UTM

UNIVERSITI TEKNOLOGI MALAYSIA

TOPIC:
ASSIGNMENT 3 DISCRETE STRUCTURE

SECTION:
SECTION 03 (2020/2021)

GROUP:
GROUP 10

LECTURER'S NAME :
DR NOR AZIZAH ALI

GROUP MEMBERS:

NAME	MATRIC NO
CHONG KAI ZHE	A20EC0186
NUR IZZAH MARDHIAH BINTI RASHIDI	A20EC0116
AMIRAH RAIHANAH BINTI ABDUL RAHIM	A20EC0182
ADRINA ASYIQIN BINTI MD ADHA	A20EC0174

1. Let G be a graph with $V(G) = \{1, 2, \ldots, 10\}$, such that two numbers 'v' and 'w' in $V(G)$ are
adjacent if and only if | v – w| ≤ 3. Draw the graph G and determine the numbers of edges,
$e(G)$.

Vertex = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

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v \ w	1	2	3	4	5	6	7	8	9	10
1		1	2	3	4	5	6	7	8	9
2	1		1	2	3	4	5	6	7	8
3	2	1		1	2	3	4	5	6	7
4	3	2	1		1	2	3	4	5	6
5	4	3	2	1		1	2	3	4	5
6	5	4	3	2	1		1	2	3	4
7	6	5	4	3	2	1		1	2	3
8	7	6	5	4	3	2	1		1	2
9	8	7	6	5	4	3	2	1		1
10	9	8	7	6	5	4	3	2	1	

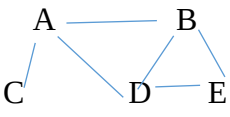
= obey | v – w| ≤ 3 = invalid. v and w cannot be the same number

2a) Model the following situation as graphs, draw each graphs and gives the corresponding
adjacency matrix.
Ahmad and Bakri are friends. Ahmad is also friends with David and Chong. David, Bakri
and Ehsan all friends.
(Note that you may use the representation of A= Ahmad; B = Bakri; C = Chong; D = David; E= Ehsan)

A= Ahmad; B = Bakri; C = Chong; D = David; E= Ehsan
Ahmad and Bakri are friends = A-B
Ahmad is also friends with David and Chong= A — D, A — C

David, Bakri and Ehsan all friends.= D — B, D — E, B — E

Therefore,



adjacency matrix

	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

2b)
There are 5 subjects to be scheduled in the exam week: Discrete Mathematics (DM), Programming Technique (PT), Artificial Intelligence (AI), Probability Statistic (PS) and
Information System (IS). The following subjects cannot be scheduled in the same time
slot:-
i. DM and IS
ii. DM and PT

	DM	PT	AI	PS	IS
DM	0	0	1	1	0
PT	0	0	1	1	1
AI	1	1	0	0	1
PS	1	1	0	0	1
IS	0	1	1	1	0

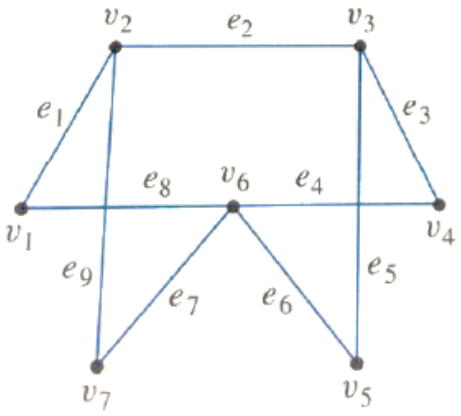
i and ii) = DM — AI, PS

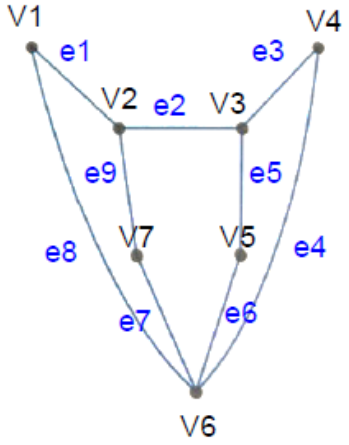
iii. AI and PS
iv. IS and AI

iii and iv) = AI — DM, PT

Final graph DM — PS, IS; AI — PT

3. Show that the two drawing repre
edges of the right-hand drawing to correspond to left-hand drawing.





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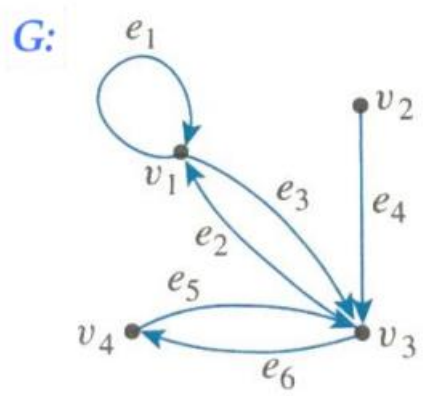
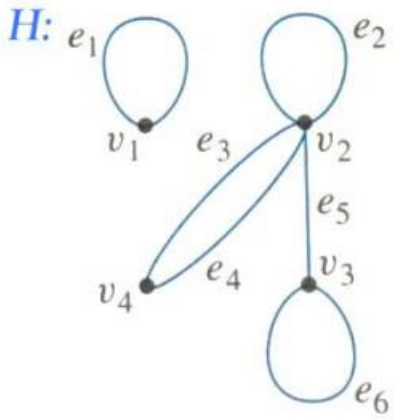


