SECP 1013 DISCRETE STRUCTURE

TUTORIAL 4

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SUBMITTED BY:

T1

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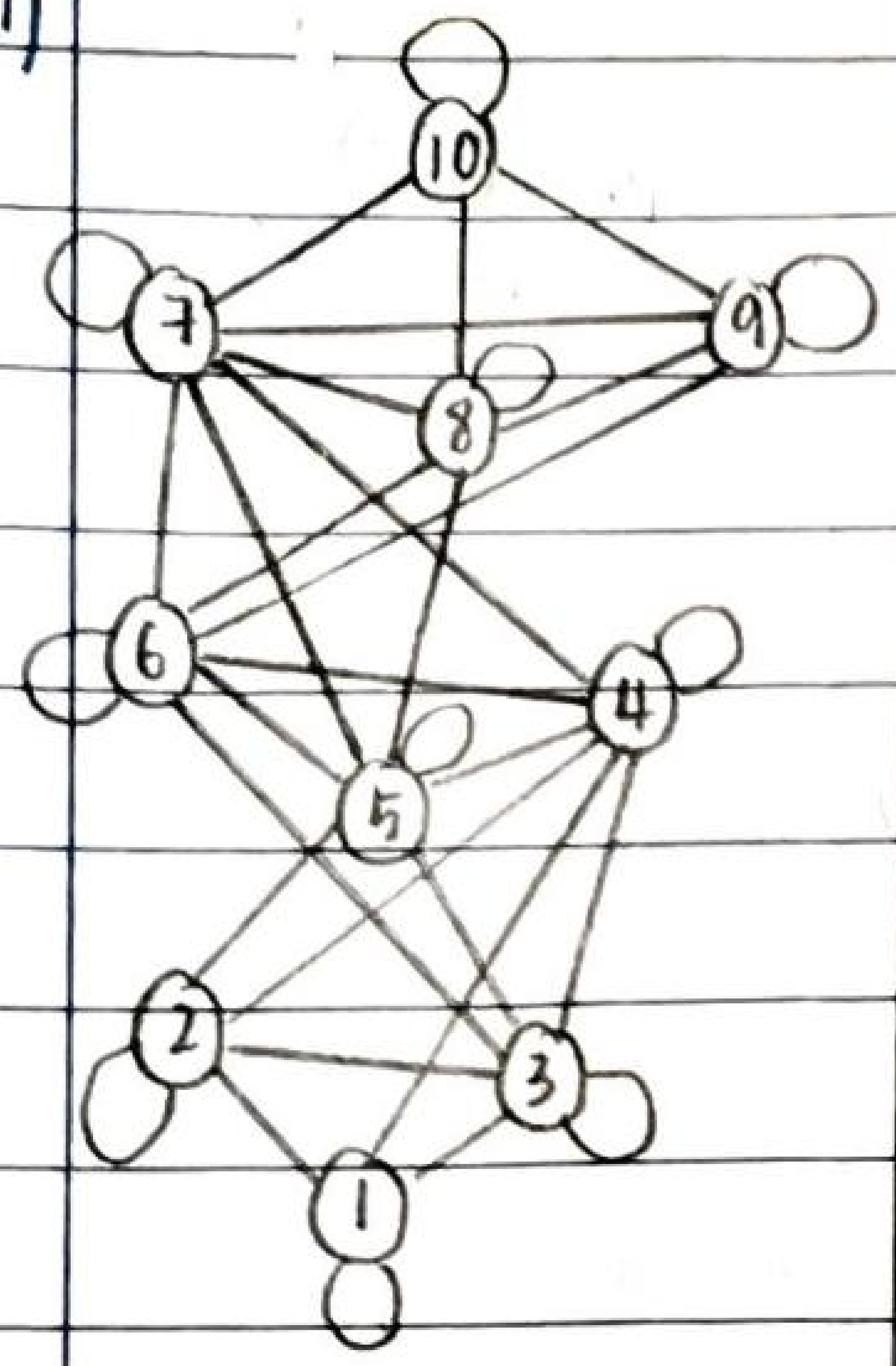
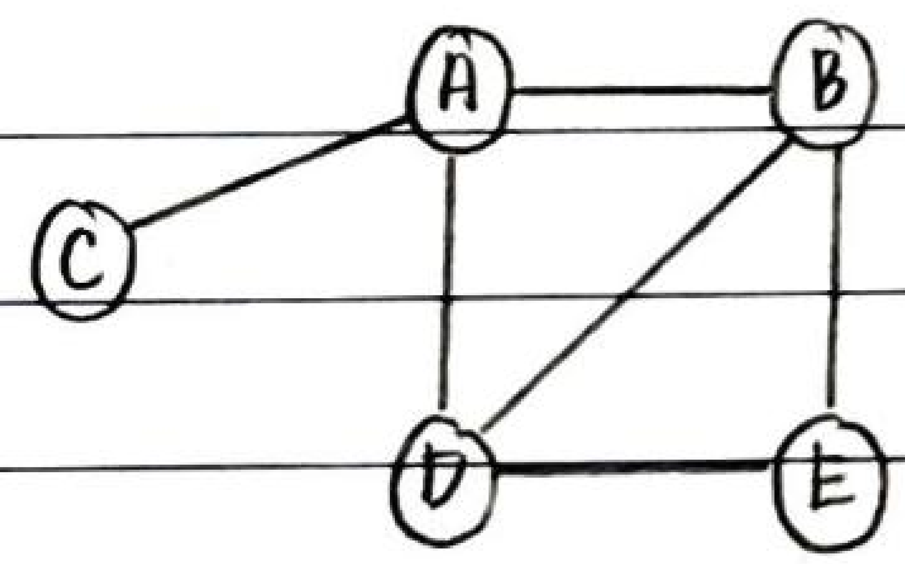
1)



