Question No 1:-

Shah sajid A20EC4050
Nafis Ahmed A20EC4044
Toya Lazmin Khan A20EC0284

ANSwer:

	1	2	3	4	5	6	7	8	9	10
1	0	1	1	1	0	0	0	0	0	0
2	1	0	1	1	1	0	0	0	0	0
3	1	1	0	1	1	1	0	0	0	0
4	1	1	1	0	1	1	1	0	0	0
5	0	1	1	1	0	1	1	1	0	0
6	0	0	1	1	1	0	1	1	1	0
7	0	0	0	1	1	1	0	1	1	1
8	0	0	0	0	1	1	1	0	1	1
9	0	0	0	0	0	1	1	1	0	1
10	0	0	0	0	0	0	1	1	1	0

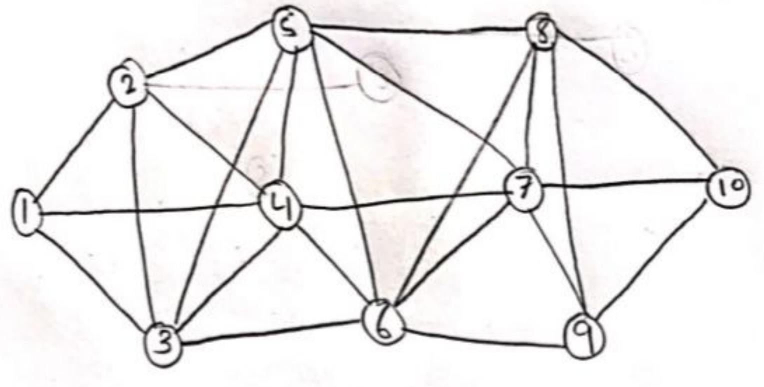
GRAPH OF G

Edges :- (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)

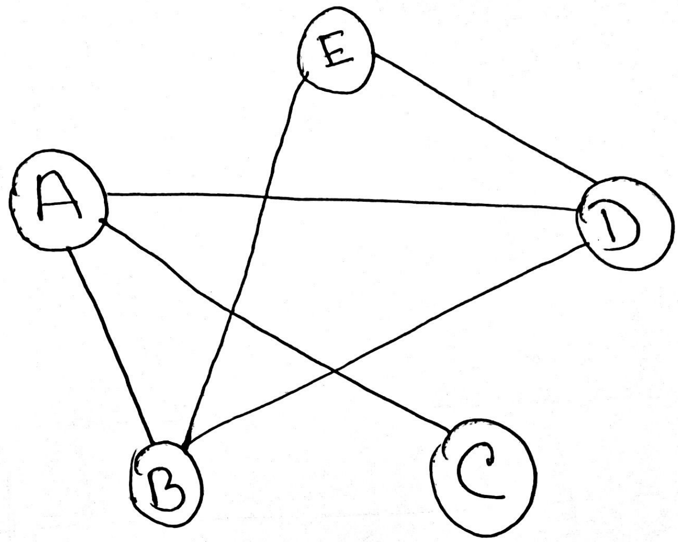
Total Number of edges is
24.

Question No 1:-

GRAPH.



2a)



