Faculty of engineering (School of computing)
Discrete structure (SECI1013-10)

Topic: Assignment 4

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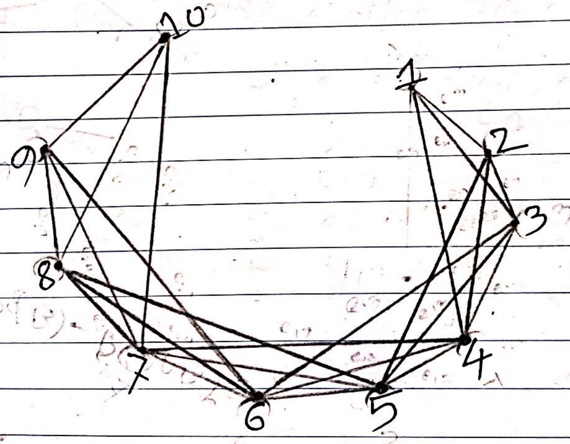
No.: .... Date: ....

Ans. to 1.

The adjacent vertices will be (1,2), (1,3), (1,4), (2,3), (2,4), (2,5), (3,4) (3,5), (3,6), (4,5), (4,6), (4,7), (5,6), (5,7), (5,8), (6,7), (6,8), (6,9), (7,8), (7,9), (7,10), (8,9), (8,10), (9,10).

Graph G →

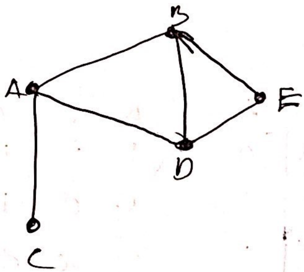


Here, total number of edges is 24 as determined from the graph.

Question 2 a

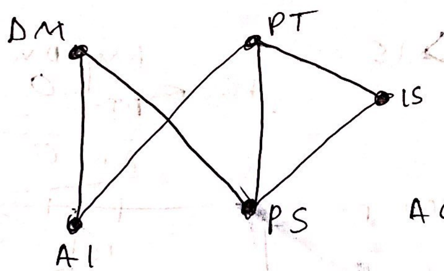
A = Ahmad, B = Bakri, C = chong.

D = David, E = Ehsan



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

Question 2b



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

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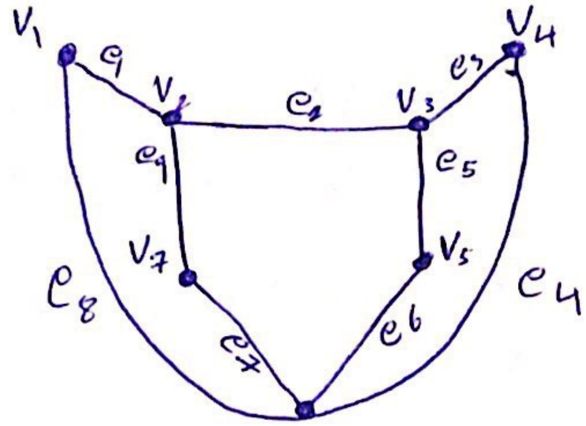
Q3



Q4

H adjacency matrix

$$\begin{array}{c|cccc} & v_1 & v_2 & v_3 & v_4 \\ \hline v_1 & 1 & 0 & 1 & 0 \\ v_2 & 0 & 0 & 1 & 0 \\ v_3 & 1 & 0 & 0 & 1 \\ v_4 & 0 & 0 & 1 & 0 \end{array}$$

Incidance matrix

$$\begin{array}{c|cccccc} & e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \\ \hline v_1 & 2 & 1 & -1 & 0 & 0 & 0 \\ v_2 & 0 & 0 & 0 & -1 & 0 & 0 \\ v_3 & 0 & \cancel{0} & 1 & 1 & 1 & -1 \\ v_4 & 0 & 0 & 0 & 0 & -1 & 1 \end{array}$$

