SCHOOL OF COMPUTING
Faculty of Engineering

Discrete Structure

Section - 7

Assignment 4

Done by:

Group = 9

Members:

No.	Name	Matric No.	Questions
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2	Savero Fajri Sutino	A19EC3016	2,5,8,11,14
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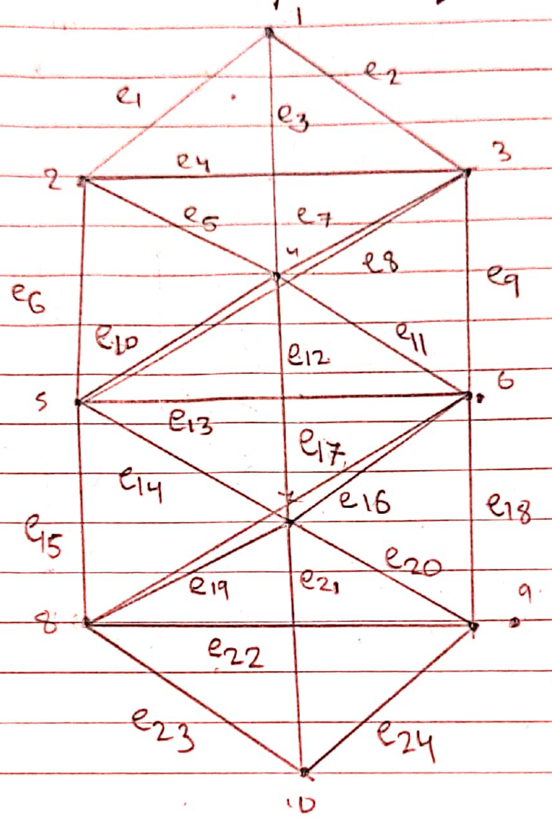
Subject: No: Date:

1) The set of vertices, $V(G) = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$\therefore$ The graph contains 10 vertices.

The vertices will be adjacent if $|v - w| \leq 3$.



From, the graph, we can say that there are 24 edges.

$\therefore E(G) = 24$

Question 2

(a)

$$\begin{array}{c|ccccc}
 & A & B & C & D & E \\
\hline
A & & & & & \\
B & & & & & \\
C & & & & & \\
D & & & & & \\
E & & & & &
\end{array}
\quad
\begin{array}{c} A \\ B \\ C \\ D \\ E \end{array}
\begin{bmatrix}
0 & 1 & 1 & 1 & 1 \\
0 & 0 & 0 & 1 & 1 \\
1 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & 0 & 1 \\
0 & 1 & 1 & 1 & 0
\end{bmatrix}$$

all friends of each others

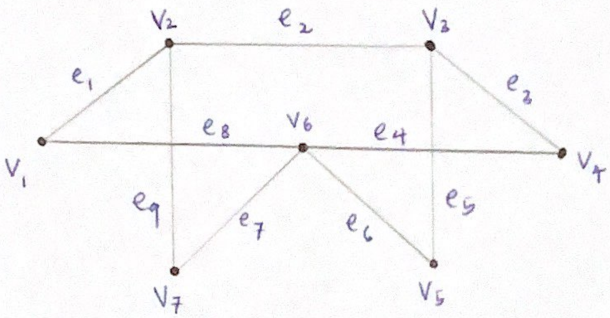
(B)

$$((DM \vee PT)' (AI \vee PS)) \vee ((DM \vee AI) \cap (PT \vee PS) \cap (AI \vee IS)))$$

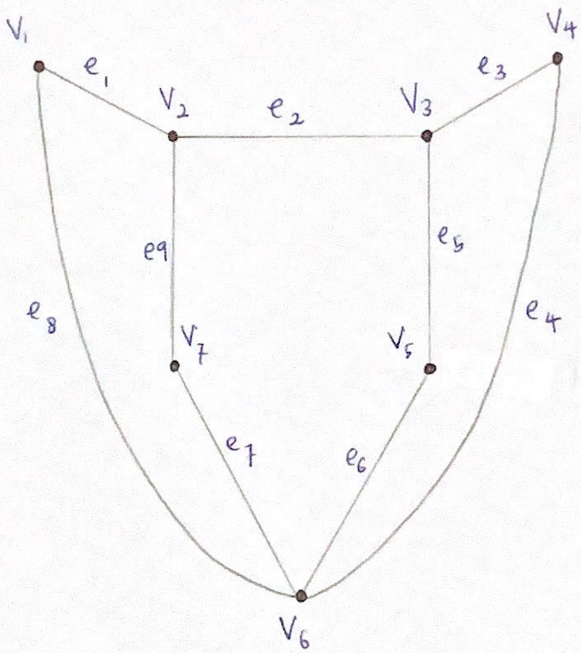
$$\cup$$

$$((DM \vee IS) \cap (PT \vee PS)) \cap ((AI \cup DM) \cap (AI \cup PS))$$

Question 3



V2
e2
V3
e1
e3
e8
V6
e4
V1
V4
e9
e7
e6
e5
V7
V5



V1
V4
e1
e3
V2
e2
V3
e9
e5
e8
e4
V7
V5
e7
e6
V6

Subject:

