UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING

SEMESTER I 2020/2021

SECI1013-06 STRUKTUR DISKRIT (DISCRETE STRUCTURE)

ASSIGNMENT 4

GROUP 2

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Ans. to the Ques. No. 1 :

According to question,

Two numbers from $V(G) = \{1, 2, \dots, 10\}$.

are adjacent if and only if $|v - w| \leq 3$.

The combinations of the graphs are

(1,1), (1,2), (1,3), (1,4), (2,2), (2,3), (2,4),
(2,5), (3,3), (3,4), (3,5), (3,6), (4,4), (4,5),
(4,6), (4,7), (5,5), (5,6), (5,7), (5,8),
(6,6), (6,7), (6,8), (6,9), (7,7), (7,8),
(7,9), (7,10), (8,8), (8,9), (8,10), (9,9),
(9,10), (10,10).

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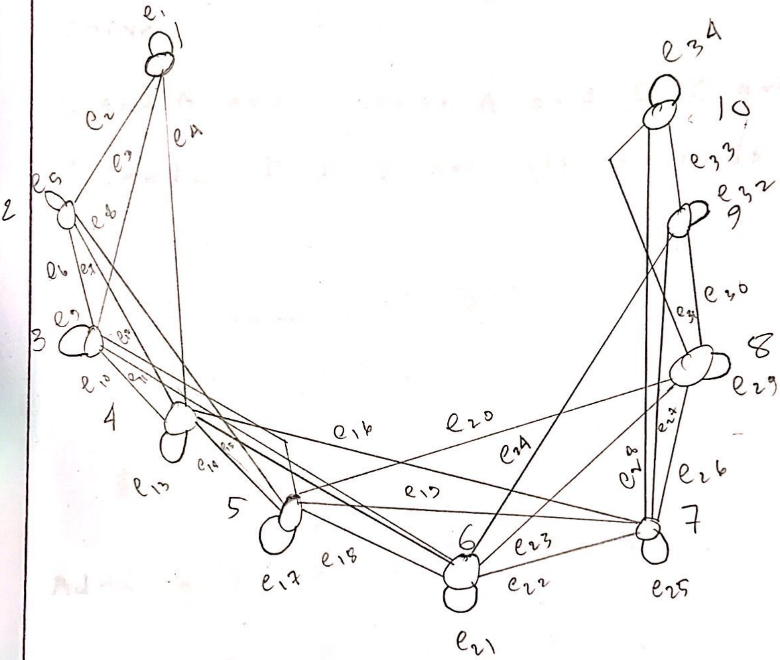

∴ Number of edges are 34.

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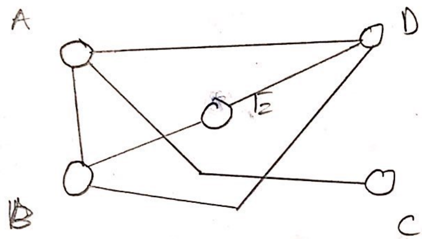
Ans. to the Ques. No. 2 :

(a)

Given,

A and B are friends, A and D, C are also friends. D, B, E are all friends.



Adjacency matrix for this :

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

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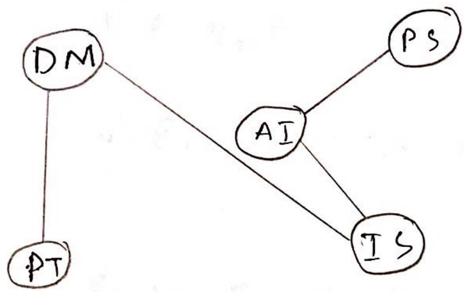
(b)

The subjects that cannot be scheduled in the same time slot :



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

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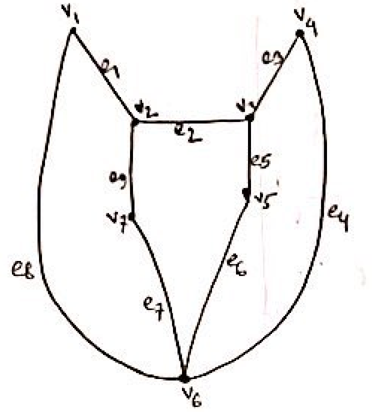
Answer to the Question NO: 3.