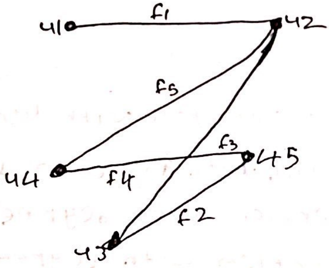
H: adjacency matrix

$$\begin{array}{c|cccc} & v_1 & v_2 & v_3 & v_4 \\ \hline v_1 & 1 & 0 & 0 & 0 \\ v_2 & 0 & 1 & 1 & 2 \\ v_3 & 0 & 1 & 1 & 0 \\ v_4 & 0 & 2 & 0 & 0 \end{array}$$

Incidance matrix

$$\begin{array}{c|cccccc} & e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \\ \hline v_1 & 2 & 0 & 0 & 0 & 0 & 0 \\ v_2 & 0 & 2 & 1 & 1 & 1 & 0 \\ v_3 & 0 & 0 & 0 & 0 & 1 & 2 \\ v_4 & 0 & 0 & 1 & 1 & 0 & 0 \end{array}$$

Question 5 a



Number of vertices: Both 5

Number of edges : Both 5

Degrees of corresponding vertices : Both has 2 vertices and degree 3, 2 vertices with degree 2, 1 vertices with degree 1

$$G_1 = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \end{array} \begin{array}{c} \begin{array}{ccccc} V_1 & V_2 & V_3 & V_4 & V_5 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

$$G_2 = \begin{array}{c} \\ u_5 \\ u_4 \\ u_2 \\ u_3 \\ u_1 \end{array} \begin{array}{c} \begin{array}{ccccc} u_5 & u_4 & u_2 & u_3 & u_1 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

Question 5b

Number of vertices: Both 5

Number of edges: Both 6

Degrees of corresponding vertices: H_1 = 1 vertices with degree 4

1 vertice with degree 3,

1 vertice with degree 2,

2 vertice with degree 1,

H_2 = 2 vertices with degree 3,

2 vertices with degree 2,

1 vertice with degree 4

H_1 and H_2 are not same. They are —

Isomorphic

Q 6

a) $v_0 e_1 v_1 e_{10} v_5 e_9 v_2 e_2 v_1$ is a trial because we note that the walke does not contain arepeated edge

b) $v_4 e_7 v_2 e_9 v_5 e_{10} v_1 e_3 v_2 e_9 v_5$ is just walk, because the walk is no trail, noppath, no closed walk, no cicuit and no simple circuit.

c) v_2 is atrail, because the walk does not contain a repeated edge.

d) $v_5 e_9 v_2 e_4 v_3 e_5 v_4 e_6 v_4 e_8 v_5$ is closed walk, trial and circuit