No:

Date:

4) For the graph ~~H~~ G,

Vertices = $\{v_1, v_2, v_3, v_4\}$

Edges = $\{e_1, e_2, e_3, e_4, e_5, e_6\}$

∴ The adjacency matrix =

$$\begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

Incidence matrix :-

$$\begin{bmatrix} 0 & -1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & -1 & -1 & -1 & 1 \\ 0 & 0 & 0 & 0 & 1 & -1 \end{bmatrix}$$

For graph H,

Vertices = $\{v_1, v_2, v_3, v_4\}$

Edges = $\{e_1, e_2, e_3, e_4, e_5, e_6\}$

Adjacency matrix :-

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 2 \\ 0 & 1 & 1 & 0 \\ 0 & 2 & 0 & 0 \end{bmatrix}$$

Incidence matrix :

$$\begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix}$$

Question 5.

a) both graph in (a) are isomorphic becasee they includes the following :

connected and a simple graph

have 5 vertrees and edges

have 3 vertrices with 2 degree

have 1 vertrices with 3 degree

have 1 vertrees with 1 degree

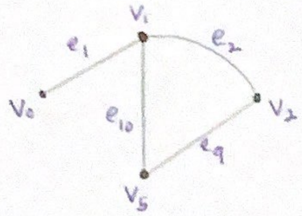
b) both graph is not isomorphic because they have the same loop and parallel

have 5 vertices and 6 edges

but they didn't have the same number of degrees and vertrices

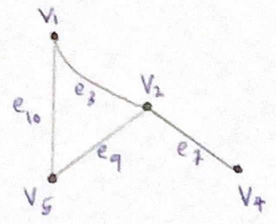
Question 6

a) $V_0 e_1 V_1 e_{10} V_5 e_9 V_2 e_2 V_1$



trail

b) $V_4 e_7 V_2 e_9 V_5 e_{10} V_1 e_3 V_2 e_9 V_5$

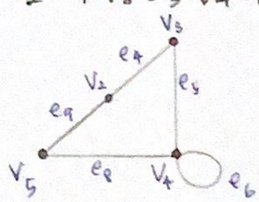


walk

c) V_2

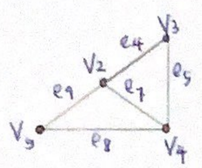
trivial walk

d) $V_5 e_9 V_2 e_4 V_3 e_5 V_4 e_6 V_4 e_8 V_5$



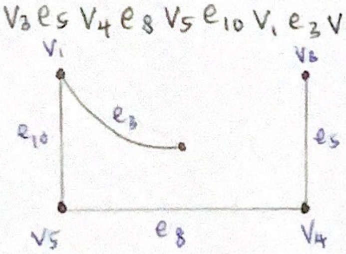
circuit

e) $V_2 e_4 V_3 e_5 V_4 e_8 V_5 e_9 V_2 e_7 V_4 e_5 V_3 e_4 V_2$



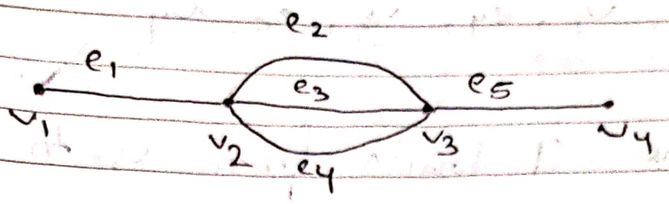
closed walk

f) $V_3 e_5 V_4 e_8 V_5 e_{10} V_1 e_3 V_2$



Path

7) 3



a) ~~For~~ The paths from v_1 to v_4 are:

~~v_1, e_1, v_2, e_2~~ i) $v_1, e_1, v_2, e_2, v_3, e_5, v_4$

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

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

$\therefore$ There are 3 paths from v_1 to v_4

b) The trails from v_1 to v_4:

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

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

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

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

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

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

vii) $v_1, e_1, v_2, e_2, v_3, e_5, v_4$

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

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

∴ There are 9 trails from v_1 to v_4.

c) For walk from v_1 to v_4, it can be done in many ways including the paths and trails because here, each vertex and ~~or~~ edge can be repeated as many times as possible.