Edge	Endpoints	Edge	Endpoints	Edge	Endpoints
e_1	{10,10}	e_{11}	{10,9}	e_{23}	{6,5}
e_2	{9,9}	e_{12}	{10,8}	e_{24}	{6,4}
e_3	{8,8}	e_{13}	{10,7}	e_{25}	{6,3}
e_4	{7,7}	e_{14}	{9,8}	e_{26}	{5,4}
e_5	{6,6}	e_{15}	{9,7}	e_{27}	{5,3}
e_6	{5,5}	e_{16}	{9,6}	e_{28}	{5,2}
e_7	{4,4}	e_{17}	{8,7}	e_{29}	{4,3}
e_8	{3,3}	e_{18}	{8,6}	e_{30}	{4,2}
e_9	{2,2}	e_{19}	{8,5}	e_{31}	{4,1}
e_{10}	{1,1}	e_{20}	{7,6}	e_{32}	{3,2}
		e_{21}	{7,5}	e_{33}	{3,1}
		e_{22}	{7,4}	e_{34}	{2,1}

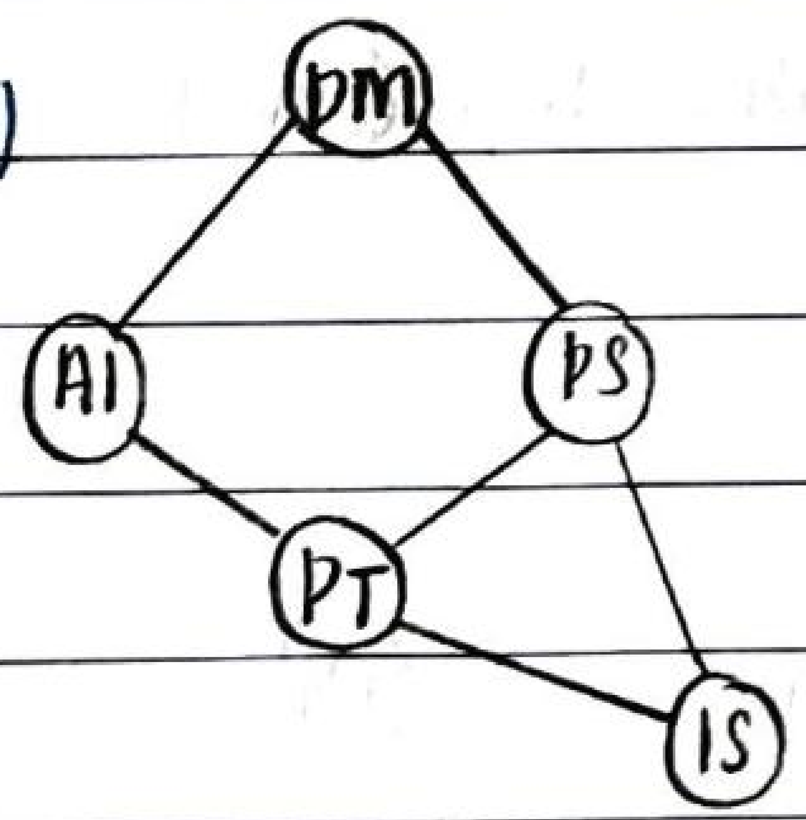
$\therefore e(G) = 34$ edges

2) a)



