ASSIGNMENT 4

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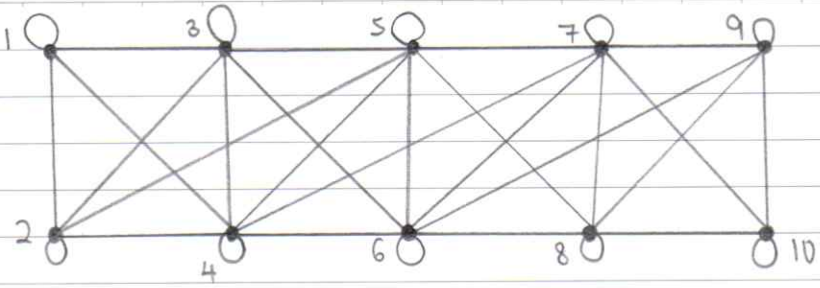
SECTION/COURSE CODE : **[SECI1013] [01] – [DISCRETE STRUCTURE]**

LECTURER : **[DR. RAZANA ALWEE]**

SESSION/SEMESTER : **[2020/2021] - [01]**

Case Study Report submitted to School of Computing, Univerisiti Teknologi Malaysia in partial fulfilment to complete the SECI1013 Assignment for Semester 1 session 2020/2021

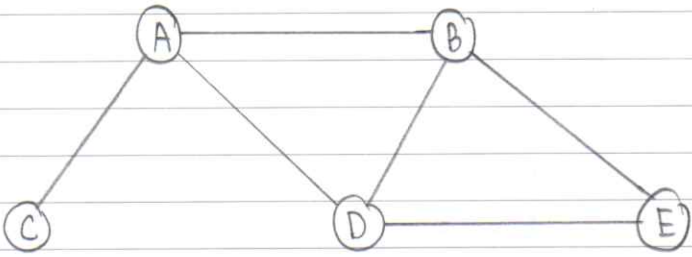
1)



$e(G) = 34$

2) a)

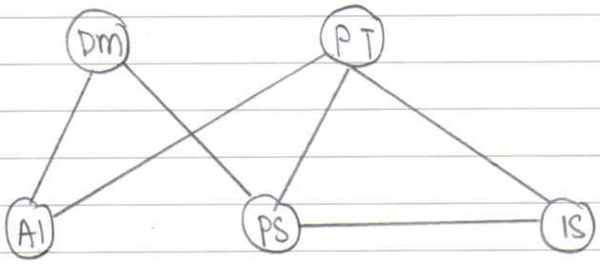
G:



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

b)

G:



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

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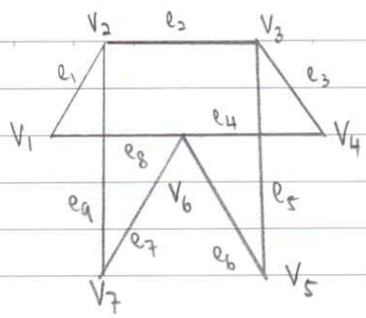
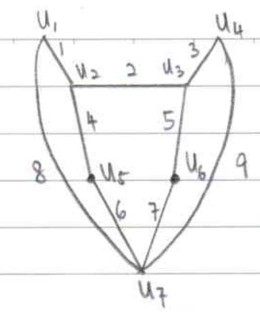
3) 



$\therefore f(v_1) = u_5$ $\qquad$ $\therefore E(e_1) = 4$

$f(v_2) = u_2$ $\qquad$ $E(e_2) = 2$

$f(v_3) = u_3$ $\qquad$ $E(e_3) = 5$

$f(v_4) = u_6$ $\qquad$ $E(e_4) = 7$

$f(v_5) = u_4$ $\qquad$ $E(e_5) = 3$

$f(v_6) = u_7$ $\qquad$ $E(e_6) = 9$

$f(v_7) = u_1$ $\qquad$ $E(e_7) = 8$

$E(e_8) = 6$

$E(e_9) = 1$

4)

$$A_G = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 2 & 0 & 2 & 0 \\ 0 & 0 & 1 & 0 \\ 2 & 1 & 0 & 2 \\ 0 & 0 & 2 & 0 \end{bmatrix} \end{array} \qquad I_G = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 2 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \end{bmatrix} \end{array}$$

$$A_H = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 2 & 0 & 0 & 0 \\ 0 & 2 & 1 & 2 \\ 0 & 1 & 2 & 0 \\ 0 & 2 & 0 & 0 \end{bmatrix} \end{array} \qquad I_H = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

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5) a) both are simple and connected graph
both have same vertices and edges. vertices = 5, edges = 5
both have same degree of vertices, where 1 vertice with 1 degree, 3 vertices with 2 degree and 1 vertice with 3 degree.

$$A_{G_1} = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{array} \begin{array}{c} \begin{array}{ccccc} v_1 & v_2 & v_3 & v_4 & v_5 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array} \qquad A_{G_2} = \begin{array}{c} \\ u_5 \\ u_4 \\ u_2 \\ u_3 \\ u_1 \end{array} \begin{array}{c} \begin{array}{ccccc} u_5 & u_4 & u_2 & u_3 & u_1 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

since $A_{G_1} = A_{G_2}$.
$\therefore$ G_1 & G_2 are isomorphic

b) both are connected graph with loops.
both have same vertices and edges, vertices = 5, edges = 6
both have different degree of vertices.
H_1 : 2 vertices with 1 degree, 1 vertice with 2 degree, 1 vertice with 3 degree, 1 vertice with 5 degree.
H_2 : 1 vertices with 1 degree, 1 vertice with 2 degree, 3 vertices with 3 degree.
$f(H_1) = H_2$ cannot be defined.
$\therefore$ H_1 and H_2 are not isomorphic.

