SECI 1013-03

STRUKTUR DISKRIT (DISCRETE STRUCTURE)

SEMESTER 1, 2020/2021

ASSIGNMENT 4

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ANSWER:

1.

$f(e_1) = (2,1)$, $f(e_2) = (3,2)$, $f(e_3) = 3,1)$, $f(e_4) = (4,3)$, $f(e_5) = (4,2)$

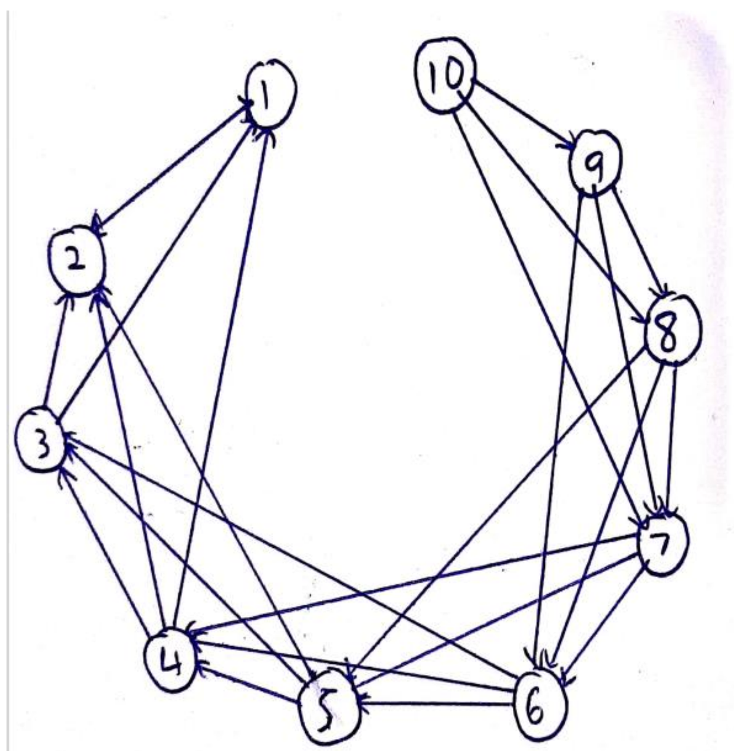
$f(e_6) = (4,1)$, $f(e_7) = (5,4)$, $f(e_8) = (5,3)$, $f(e_9) = (5,2)$, $f(e_{10}) = (6,5)$

$f(e_{11}) = (6,4)$, $f(e_{12}) = (6,3)$, $f(e_{13}) = (7,6)$, $f(e_{14}) = (7,5)$, $f(e_{15}) = (7,4)$

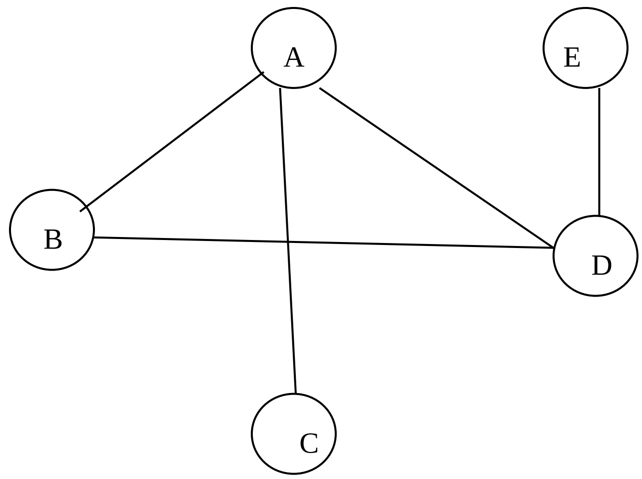
$f(e_{16}) = (8,7)$, $f(e_{17}) = (8,6)$, $f(e_{18}) = (8,5)$, $f(e_{19}) = (9,8)$, $f(e_{20}) = (9,7)$

$f(e_{21}) = (9,6)$, $f(e_{22}) = (10,9)$, $f(e_{23}) = (10,8)$, $f(e_{24}) = (10,7)$

Number of edges is 24

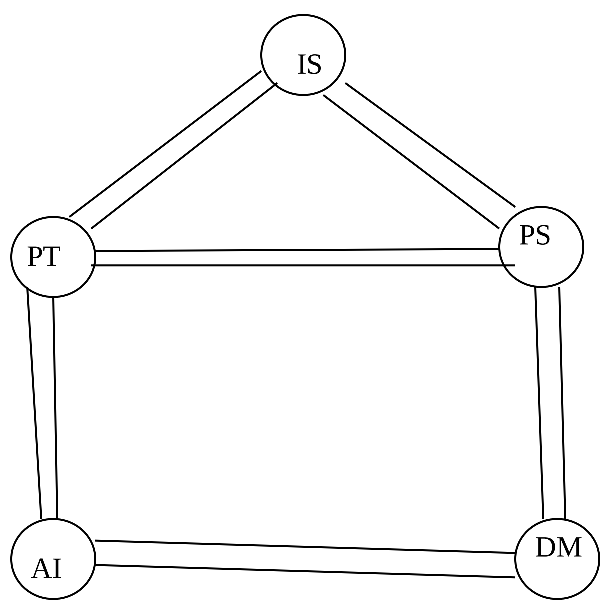


2. a)