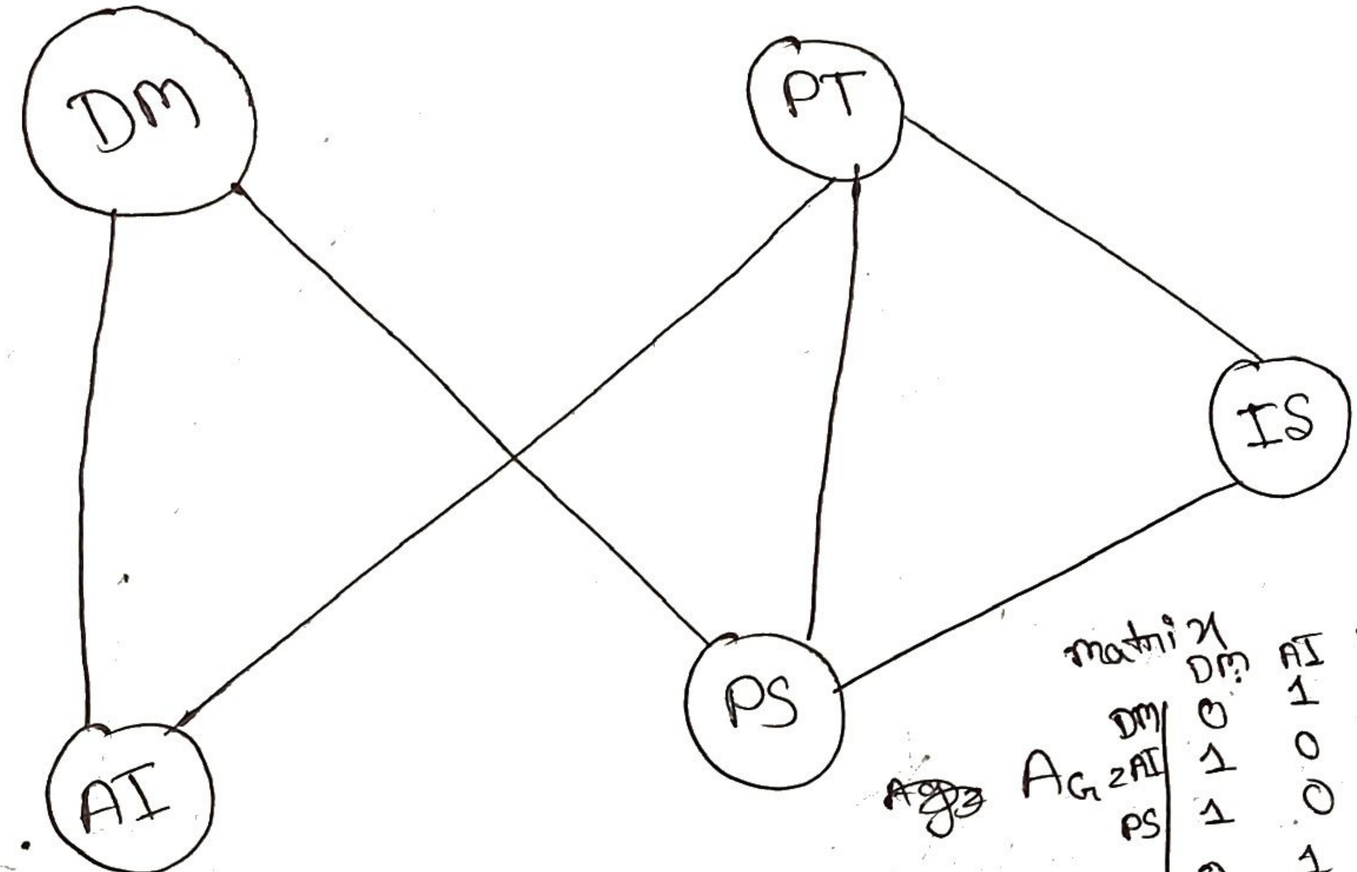
$$A_G = \begin{array}{c|ccccc|} & A & B & C & D & E \\ A & 0 & 1 & 1 & 1 & 0 \\ B & 1 & 0 & 0 & 1 & 1 \\ C & 1 & 0 & 0 & 0 & 0 \\ D & 1 & 1 & 0 & 0 & 1 \\ E & 0 & 1 & 0 & 1 & 0 \end{array}$$

b)

