UTM UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING
Faculty of Engineering

Semester 1 2020/2021

SUBJECT: DISCRETE STRUCTURE (SECI1013)

SECTION: 09

ASSIGNMENT 4 : TUTORIAL 4

DUE DATE : 10.1.2021

85%

GROUP 2:-

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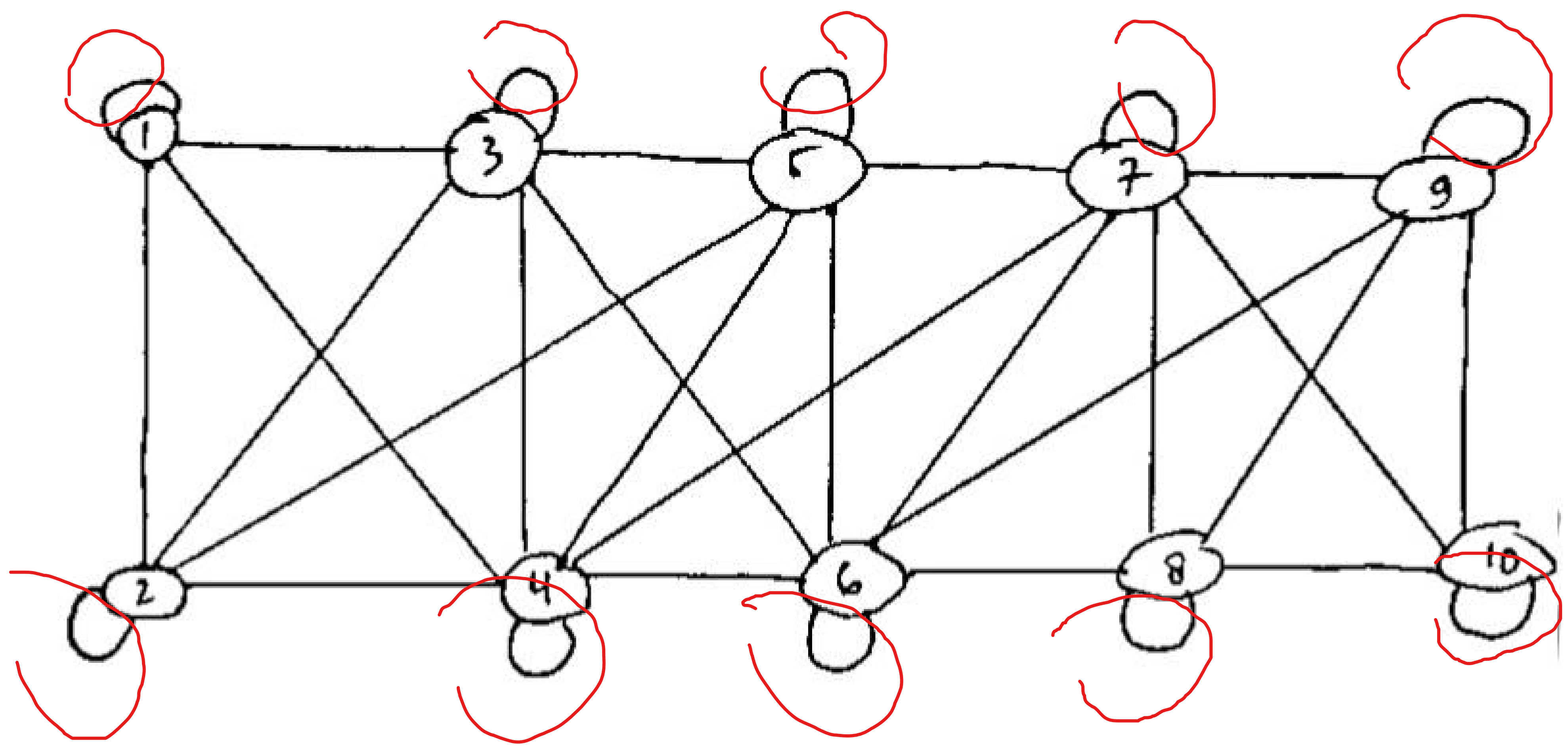
1.