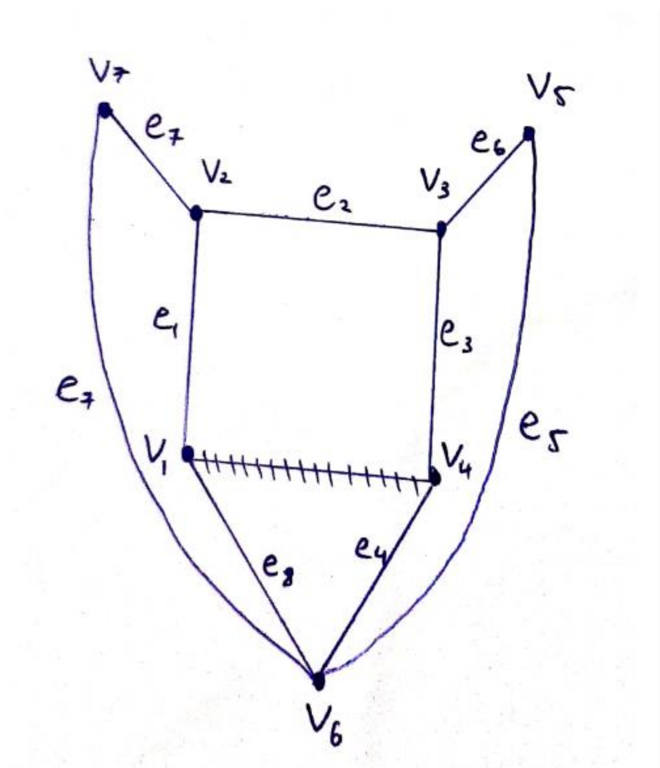
$$A_G = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

b)



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

3.



4.

a)

$$A_G = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \end{array} \begin{array}{c} \begin{array}{cccc} V_1 & V_2 & V_3 & V_4 \end{array} \\ \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

$$I_G = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \end{array} \begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 2 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

b)

$$A_H = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \end{array} \begin{array}{c} \begin{array}{cccc} V_1 & V_2 & V_3 & V_4 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 2 \\ 0 & 1 & 1 & 0 \\ 0 & 2 & 0 & 0 \end{bmatrix} \end{array}$$

$$I_H = \begin{array}{c} \\ V_1 \\ V_2 \\ V_3 \\ V_4 \end{array} \begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

5. a) - Both G1 and G2 have same number of vertices (5) and edges (6).

- Corresponding vertices has the same degree which are 1, 2 and 3.

- Define f: $V \rightarrow U$, where $V = \{v_1, v_2, v_3, v_4, v_5\}$ and $U = \{u_1, u_2, u_3, u_4, u_5\}$,

  $f(v_1) = u_3$; $f(v_2) = u_4$; $f(v_3) = u_2$; $f(v_4) = u_5$; $f(v_5) = u_1$

$$\begin{array}{cc} & \begin{matrix} v_1 & v_2 & v_3 & v_4 & v_5 \end{matrix} \\ A_V = & \begin{pmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{pmatrix} \begin{matrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{matrix} \end{array} \qquad \begin{array}{cc} & \begin{matrix} u_3 & u_4 & u_2 & u_5 & u_1 \end{matrix} \\ A_U = & \begin{pmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{pmatrix} \begin{matrix} u_3 \\ u_4 \\ u_2 \\ u_5 \\ u_1 \end{matrix} \end{array}$$

- Both graphs have same number of loop but different parallel edges. Therefore, G1 and G2 are not isomorphic graphs.

b) - Both H1 and H2 have the same number of vertices (5) and edges (6).

- H1 and H2 have different degrees for corresponding vertices.

  H1 has 1, 1, 3, 2, 4 while H2 has 3, 1, 2, 3, 2.

  Therefore, H1 and H2 are not isomorphic.

6. a) Trail

   b) Trail

   c) None of those

   d) Closed walk

   e) Closed walk

   f) Path

7. a) 3

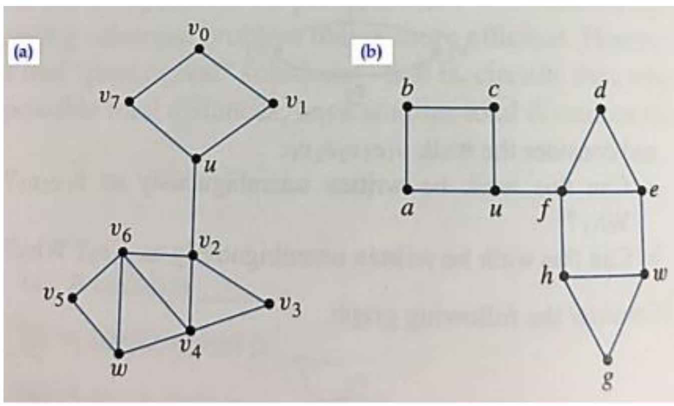
b) 4

c) 5

8. a) ($v_1, e_1, v_2, e_3, v_5, e_7, v_4, e_5, v_3, e_4, v_2, e_2, v_5, e_6, v_4, e_8, v_1$) is the euler circuit.

b) No euler circuit exist, because it requires to use some edges more than once.