Can be scheduled

matrix

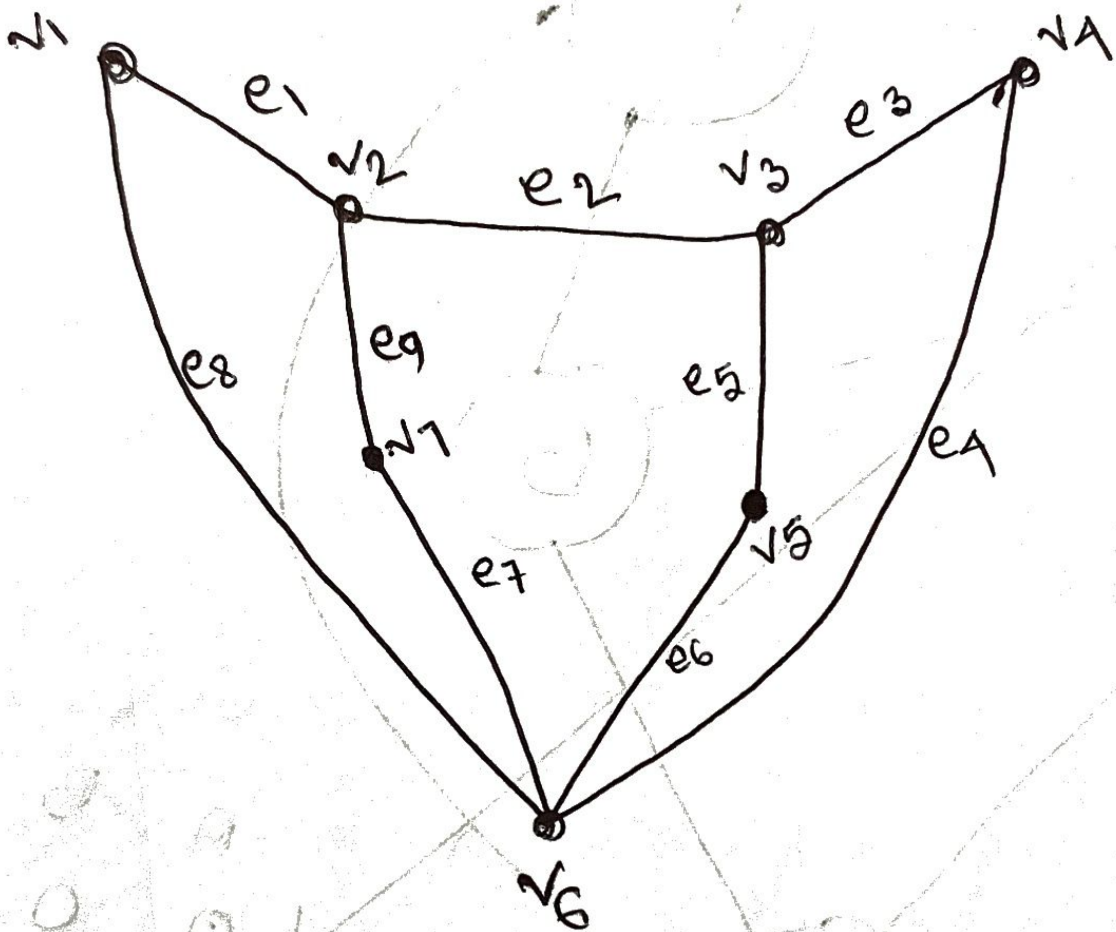
$$A_G = \begin{array}{c|ccccc} & A & B & C & D & E \\ \hline A & 0 & & & & \\ B & & 0 & & & \\ C & & & 0 & & \\ D & & & & 0 & \\ E & & & & & 0 \end{array}$$



matrix

$$\cancel{A_{G_3}}\ A_G = \begin{array}{c|ccccc} & DM & AI & PS & PT & IS \\ \hline DM & 0 & 1 & 1 & 0 & 0 \\ AI & 1 & 0 & 0 & 1 & 0 \\ PS & 1 & 0 & 0 & 1 & 1 \\ PT & 0 & 1 & 1 & 0 & 1 \\ IS & 0 & 0 & 1 & 1 & 0 \end{array}$$

3.



4.

G's Adjacency matrix

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

G's Incidence matrix

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

H's adjacency matrix

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

H's incidence matrix

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

Quetio No 5:

Answer (a)

(i) Both graphs are connected and simple graphs.
(ii) Both graphs have 5 edges and 5 vertices
(iii) Both have 3 vertices with 2 degrees
1 vertex with 1 degree and 1 vertex with
3 degree.