1 $V(G) = \{1, 2, \ldots, 10\}$

v and w in $V(G)$ are adjacent if and only if $|v-w| \leq 3$

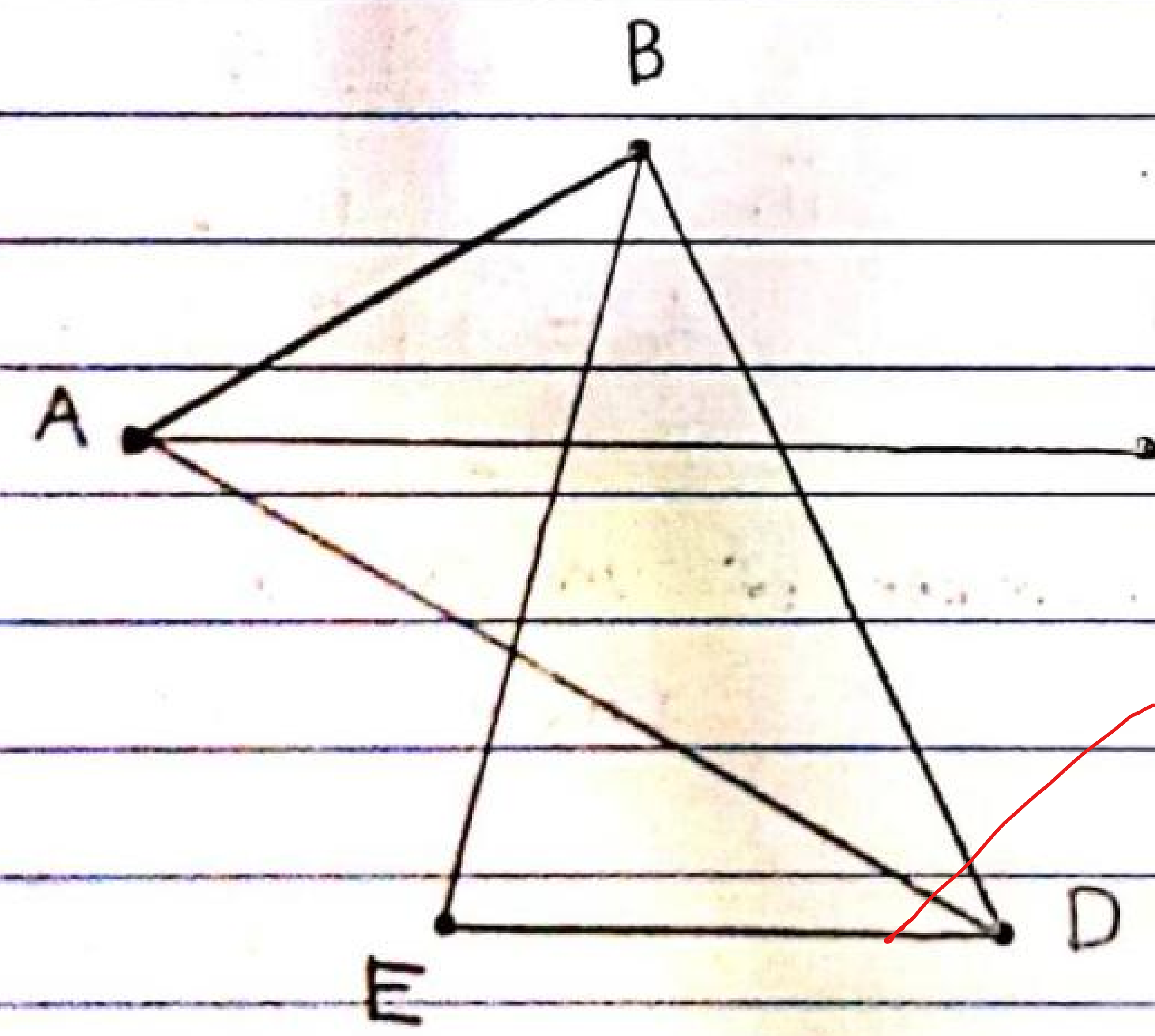


2½

N. of edges. $e(G) = 33$

2 numbers
$v \neq w$

2.(a)