6) a) trail. A walk from v_0 to v_1 does not contain a repeated edge.
b) walk. It got repeated edge which is e_9 and repeated vertex which is v_5.
c) closed walk. A walk start and ends at same vertex which is v_2.
d) circuit. A closed walk contain at least one edge and does not contain repeated edge. It start and ends at vertex v_5.
e) closed walk. A walk start and ends at same vertex which is v_2.
f) path. A trails does not contain repeated vertex. A walk from v_3 to v_2 does not contain repeated edge.

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7) a) $V_1, e_1, V_2, e_2, V_3, e_5, V_4$

$V_1, e_1, V_2, e_3, V_3, e_5, V_4$

$V_1, e_1, V_2, e_4, V_3, e_5, V_4$

$\therefore$ 3 path

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

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

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

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

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

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

$3 + 6 = 9$ note: 3 from 3 path

$\therefore$ 9 trails.

c) number of walks is infinite. A walk from a vertex to another vertex is a finite alternating sequence of adjacent vertices and edges.

8) a) Graph (a) has Euler circuit.

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

b) Graph (b) has no Euler circuit.

V_1 have odd degree, $d(V_1) = 5$, V_7 have odd degree, $d(V_7) = 3$, V_8 have odd degree, $d(V_8) = 3$ and V_9 have odd degree, $d(V_8) = 3$.

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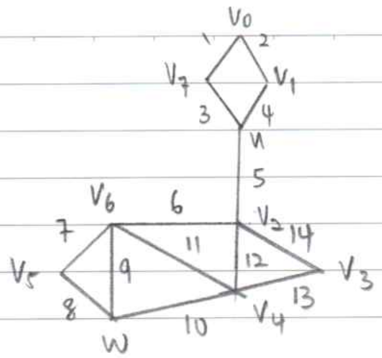
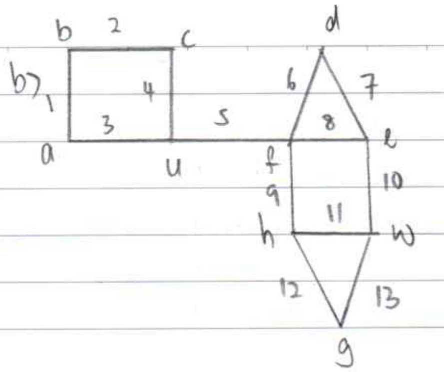
9) a)



b)



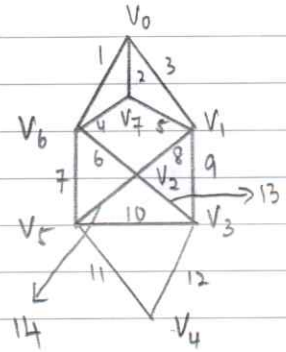
a) there is Euler path from u to w.

u, 4, V_1, 2, V_0, 1 V_7, 3, u, 5, V_2, 14, V_3, 13, V_4, 12, V_2, 6, V_6, 7, V_5, 8, W, 9, V_6, 11, V_4, 10, w

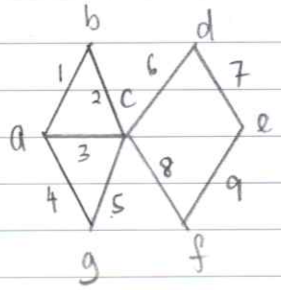
b) there is no Euler path from u to w.

This is because vertices e and h have odd degree. d(e) = 3, d(h) = 3.

10) a)



b)



a) There is Hamiltonian circuit.

V_0, 1, V_6, 7, V_5, 11, V_4, 12, V_3, 13, V_2, 8, V_1, 5, V_7, 2, V_0

b) there is no Hamiltonian circuit

11) m = 3, n = 100,

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

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

$$= 67$$

∴ A full 3-ary tree with 100 vertices will have 67 leaves

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12) a) root = a

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

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

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

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

14) GH = 1　　BG = 5　　HE = 8

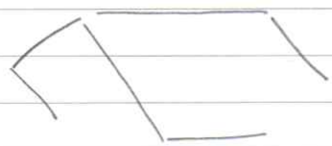
AB = 1　　CG = 6

BC = 2　　DH = 6

AF = 3　　DG = 7

BF = 4　　DE = 7

CD = 4　　FG = 8



∴ minimum spanning tree = 3 + 1 + 5 + 1 + 2 + 4 + 7

= 23

15)

No	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, T}	{O, Q}	0	4	7	2	6	5	5	6

∴ shortest path from M to T is 6, m – R – T.