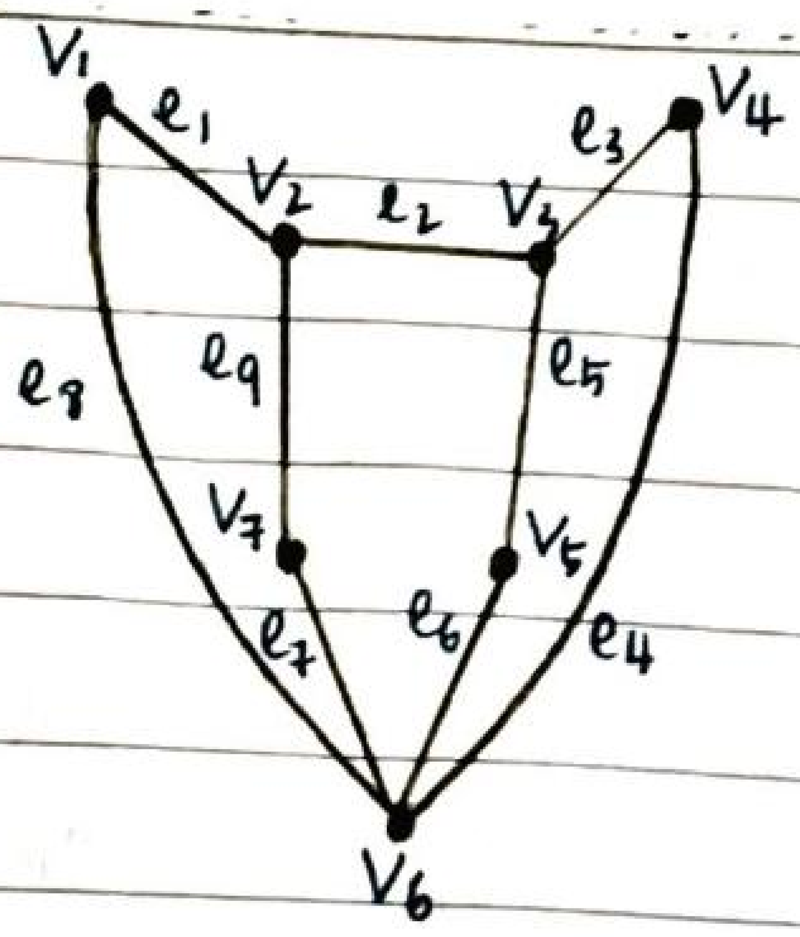
$$A_G = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array}\begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

b)



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

3)



4) G:

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

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

H:

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

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

5) a) No. of vertices $G_1 = 5$, $G_2 = 5$

No of edges $G_1 = 5$, $G_2 = 5$

$Deg(V_1) = 2$, $Deg(V_2) = 2$, $Deg(V_3) = 3$, $Deg(V_4) = 2$, $Deg(V_5) = 1$

$Deg(u_1) = 1$, $Deg(u_2) = 3$, $Deg(u_3) = 2$, $Deg(u_4) = 2$, $Deg(u_5) = 2$

Both G1 and G2 have 1 vertex with 1 degree, 3 vertices with 2 degree and 1 vertices with 3 degree.

$f(V_1) = u_5$, $f(V_2) = u_3$, $f(V_3) = u_2$, $f(V_4) = u_4$, $f(V_5) = u_1$

Adjacency Matrix, A_{G1}

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

Adjacency Matrix, A_{G2}

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

$\therefore$ G1 and G2 are isomorphic.

b) Number of vertices $H_1 = 5$, $H_2 = 5$

Number of edges $H_1 = 6$, $H_2 = 6$

$Deg(a_1) = 1$, $Deg(a_2) = 1$, $Deg(a_3) = 3$, $Deg(a_4) = 2$, $Deg(a_5) = 4$

$Deg(x_1) = 3$, $Deg(x_2) = 1$, $Deg(x_3) = 3$, $Deg(x_4) = 3$, $Deg(x_5) = 2$

$\therefore$ The graphs are not isomorphic because they do not have same degrees for corresponding vertices.