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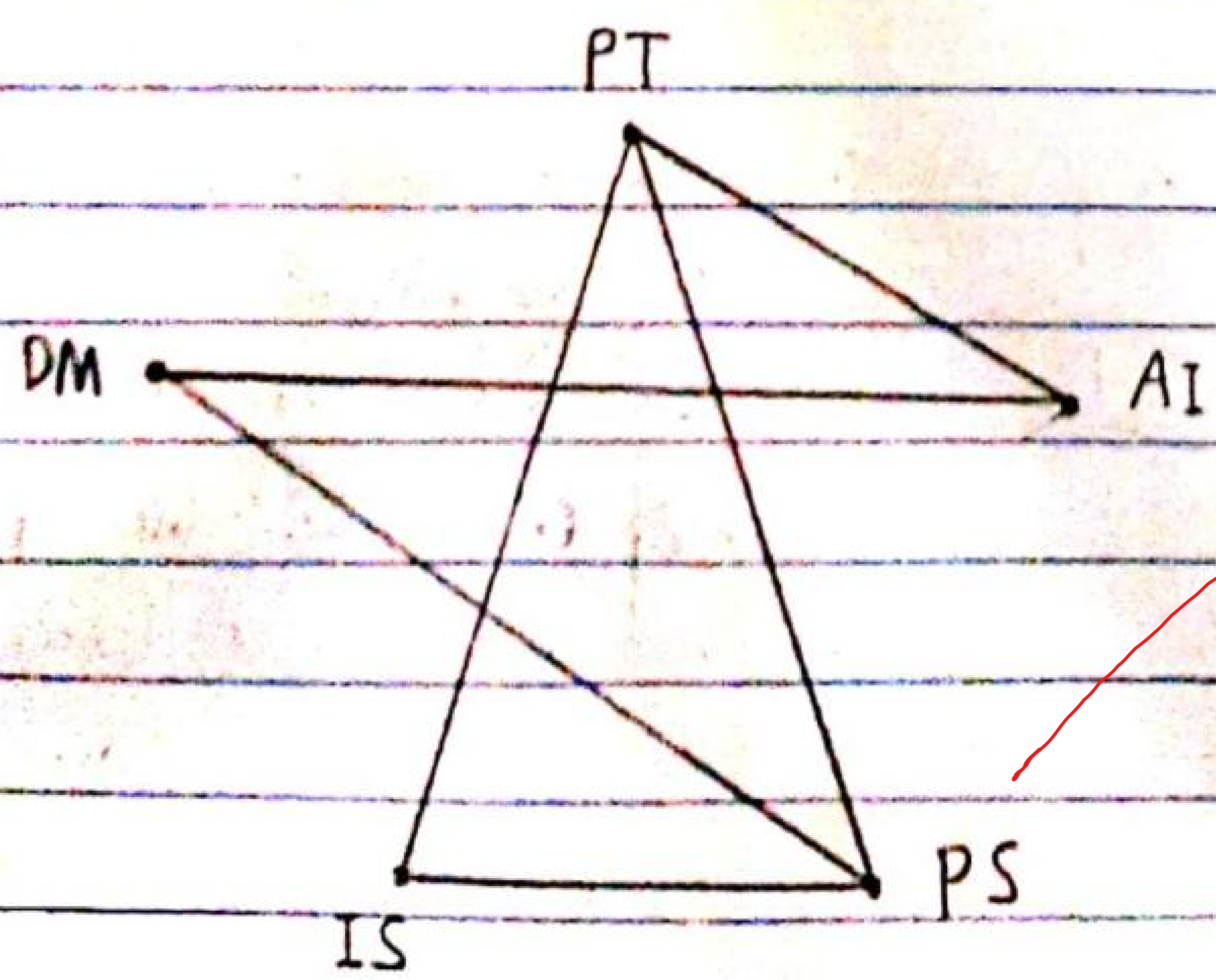
$$A_G = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

(b)