Qustion 8

- graph (A) is an eular circuit

because the path travels every edge only once and it ends in the same vertex

- graph (B) is not an eular circuit

because it's not end on the same vertex without crossing atleast an edge more than twice

Question 9

a) Possible

$u\ V_7\ V_0\ V_1\ u\ V_2\ V_3\ V_4\ V_2\ V_6\ V_4\ W\ V_6\ V_5\ W$

b) Not possible

This is because there will be repeated edges.
Based on theorem, every edges should be used exactly once.

Subject: No: Date:

10) For graph (a), there is no Hamiltonian Circuit. Because there is only one way for going to 'u' to 'v_2' or 'v_2' to 'u.' So ~~the~~ we can never reach to the vertex from where we started.

For graph (b) there is no Hamiltonian Circuit because there is only one way for going from 'υ' to 'f' or 'f' to 'υ'. So if we start from a vertex, we can never reach the vertex again without using one vertex more than once.

Scanned with CamScanner

Question 11

3-ary tree = 9

100 vertices = 4

$$\frac{(9-1)n+1}{4} = \frac{(3-1)100+1}{3} = 67 \text{ leaves}$$

Question 12

a) Root = a

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

c) Leaves = k, l, m, r, s, f, c, 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) For figure 1,

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

ii) Post order = k, l, m, e, f, r, s, n, g, b, c, o, h, i, p, q, j, d, a.

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

Question 14

A-B = 1

G - H = 1

B - C = 2

A - F = 3

C - D = 4

B - G = 5

~~C - G = 6~~

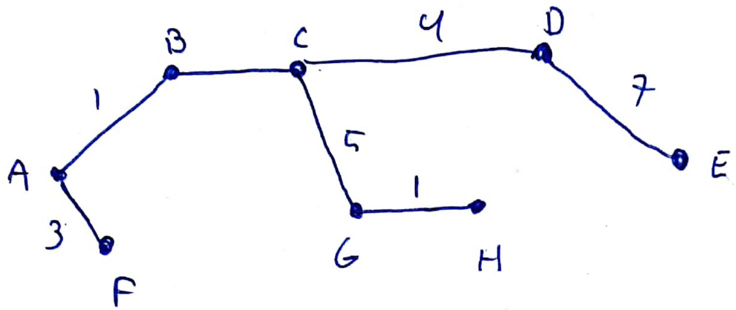
~~D - H = 6~~

~~D - G = 7~~

D - E = 7

~~H - E = 8~~

~~f~~



total weight = 23

Question 14

A-B = 1

G - H = 1

B - C = 2

A - F = 3

C - D = 4

B - G = 5

~~C - G = 6~~

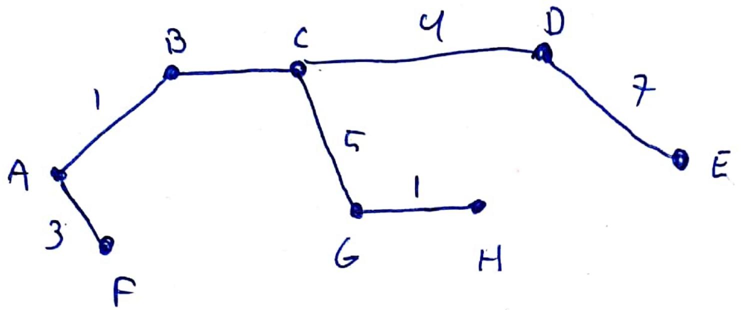
~~D - H = 6~~

~~D - G = 7~~

D - E = 7

~~H - E = 8~~

~~f~~



total weight = 23

Question 15

V	M	N	O	P	Q	R	S	T
M	0_M	4_M	∞	2_M	∞	5_M	∞	∞
P	0_M	4_M	∞	2_M	6_P	5_M	5_P	∞
N	0_M	4_M	10_N	2_M	6_P	5_M	5_P	∞
R	0_M	4_M	7_R	2_M	6_P	5_M	5_P	6_R
S	0_M	4_M	7_R	2_M	6_P	5_M	5_P	6_R
Q	0_M	4_M	7_R	2_M	6_P	5_M	5_P	6_R
T	0_M	4_M	7_R	2_M	6_P	5_M	5_P	6_R
O	0_M	4_M	7_R	2_M	6_P	5_M	5_P	6_R

shortest path from M to T is

M to R to T by total weight of 6