When $f: H_1 \to H_2$, it cannot be achieved.

6a) $(v_0, e_1, v_1, e_{10}, v_5, e_9, v_2, e_2, v_1)$ is a trail from v_0 to v_1 since it is a walk from v_0 to v_1 that does not contain repeated 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 a walk from v_4 to v_5.

c) v_2 is a trivial walk.

d) $(v_5, e_9, v_2, e_4, v_3, e_5, v_4, e_6, v_4, e_8, v_5)$ is a circuit / cycle since it is a closed walk that contains at least one edge and does not contain a repeated edge.

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 a closed walk since it starts and end at the same vertex.

f) $(v_3, e_5, v_4, e_8, v_5, e_{10}, v_1, e_3, v_2)$ is a path from v_3 to v_2 since it is a trail that does not contain a repeated vertex.

7a) $(v_1, e_1, v_2, e_2, v_3, e_5, v_4)$

$(v_1, e_1, v_2, e_3, v_3, e_5, v_4)$

$(v_1, e_1, v_2, e_4, v_3, e_5, v_4)$

3 paths*

b) $(v_1, e_1, v_2, e_2, v_3, e_4, v_2, e_3, v_3, e_5, v_4)$

$(v_1, e_1, v_2, e_3, v_3, e_4, v_2, e_2, v_3, e_5, v_4)$

$(v_1, e_1, v_2, e_4, v_3, e_2, v_2, e_3, v_3, e_5, v_4)$

$(v_1, e_1, v_2, e_2, v_3, e_3, v_2, e_4, v_3, e_5, v_4)$ 9 trails*

$(v_1, e_1, v_2, e_3, v_3, e_2, v_2, e_4, v_3, e_5, v_4)$

$(v_1, e_1, v_2, e_4, v_3, e_3, v_2, e_2, v_3, e_5, v_4)$

c) There is infinity walk from V_1 to V_4.

8) (a)

Vertex	V_1	V_2	V_3	V_4	V_5
Degree	2	4	2	4	4

(b)

Vertex	V_0	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9
Degree	2	4	2	2	2	4	2	3	3	3

(a) has Euler circuit since all the vertices have even degree.

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

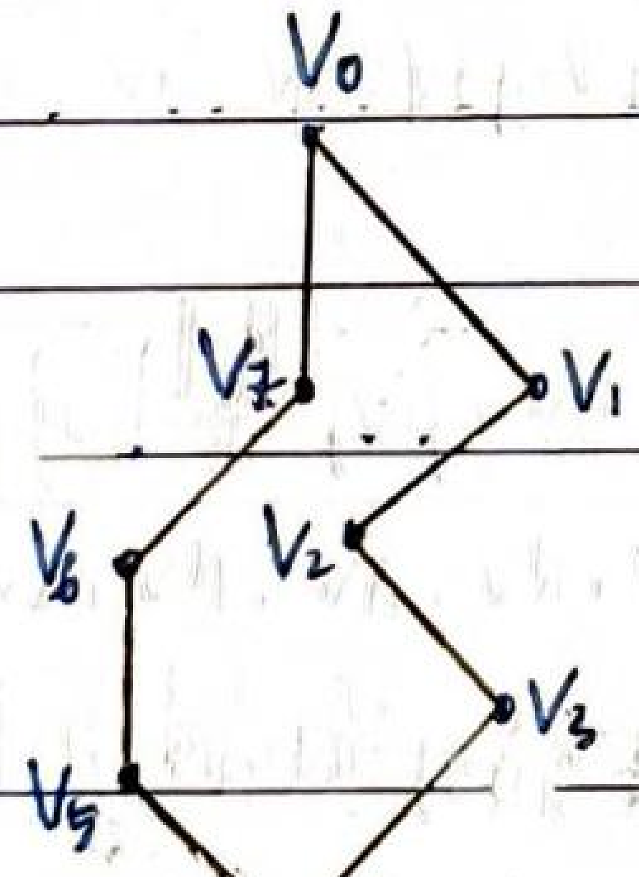
(b) has no Euler circuit since the vertices V_7, V_8 and V_9 have odd degrees.