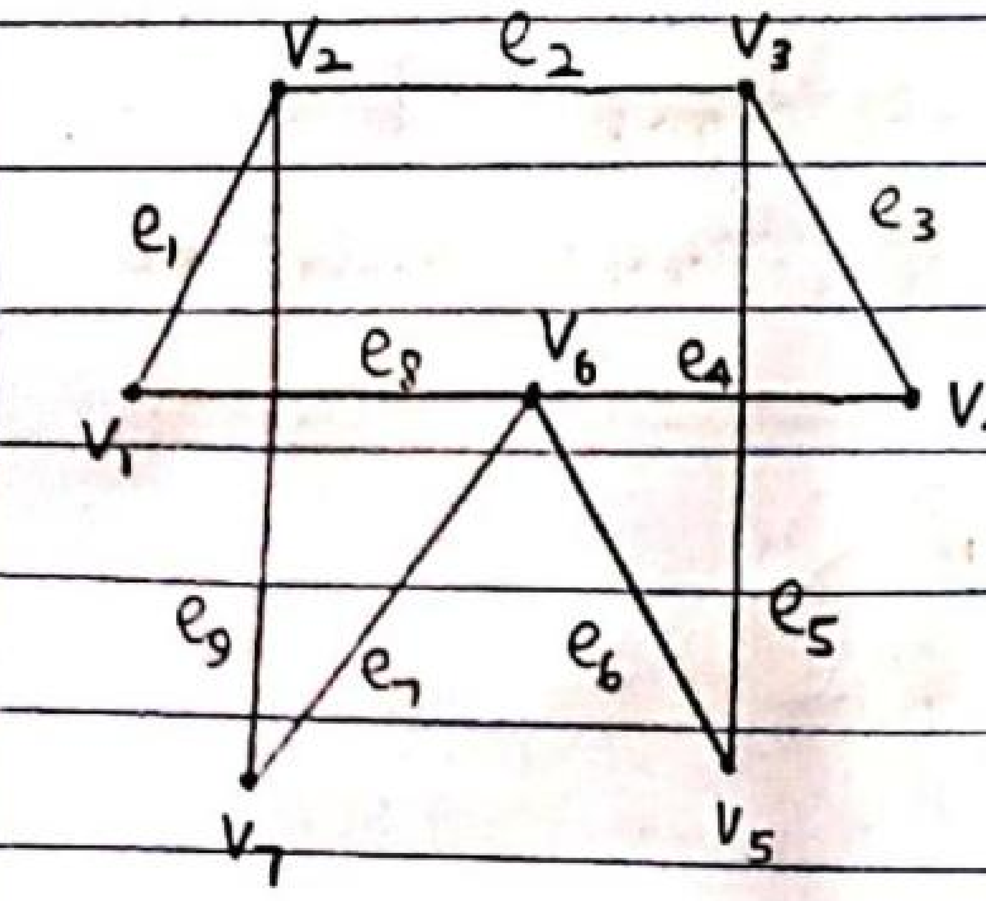


$$A_G = \begin{array}{c} \\ DM \\ PT \\ AI \\ PS \\ IS \end{array} \begin{array}{c} \begin{array}{ccccc} DM & PT & AI & PS & IS \end{array} \\ \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

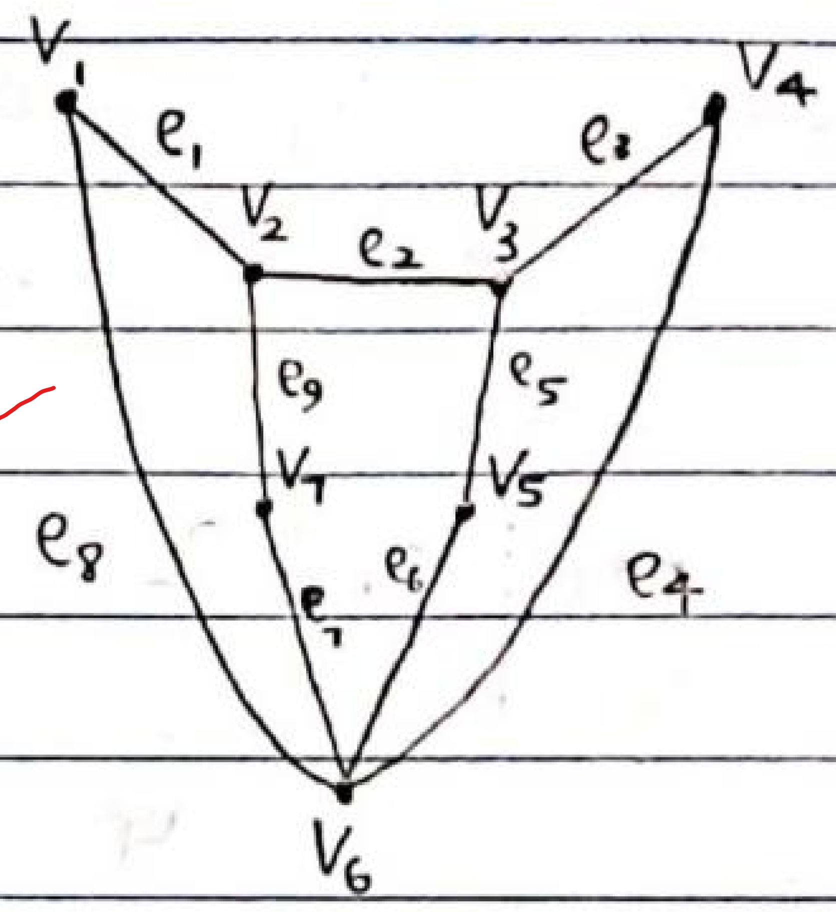
4

No. Date

3.