$v_3 = u_2$, $v_5 = u_1$, $v_1 = u$, $v_2 = u_3$, $v_4 = u_4$

$$
\begin{array}{c|ccccc|}
 & v_1 & v_2 & v_3 & v_4 & v_5 \\
\hline
v_1 & 0 & 1 & 0 & 1 & 0 \\
v_2 & 1 & 0 & 1 & 0 & 0 \\
v_3 & 0 & 1 & 0 & 1 & 1 \\
v_4 & 1 & 0 & 1 & 0 & 0 \\
v_5 & 0 & 0 & 1 & 0 & 0
\end{array}
\qquad
\begin{array}{c|ccccc|}
 & u & u_3 & u_2 & u_4 & u_1 \\
\hline
u & 0 & 1 & 0 & 1 & 0 \\
u_3 & 1 & 0 & 1 & 0 & 0 \\
u_2 & 0 & 1 & 0 & 1 & 1 \\
u_4 & 1 & 0 & 1 & 0 & 0 \\
u_1 & 0 & 0 & 1 & 0 & 0
\end{array}
$$

the ajdacency matrix are same, so, it is isomorphic.

ANSWER No (b)

(i) Both graphs have 2 parallel edges and 1 loop

(ii) Both graphs have 6 edges and 5 vertices.

but the degree of all the vertices of H are 1,1,3,2,4 respectively and degree of vertices of H_2 are, 3,3, 2,1,2

Therefore H_1 and H_2 are not isomorphic.

6a) $v_0 e_1 v_1 e_{10} v_5 e_9 v_2 e_2 v_1$ = trail

as edges not repeated

vertex repeated

b) $v_4 e_7 v_2 e_9 v_5 e_{10} v_1 e_3 v_2 e_9 v_5$ = walk

as edges and vertex were repeated

c) v_2

only 1 vertex ~~so~~ i. and no edge. so it is path.

d) $v_2 e_9 v_2 e_4 v_3 e_5 v_4 e_6 v_4 e_8 v_5$

vertex → repeated

edges → not repeated

So, ~~closed trail~~ it is a cycle

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

vertex → repeated

edges → repeated

starts and ends with same vertex So it is closed walk.

f) $v_3 e_5 v_4 e_8 v_5 e_{10} v_1 e_3 v_2$

~~ve~~vertex not repeated

edges not repeated

starts and ends with different vertex

∴ it is a path.

Scanned with CamScanner

Ans to que no:7

(a) 3 paths from v_1 to v_4

(b) The number of ~~tra~~ trails is

$$= 3 + 3!$$

$$= 9 \text{ trails}$$

(c) There are infinite (∞) walks from v_1 to v_4

Ans. to Que no: 8

[For graph a]

vertex	v_1	v_2	v_3	v_4	v_5
Degree	2	4	2	4	4

All the vertex have even degree. So it has an Euler Circuit

One of it is,

$(v_1, e_1, v_2, e_3, v_5, e_2, v_2, e_4, v_3, e_5, v_4, e_6, v_5, e_7, v_4, e_8, v_1)$

[For graph 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

~~Gr~~ Graph b doesn't have any euler circuit. Because all vertex doesn't have even degree.

Scanned with CamScanner

9a)

vertex	u	v_0	v_1	v_2	v_3	v_4	v_5	v_6	v_7	w
degree	3	2	2	4	2	4	2	4	2	3

it is Eular path as it has 2 vertexes which as odd degree

b)

vertex	a	b	c	d	e	f	g	h	u	w
degree	2	2	2	2	3	4	2	3	3	3

it is not an eular path as there are 4 odd degree ~~vertexes~~ when there should only be 2 odd degree.

Ans. to Que no: 10

For graph(a), there is no ~~Hamiltonial~~ Hamiltonian circuit because v and v_2 vertex needs to be traversed twice. But, Hamiltonian circuit allows to traverse each vertex only once.

For graph(b), there is no Hamiltonian circuit because vertex v and ~~f need~~ f need to be traversed twice.