Answer to the Question NO: 4

Adjacency & incidence matrices of graph 'G'

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

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

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Adjacency & Incidence matrix of graph H

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

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

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Answer to the question No: 5:

a) G_1

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

G_2

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

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Both G_1 & G_2 have 5 vertices & 5 edges

Since the A_{G_1} & A_{G_2} are same.

So, G_1 & G_2 are isomorphic.

b) $f(a_{3H_1}) = x_1 H_2$

$f(a_5 H_1) \neq x_3 H_2$

Since $f(H_1) \neq H_2$, H_2 & H_1 are not isomorphic

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Answer to the Question No: 6.

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

It is a trail because, it doesn't repeat any edges.

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

it is also a trail.

c) v_2.

It is a trival walk. because it has only one vertex & contains 0 edges.

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

It is a ~~circuit~~ simple circuit. Because it has only repeated vertices except the first & last one.

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

It is a closed walk.

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

It is a path.

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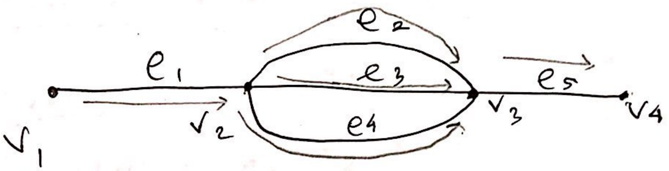
Ans. to the Ques. No. 7:

(a)

There are 3 paths from v_1 to v_4:



Path 1: $v_1\ e_1\ v_2\ e_3\ v_3\ e_5\ v_4$

Path 2: $v_1\ e_1\ v_2\ e_2\ v_3\ e_5\ v_4$

Path 3: $v_1\ e_1\ v_2\ e_4\ v_3\ e_5\ v_4$

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(b)

There are 9 trials for this graph:

Trail 1: $v_1\, e_1\, v_2\, e_2\, v_3\, e_5\, v_4$

Trail 2: $v_1\, e_1\, v_2\, e_3\, v_3\, e_5\, v_4$.

Trail 3: $v_1\, e_1\, v_2\, e_4\, v_3\, e_5\, v_4$

Trail 4: $v_1\, e_1\, v_2\, e_2\, v_3\, e_4\, v_2\, e_3\, v_3\, e_5\, v_4$

Trail 5: $v_1\, e_1\, v_2\, e_2\, v_3\, e_3\, v_2\, e_4\, v_3\, e_5\, v_4$

Trail 6: $v_1\, e_1\, v_2\, e_3\, v_3\, e_2\, v_2\, e_4\, v_3\, e_5\, v_4$

Trail 7: $v_1\, e_1\, v_2\, e_3\, v_3\, e_4\, v_2\, e_2\, v_3\, e_5\, v_4$

Trail 8: $v_1\, e_1\, v_2\, e_4\, v_3\, e_3\, v_2\, e_2\, v_3\, e_5\, v_4$

Trail 9: $v_1\, e_1\, v_2\, e_4\, v_3\, e_2\, v_2\, e_3\, v_3\, e_5\, v_4$

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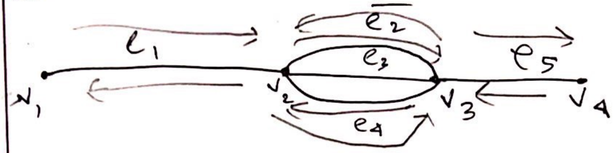
(c)



Since walks can have repeated edge and vertices, From v_1 to v_4 there will be infinite number of walks.