Answer :



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4.
$$A_G = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 1 & 0 & 2 & 0 \\ 0 & 0 & 1 & 0 \\ 2 & 1 & 0 & 2 \\ 0 & 0 & 2 & 0 \end{bmatrix} \end{array}$$

4

$$A_H = \begin{array}{c} \\ v_1 \\ v_2 \\ v_3 \\ v_4 \end{array} \begin{array}{c} \begin{array}{cccc} v_1 & v_2 & v_3 & v_4 \end{array} \\ \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 2 \\ 0 & 1 & 1 & 0 \\ 0 & 2 & 0 & 0 \end{bmatrix} \end{array}$$

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

4

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

5. a) Both G_1 and G_2 has same number of vertices and edges.
Both G_1 and G_2 are connected and simple graph.
All the vertices in G_1 has the same degree as the corresponding vertices in G_2.

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

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

$$A_{G_1} = \begin{array}{c} \\ v_5 \\ v_3 \\ v_4 \\ v_2 \\ v_1 \end{array} \begin{array}{c} \begin{array}{ccccc} v_5 & v_3 & v_4 & v_2 & v_1 \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

Since $A_{G_1} = A_{G_2}$, therefore G_1 and G_2 are isomorphic.

b) Both H_1 and H_2 has the same number of edges and vertices. However, the degree of vertices in H_1 is different from the corresponding counterparts in H_2.

Vertices	a_1	a_2	a_3	a_4	a_5
Degree	1	1	3	2	5

H_1

Vertices	x_1	x_2	x_3	x_4	x_5
Degree	3	1	3	3	2

H_2

Thus, H_1 and H_2 are not isomorphic.

5

6. a) Trails
b) Walk
c) Trivial walk
d) Circuits / cycles
e) closed walk
f) Paths

6

7. a) 3 paths. $(v_1, e_1, v_2, e_3, v_3, e_5, v_4)$, $(v_1, e_1, v_2, e_2, v_3, e_5, v_4)$, $(v_1, e_1, v_2, e_4, v_3, e_5, v_4)$
b) 2 trails. $(v_1, e_1, v_2, e_2, v_3, e_4, v_2, e_3, v_3, e_5, v_4)$
$(v_1, e_1, v_2, e_4, v_3, e_3, v_2, e_2, v_3, e_5, v_4)$
c) Infinity (∞) walks

2

8. The graph in (a) has an Euler circuit because all the vertices has even degree.
Consider starting at v_1 and ends at v_1.
$(v_1, e_1, v_2, e_2, v_5, e_7, v_4, e_6, v_5, e_3, v_2, e_4, v_3, e_5, v_4, e_8, v_1)$

4

The graph in (b) does not have an Euler circuit because v_1, v_7, v_8 and v_9 have odd degree.

9. There is an Euler path from u to w for graph in (a). Because every vertices has even degree beside w.
The path is $(u, v_7, v_0, v_1, u, v_2, v_3, v_4, v_2, v_6, v_4, w, v_6, v_5, w)$ 4

There is no Euler path from u to w for graph in (b). Because the vertices e and h has odd degree.

Question 10 is answered at last page

~~10. Both graphs in (a)−(b) has no Hamiltonian circuit.~~

11. $n = mi + 1$ Where n = number of vertices
$l = n - i$ l = number of leaves
i = number of internal nodes/vertices
for m-ary tree

Given $m=3$, $n=100$
$100 = 3i + 1$
$i = 33$ 2
Substitute $i=33$ and $n=100$ into $l = n-i$,
$\therefore l = 100 - 33$
$= 67$ leaves

12. a) Root = a
b) Internal vertices = a, b, e, g, n, h, d, j
c) Leaves = k, l, m, f, r, s, c, o, i, p, q 4
d) Children of n = r and s
e) Parent of e = b
f) Siblings of k = l and m
g) Proper ancestors of q = j, d, a
h) Proper descendants of b = e, f, g, k, l, m, r, s, n