1 ii. Leaves, $l = ?$

3-ary tree, $m = 3$

vertices, $n = 100$

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

$$= \cancel{\frac{2 \times 101}{3}} \quad \frac{201}{3}$$

$= 67$ leaves

12. a) Root = a

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

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

d) Children of n = r, s

e) Parent of e = b

f) Sibling of k = l, m

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

h) " decendants " b = ~~a~~ e, f, g, k, l, m, n, r, s

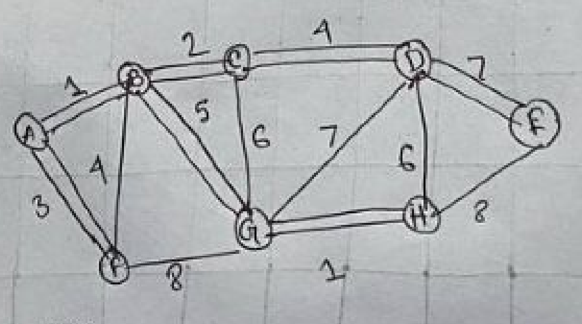
13. pre-order = a, b, e, k, l, m, f, g, n, r, s, c, d, h, o, i, j, p, q

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

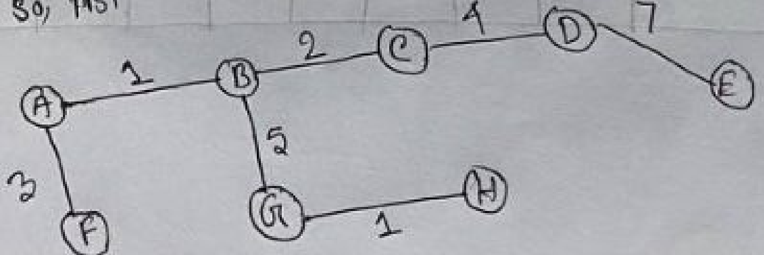
post-order = k, l, m, e, f, r, s, n, g, b, c, o, h, i, p, q, j, d, a

14. the edges

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



So, MST



total weight = 23

5. $S = \emptyset$

$N = \{M, N, O, P, Q, R, S, T\}$

$L(m) + w(m,R) < L(R)$
$0 + 5 = 5 < \infty$
$L(R) = 5$

$L(m) + w(m,N) < L(N)$
$0 + 4 = 4 < \infty$
$L(N) = 4$

$L(m) + w(m,P) < L(P)$
$0 + 2 = 2 < \infty$
$L(P) = 2$

$L(P) + w(P,Q) < L(Q)$
$2 + 4 = 6 < \infty$
$L(Q) = 6$

$L(P) + w(P,S) < L(S)$
$2 + 3 = 5 < \infty$
$L(S) = 5$

$L(P) + w(P,m) < L(m)$
$2 + 2 = 4 < 0$
$L(m) = 0$

$L(N) + w(N,m) < L(m)$
$4 + 4 < 0$
$L(m) = 0$

$L(N) + w(N,O) < L(O)$
$4 + 6 < \infty$
$L(O) = 10$

$L(R) + w(R,S) < L(S)$
$5 + 2 < L(S)$
$7 \not< 5$
$L(S) = 5$

$L(R) + w(R,O) < L(O)$
$5 + 2 < 10$
$L(O) = 7$

$L(R) + w(R,T) < L(T)$
$5 + 1 < \infty$
$L(T) = 6$

$L(S) + w(S,P) < L(P)$
$5 + 3 > \not< 2$
$L(P) = 2$

$L(S) + w(S,R) < L(R)$
$5 + 2 > \not< 5$
$L(R) = 5$

$L(S) + w(S,Q) < L(Q)$
$5 + 2 > \not< 6$
$L(Q) = 6$

$L(Q) + w(Q,P) < L(P)$
$6 + 4 > 2$
$L(P) = 2$

$L(Q) + w(Q,S) < L(S)$
$6 + 2 > 5$
$L(S) = 5$

$L(Q) + w(Q,T) < L(T)$
$6 + 6 > 6$
$L(T) = 6$

$L(T) + w(T,R) < L(R)$
$6 + 1 > 5$
$L(R) = 5$

$L(T) + w(T,Q) < L(Q)$
$6 + 6 > 6$
$L(Q) = 6$

$L(T) + w(T,O) < L(O)$
$6 + 1 = 7$
$L(O) = 7$

Loop terminates as $S \in T$

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

Shortest path from M to T is M --> R --> T, with shortest length is 6.