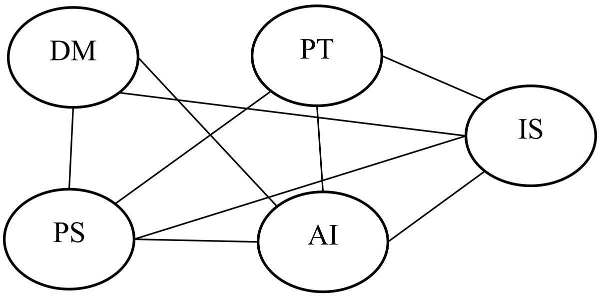
IS = Information System



Adjacency matrices

$$
\begin{array}{c}
\\
DM\\
PT\\
AI\\
PS\\
IS
\end{array}
\begin{array}{c}
\begin{array}{ccccc} DM & PT & AI & PS & IS \end{array}\\
\begin{bmatrix}
0 & 1 & 1 & 1 & 0\\
1 & 0 & 1 & 1 & 1\\
1 & 1 & 0 & 1 & 1\\
1 & 1 & 1 & 0 & 1\\
0 & 1 & 1 & 1 & 0
\end{bmatrix}
\end{array}
$$

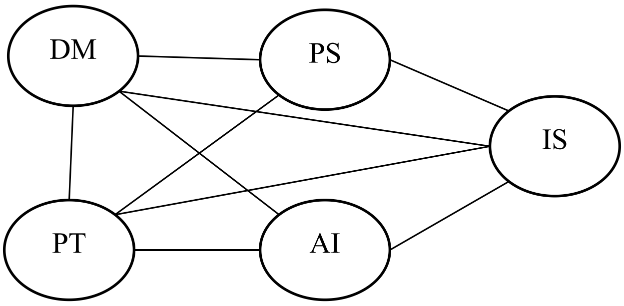
ii)



Adjacency matrices

$$
\begin{array}{c}
\\
DM\\
PT\\
AI\\
PS\\
IS
\end{array}
\begin{array}{c}
\begin{array}{ccccc} DM & PT & AI & PS & IS \end{array}\\
\begin{bmatrix}
0 & 0 & 1 & 1 & 1\\
0 & 0 & 1 & 1 & 1\\
1 & 1 & 0 & 1 & 1\\
1 & 1 & 1 & 0 & 1\\
1 & 1 & 1 & 1 & 0
\end{bmatrix}
\end{array}
$$

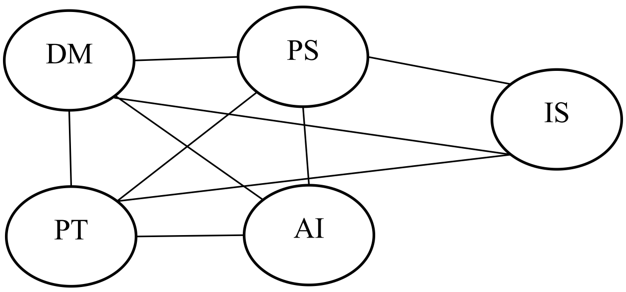
iii)



Adjacency matrices

$$\begin{array}{c} \\ DM \\ PT \\ AI \\ PS \\ IS \end{array} \begin{array}{c} \begin{array}{ccccc} DM & PT & AI & PS & IS \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

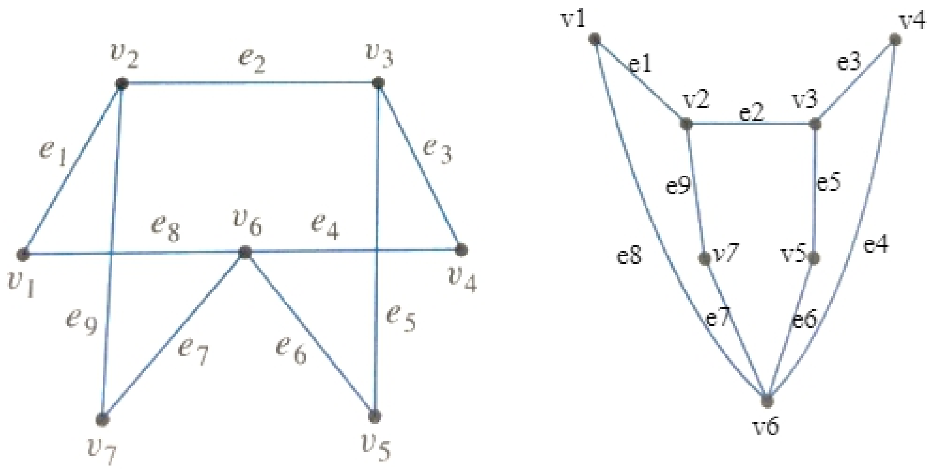
iv)



Adjacency matrices

$$\begin{array}{c} \\ DM \\ PT \\ AI \\ PS \\ IS \end{array} \begin{array}{c} \begin{array}{ccccc} DM & PT & AI & PS & IS \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 1 \\ 1 & 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

3)



4) Adjacency matrices

$$G = \begin{array}{c} \\ v1 \\ v2 \\ v3 \\ v4 \end{array} \begin{array}{c} \begin{array}{cccc} v1 & v2 & v3 & v4 \end{array} \\ \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

$$H = \begin{array}{c} \\ v1 \\ v2 \\ v3 \\ v4 \end{array} \begin{array}{c} \begin{array}{cccc} v1 & v2 & v3 & v4 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 2 \\ 0 & 1 & 1 & 0 \\ 0 & 2 & 0 & 0 \end{bmatrix} \end{array}$$

Incidence matrices

$$I = \begin{array}{c} \\ v1 \\ v2 \\ v3 \\ v4 \end{array} \begin{array}{c} \begin{array}{cccccc} e1 & e2 & e3 & e4 & e5 & e6 \end{array} \\ \begin{bmatrix} 2 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

$$I = \begin{array}{c} \\ v1 \\ v2 \\ v3 \\ v4 \end{array} \begin{array}{c} \begin{array}{cccccc} e1 & e2 & e3 & e4 & e5 & e6 \end{array} \\ \begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

5a) - Both graphs have same number of vertices and number of edges.