13. Preorder : a, b, e, k, l, m, f, g, n, r, s, c, d, h, o, i, j, p, q 6
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

t6uuu

14) Ans :-

AB 1 ✓ CG 6

GH 1 ✓ DH 6

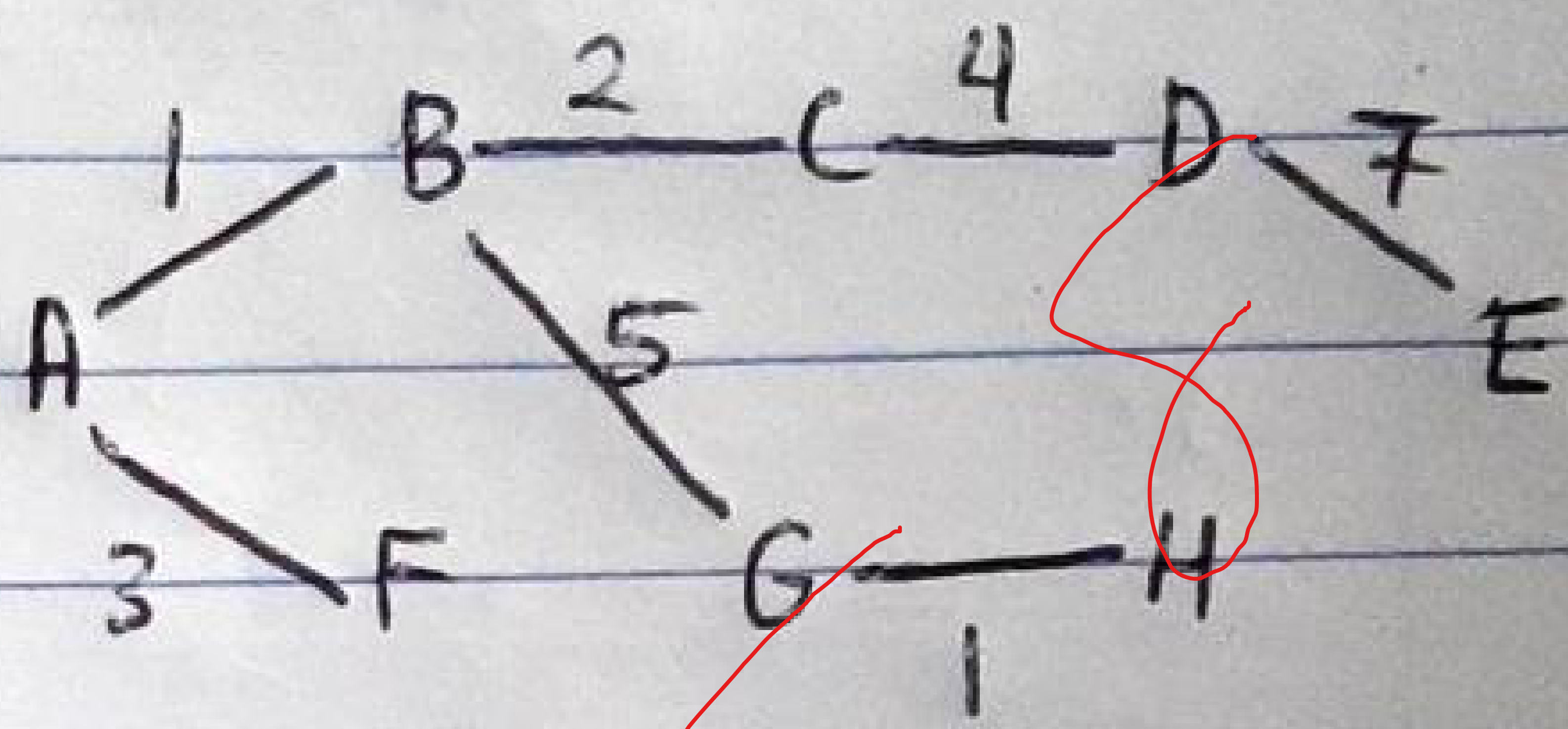
BC 2 ✓ DE 7 ✓

AF 3 ✓ DG 7

CD 4 ✓ EH 8

BF 4

BG 5 ✓



Total weigthage :-

$1+3+2+4+5+1+7 = 23$

Total weight = 24

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

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

∴ The shortest path is M, R, T

Total length is 6.

10

10. (a) The graph in (a) has a Hamiltonian circuit.

($v_0 - v_6 - v_5 - v_4 - v_3 - v_2 - v_1 - v_7 - v_0$)

2

(b) The graph in (b) has no Hamiltonian circuit.