9) (a) has Euler path.

Euler path = $U, V_1, V_0, V_7, U, V_2, V_3, V_4, V_2, V_6, V_4, W, V_6, V_5, W$

(b) has no Euler path.

10) (a) has Hamiltonian circuit, which is $V_2, V_1, V_7, V_0, V_6, V_5, V_4, V_3, V_2$.



(b) does not have Hamiltonian Circuit.

11) $n = \frac{ml - 1}{m-1}$

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

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

$= 67$

12) a) {a}

b) {a, b, e, g, n, d, h, j}

c) {k, l, m, f, r, s, c, o, i, p, q}

d) {r, s}

e) {b}

f) {l, m}

g) {a, d, j}

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

postorder

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

14)

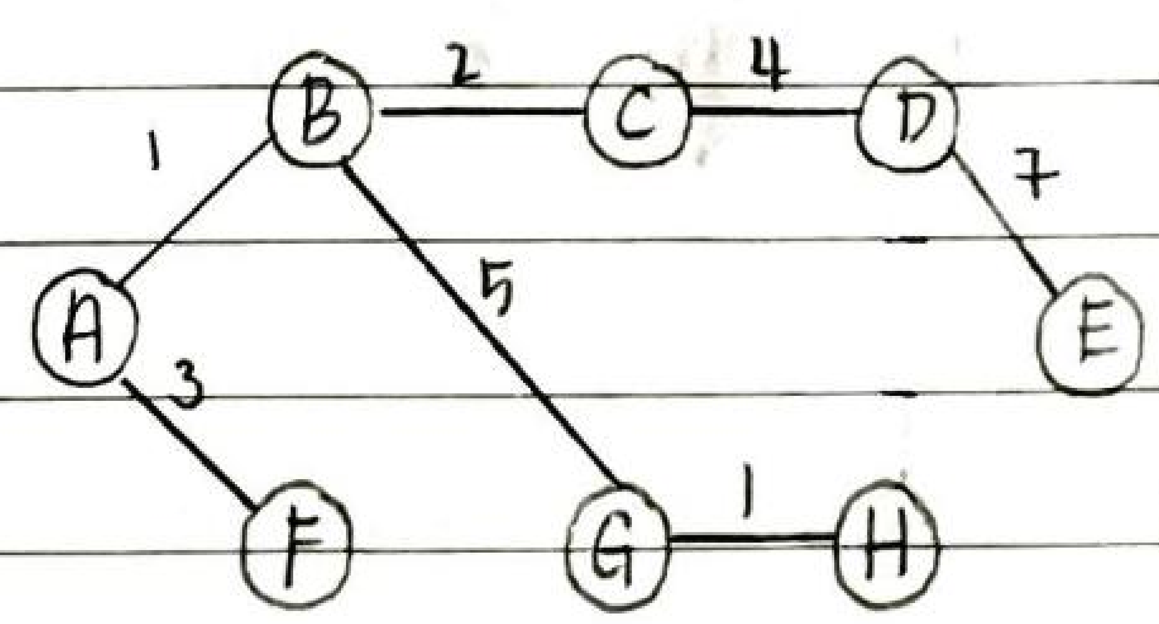
AB	1	DH	6
GH	1	DG	7
BC	2	DE	7
AF	3	EH	8
BF	4	FG	8
CD	4		
BG	5		
CG	6		

AB	1
GH	1
BC	2
AF	3
CD	4
BG	5
DE	7

Weight of subgraph:

$1+1+2+3+4+5+7$

$= 23$



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Perkara

15)

i	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,N,P}	{O,Q,R,S,T}	0	4	10	2	6	5	5	∞
4	{M,N,P,R}	{O,Q,S,T}	0	4	7	2	6	5	5	6
5	{M,N,P,R,S}	{O,Q,T}	0	4	7	2	6	5	5	6
6	{M,N,P,R,S,T}	{O,Q}	0	4	7	2	6	5	5	6

Minimum distance = 6

Shortest path from M to T is M-R-T.

No.

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