- All corresponding vertices of both graphs do not have the same degree.

- f : $G_1 \rightarrow G_2$ can be defined where $G_1 = \{v_1, v_2, v_3, v_4, v_5\}$ and $G_2 = \{u_1, u_2, u_3, u_4, u_5\}$, $f(v_1) = u_1$; $f(v_2) = u_2$; $f(v_3) = u_3$; $f(v_4) = u_4$

$$G_1 = \begin{array}{c} \\ v1 \\ v2 \\ v3 \\ v4 \\ v5 \end{array} \begin{array}{c} \begin{array}{ccccc} v1 & v2 & v3 & v4 & v5 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array} \qquad G_2 = \begin{array}{c} \\ u1 \\ u2 \\ u3 \\ u4 \\ u5 \end{array} \begin{array}{c} \begin{array}{ccccc} u1 & u2 & u3 & u4 & u5 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \end{array} \qquad G_1 \neq G_2$$

$Graph\ G_1\ and\ graph\ G_2\ are\ not\ isomorphic.$

b) - Both graphs have same number of vertices and number of edges.

- All corresponding vertices of both graphs do not have the same degree.

$$H_1 = \begin{array}{c} \\ a1 \\ a2 \\ a3 \\ a4 \\ a5 \end{array} \begin{array}{c} \begin{array}{ccccc} a1 & a2 & a3 & a4 & a5 \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 2 & 1 \\ 0 & 0 & 2 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 \end{bmatrix} \end{array} \qquad H_2 = \begin{array}{c} \\ x1 \\ x2 \\ x3 \\ x4 \\ x5 \end{array} \begin{array}{c} \begin{array}{ccccc} x1 & x2 & x3 & x4 & x5 \end{array} \\ \begin{bmatrix} 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 2 & 0 & 0 & 0 & 0 \end{bmatrix} \end{array} \qquad H_1 \neq H_2$$

$Graph\ H_1\ and\ graph\ H_2\ are\ not\ isomorphic.$

6)

a) trail

b) walk

c) walk

d) circuit

e) closed walk

f) path

7)

a) 3 path

v1, e1, v2, e3, v3, e5, v4

v1, e1, v2, e4, v3, e5, v4

v1, e1, v2, e2, v3, e5, v4

b) 3 trails

c) infinite

8) Graph (a) have Euler Circuit because the degree of every vertex is even. Therefore, we can say it is a Euler circuit.

Graph (b) don't have Euler Circuit because every vertex doesn't not have even degree. v1, v3, v5 and v7 have vertices with odd degree.

9)

For graph (a) there is a Euler circuit. u, v1, v0, v7, u, v2, v3, v4, v6, v2, v4, w, v5, v6, w.

For graph (b) there is no Euler circuit.

10) In both graphs there is no Hamiltonian path, because both graphs have more than one connected cycles.

11) How many leaves does a full 3-ary tree with 100 vertices have?

A full 3-ary tree with 100 internal vertices has:

$l = (3 - 1) * 100 + 1$

$= 201$ leaves

12)

a) Root = a

b) Internal vertices = a, b, d, e, g, n, h, j

c) Leaves = c, k, i, m, f, r, s, o, I, p, q

d) Children of n = r, s

e) Parent of e = b

f) Siblings of k = l, m

g) Proper ancestors of q = a, d, j

h) Proper descendants of b= e, f, g, k, l, m, n, r, s

13) Preorder traversal = a, b, e, k, l, m, f, g, n, r, s, c, d, h, o, i, j, p, q

Inorder Travesal = k, e, l, m, b, f, r, n, s, g, a, c, o, h, d, i, p, j, q

Postorder traversal= k, l, m, e, f, r, s, n, g, b, c, o, h, i, p, q, j, d, a

14)

Edge	Size
AB	1
GH	1
BC	2
AF	3
BF	4
CD	4
BG	5
CG	6
DH	6
GD	7
DE	7
FG	8
HE	8

Solution :

AB 1

GH 1

BC 2

AF 3

CD 4

BG 5

DE 7 = 23

15)

Iteration	S	N	L(M)	L(N)	L(O)	L(P)	L(Q)	L(R)	L(S)	L(T)
0	{}	{M, N, O, P, Q, R, S, T}	0	∞	∞	∞	∞	∞	∞	∞
1	{M}	{N, O, P, Q, R, S, T}	0	4	∞	2	∞	5	∞	∞
2	{M, P}	{N, O, Q, R, S, T}	0	4	∞	2	6	5	5	∞
3	{M, P, N}	{O, Q, R, S, T}	0	4	10	2	6	5	5	∞
4	{M, P, N, R}	{O, Q, S, T}	0	4	7	2	6	5	5	6
5	{M, P, N, R, S}	{O, Q, T}	0	4	7	2	6	5	5	6
6	{M, P, N, R, S, Q}	{O, T}	0	4	7	2	6	5	5	6
7	{M, P, N, R, S, Q, T}	{O}	0	4	7	2	6	5	5	6

= shortest length in each iteration

= shortest path

Shortest length = 6

Shortest Path = {M, R, T}