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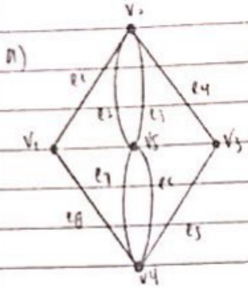
8 Determine which graph in (a)-(b) have Euler Circuit

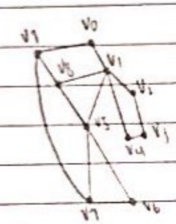
a)



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

(a) have an Euler Circuit because is it connected grap and all vertex have even degree.

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

(b) is not an Euler Circuit circuit because it have 3 vertex that have odd degree (v_7, v_8, v_9)

9. Determine whether there is an Euler Path from u to w.

a)

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

(a) have an Euler Path because only u and w have odd degree

b)

Vertex	u	a	b	c	d	e	f	g	h	w
Degree	3	2	2	2	2	4	4	2	3	3

∴ Therefore (b) is not an Euler Path because vertex h have odd degree.

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10. For each graph (a) - (b), determine whether there is Hamiltonian circuit If there, exhibit one

(a) Not having a Hamiltonian Circuit
(b) Not having a Hamiltonian Circuit

11 How many leaves does a full 3-ary tree with 100 vertices have?

$m = 3$

$n = 100$

$l = ?$

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

$$100 = \frac{3l - 1}{3 - 1}$$

$$3l = 201$$

$$l = 67$$

$\therefore$ 67 leaves

Typo

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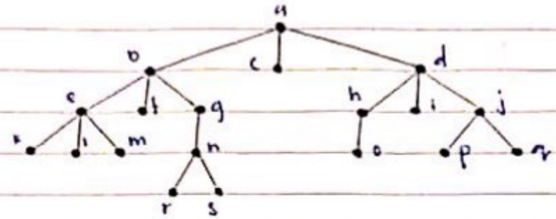
12.



a) Root : a
b) Internal vertices : a, b, d, e, g, h, j, n
c) Leaves : c, f, i, k, l, m, o, p, q, r, s
d) children of n : r, s
e) Parent of e : b
f) sibling of k : l, m
g) Proper ancestors of q : a, d, j
h) Proper descendant of b : e, f, g, k, l, m, n, r, s

13

Preorder : 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

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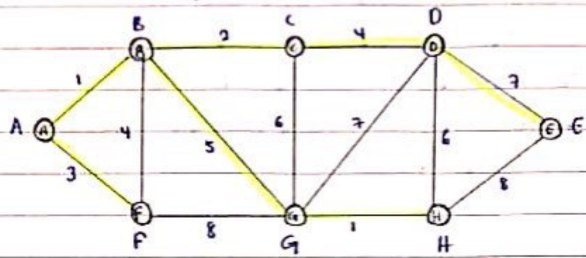
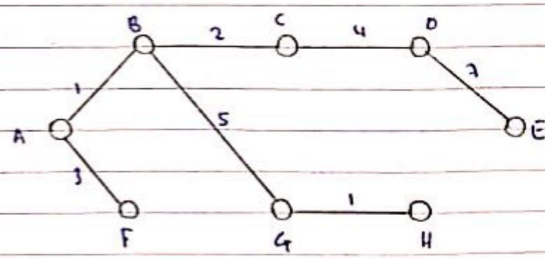
1) minimum spanning tree using kruskal's algorithm.



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



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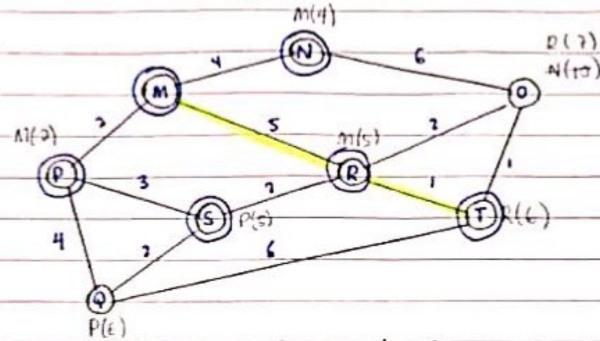
15 Use Dijsktra's algorithm - from M to T



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

Shortest way from M to T : M, R, T
length : 6

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