e) $v_2 e_4 v_3 e_5 v_4 e_8 v_5 e_9 v_2 e_7 v_4 e_5 v_3 e_4 v_2$ is closed walk

f) $v_3 e_5 v_4 e_8 v_5 e_{10} v_1 e_3 v_2$ is path and trail

Q7

a) $V_1 e_1 V_2 e_2 V_3 e_5 V_4$

$V_1 e_1 V_2 e_3 V_3 e_5 V_4$

$V_1 e_1 V_2 e_4 V_3 e_5 V_4$

number of path = 3

b) $V_1 e_1 V_2 e_2 V_3 e_3 V_2 e_4 V_3 e_5 V_4$

$V_1 e_1 V_2 e_4 V_3 e_3 V_2 e_2 V_3 e_5 V_4$

$V_1 e_1 V_2 e_3 V_3 e_5 V_4$

$V_1 e_1 V_2 e_2 V_3 e_5 V_4$

$V_1 e_1 V_2 e_4 V_5 e_5 V_4$

number of trails = 5

c) $V_1 e_1 V_2 e_2 V_3 e_5 V_5$

$V_1 e_1 V_2 e_4 V_3 e_5 V_5$

$V_1 e_1 V_2 e_2 V_3 e_3 V_2 e_4 V_3 e_5 V_4$

$V_1 e_1 V_2 e_4 V_3 e_3 V_2 e_3 V_2 e_2 V_3 e_5 V_4$

$V_1 e_1 V_2 e_3 V_3 e_5 V_4$

Numbe of walks = 5

Q 8

a) Euler circuit exists

$V_1 e_1 V_2 e_2 V_5 e_3 V_2 e_4 V_3 e_5 V_4 e_6 V_5 e_7 V_4 e_8 V_1$

Also ~~th~~ the number of degrees ~~a~~ of ~~even~~ vertex is even

$\deg(V_1) = 2$
$\deg(V_2) = 4$
$\deg(V_3) = 2$
$\deg(V_4) = 4$
$\deg(V_5) = 4$

b) The graph does not have ~~E~~ Euler circuit because a vertex

V_1 has odd degree $= \deg(V_1) = 5$

the graph does not have Euler circuit

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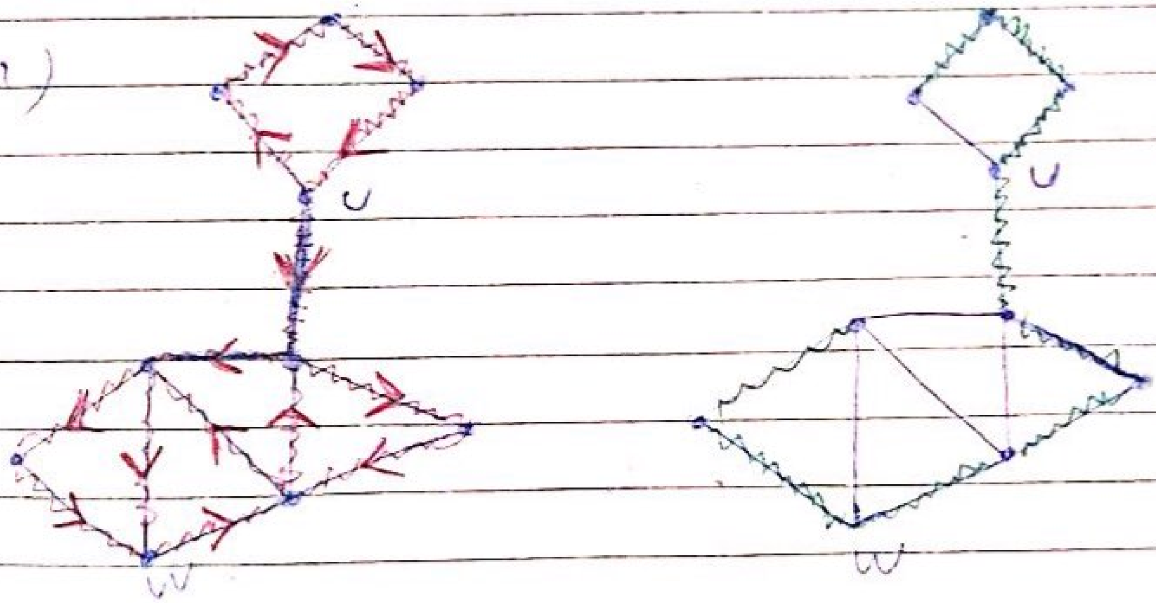
Q9

Soln:

Euler path :- An Euler path is a path that uses every edge a graph exactly once.

· Hamiltonian path Hamiltonian path is a path in an undirected or directed graph that visit each vertex exactly once.

a)



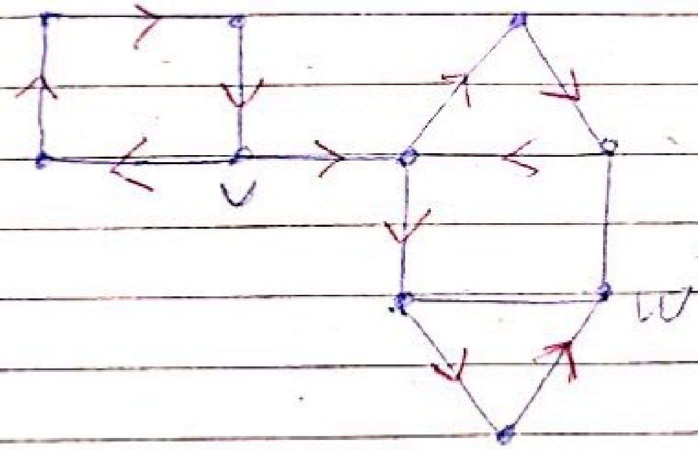
Hamiltonian Circuit :- Hamiltonian circuit is a graph cycle (closed loop) through a graph that visit each vertex exactly once.