9. Determine Euler path



a. For graph a:
   There are exist euler path from u to w
   - Start(u) and End(w) have positive odd degree
   - All the other vertices have positive even degree
   (u, v7, v0, v1, u, v2, v3, v4, v2, v6, v5, w, v4, v6, w)

b. For graph b:
   Euler path does not exist.

10. Determine Hamiltonian circuit for graph (a)-(b)

a. Hamiltonian circuit/cycle does not exist in this graph.
   - Exist bridge, vertex will appear more than one

b. Hamiltonian circuit/cycle does not exist for the graph

11. Fully 3-ary tree

n = 100 vertices
m = 3

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

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

= 67.3 leaves
=67 leaves

12. Rooted tree

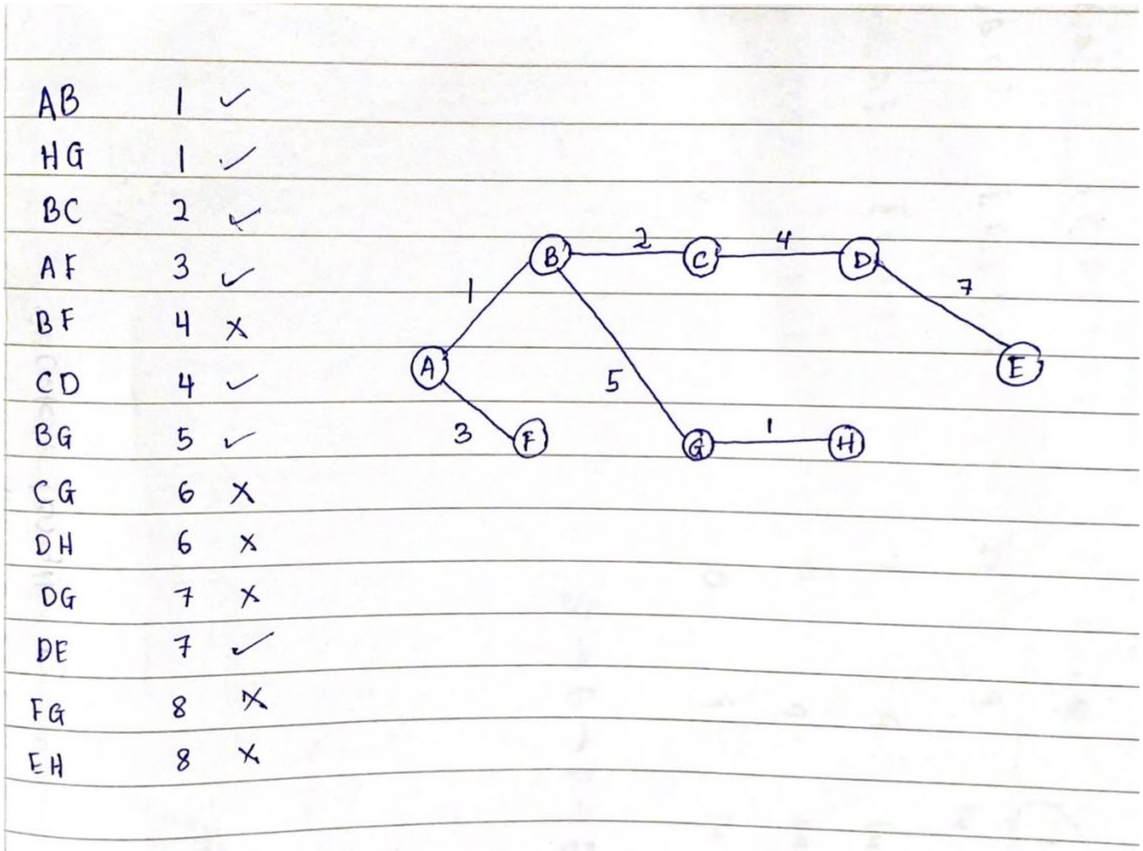
a. Root: a
b. Internal vertices: a, b, e, g, n, d, h, j
c. Leaves: c, k, l, m, f, r, s, o, I, p, q
d. Children of n: r and s
e. Parent of e: b
f. Sibling of k: k, l, and m.
g. Proper ancestors of q: j, d, a
h. Proper descendant of b: e, k, l, m, f, g, n, r, s

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

Inorder Traversal: 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, g, b, c, o, h, i, p, q, j, d, a

14.



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, T}	{O, Q}	0	4	7	2	6	5	5	6

Shortest distance: 6

Shortest path: M $\rightarrow$ R $\rightarrow$ T