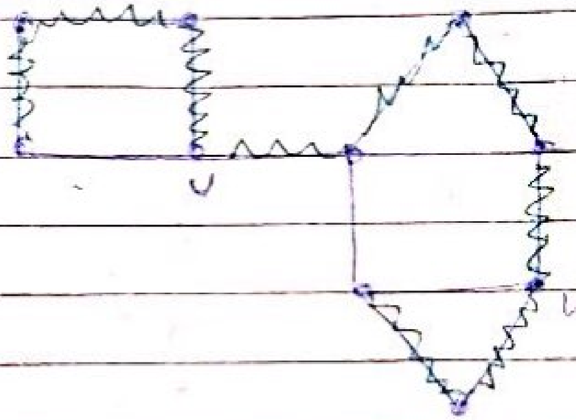
i.e. It is a Hamiltonian path that is a cycle

* graph a) have Euler path.

* graph a) have Hamitonian paths but not hamiltonian cycle as the path doesn't form a loop.

b)





It does not have a Euler path.

also can be checked by the condition that a graph have Euler path if zero or 2 vertices have odd degree and rest all vertices have even degree.

v, w, h, e have odd degree hence it cannot have Euler path.

b) has Hamiltonian path but it doesn't have hamiltonian circuit.
It can also be seen through Ore's theorem.

Ans: to the question :-10.

For (a),

There is no Hamilton circuit because all vertices cannot be connected without touching u ~~and~~ or V_2 twice.

For (b),

There is no Hamilton circuit either because all vertices cannot be connected without going through u ~~and~~ or f twice.

Q11

$m = 3$
$n = 100$

$$l = \frac{(m-1)n+1}{m}$$

$$= \frac{(3-1)100+1}{3}$$

$$= \frac{(2 \times 100)+1}{3}$$

$= 67$ leaves

Q12

a) root = 1, a

b) internal vertices = 8, a, b, d, e, g, h, j, n.

c) leaves = 11, c, f, i, k, l, m, r, s, o, p, q.

d) children of n = 2, r, s.

e) parent of e = 1, b

f) sibling of k = 2, l, m.

g) proper ancestors of q = 3, a, d, j.

h) proper descendants of b = 9, e, f, g, k, l, m, n, r, s.

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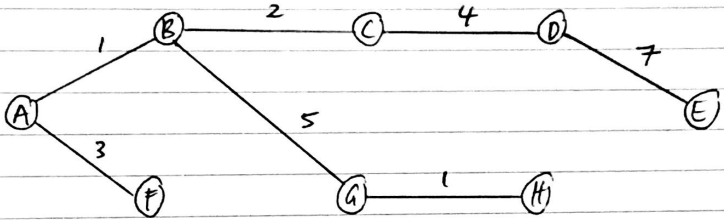
13) Preorder = a, b, e, k, l, m, a, f, g, n, r, s, c, d, h, o, i, j, p, q.

For inorder = k, e, l, m, b, f, r, n, s, g, a, e, o, h, d, i, p, j, q.

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

Q14



Q 15

No.	S	N	L(M)	L(N)	L(R)	L(P)	L(Q)	L(S)	L(O)	L(T)
1.	{ }	{M, N, R, P, Q, S, O, T}	0	∞	∞	∞	∞	∞	∞	∞
2	{M}	{N, R, P, Q, S, O, T}		4	5	2	∞	∞	∞	∞
3.	{M, P}	{N, R, Q, S, O, T}		4	5	2	6	5	∞	∞
4.	{M, P, N}	{R, Q, S, O, T}		4	5		6	5	10	∞
5.	{M, P, N, R}	{Q, S, O, T}			5		6	5	7	6
6.	{M, P, N, R, Q}	{S, O, T}					6	5	7	6
7.	{M, P, N, R, Q, O}	{S, T}						5	7	6
8.	{M, P, N, R, Q, S, T}	{O}							7	6

* M, R, T
* The length is 6