Adjacency matrices

	V1	V2	V3	V4
V1	1	0	1	0
V2	0	0	1	0
V3	1	0	0	1
V4	0	0	1	0

Incidence matrices

	e1	e2	e3	e4	e5	e6
V1	1	0	1	0	0	0
V2	0	0	0	1	0	0
V3	0	1	0	0	0	1
V4	0	0	0	0	1	0



Adjacency matrices

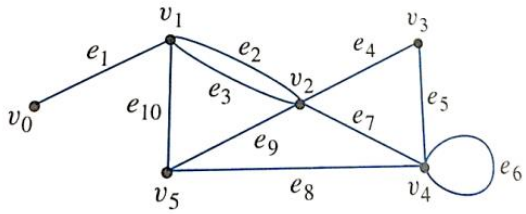
	V1	V2	V3	V4
V1	1	0	0	0
V2	0	1	1	1
V3	0	1	1	0
V4	0	1	0	0

Incidence matrices

	e1	e2	e3	e4	e5	e6
V1	2	0	0	0	0	0
V2	0	2	1	1	1	0
V3	0	0	0	0	1	2
V4	0	0	1	1	0	0

5. a) G1 and G2 are isomorphisms
   b) H1 and H2 are not isomorphisms

6) In the graph below, determine whether the following walks are trails, paths, closed walks,
circuits/cycles, simple circuits or just walks



a) $v_0e_1v_1e_{10}v_5e_9v_2e_2v_1$

Repeated vertices : Yes
Repeated edges : No
Open/Close : Open
∴ Trails

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

Repeated vertices : Yes
Repeated edges : Yes
Open/Close : Open
∴ Walks

c) v_2

Repeated vertices : No
Repeated edges : No
Open/Close : Close
∴ Cycle

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

Repeated vertices : Yes
Repeated edges : No
Open/Close : Close
∴ Circuit

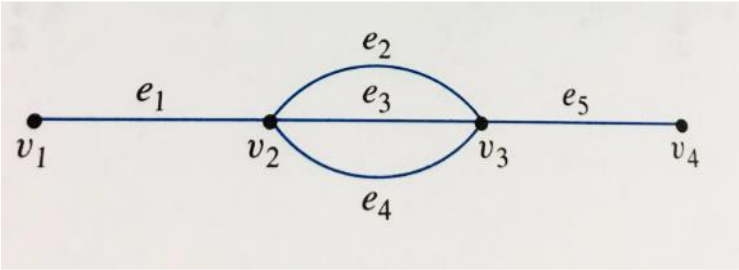
e) $v_2 e_4 v_3 e_5 v_4 e_8 v_5 e_9 v_2 e_7 v_4 e_5 v_3 e_4 v_2$

Repeated vertices : Yes
Repeated edges : Yes
Open/Close : Close
∴ Closed walks

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

Repeated vertices : No
Repeated edges : No
Open/Close : Open
∴ Paths

7. Consider the following graph.



a) How many paths are there from $v1$ to $v4$?

= $v1, e1, v2\ , e2, v3, e5, v4$

=$v1, e1, v2, e3, v3, e5, v4$

=$v1, e1, v2, e4, v3, e5, v4$

= total paths is 3

b) How many trails are there from $v1$ to $v4$?

$= v1, e1, v2\ , e2, v3, e5, v4$ =
$v1, e1, v2, e4, v3, e2, v2, e3, v3, e5, v4$

$=v1, e1, v2, e3, v3, e5, v4$ $=v1, e1, v2, e2, v3, v4, v2, e3, v3, e5, v4$
$=v1, e1, v2, e4, v3, e5, v4$ $= v1, e1, v2, e3, v3, e2, v2, e4, v3, e5, v4$
$= v1, e1, v2\ , e2, v3, e3, v2, e4, v3, e5, v4$
$=v1, e1, v2, e3, v3, , e4, v2, e2, v3, e5, v4$

$=v1, e1, v2, e4, v3, e3, v2, e2, v3, e5, v4$

=total is 9 trails

c) How many walks are there from $v1$ to $v4$?
= infinity because it can go through combination of edges and vertices repeatedly.

8. Determine which of the graphs in (a) – (b) have Euler circuits. If the graph does not have a Euler circuit, explain why not. If it does have a Euler circuit, describe one.

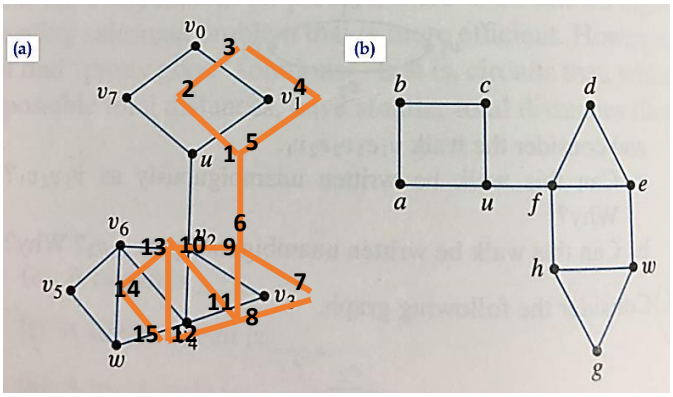
Diagram a has Euler circuit because every vertex has a positive even degree.

Deg(V1) = 2
Deg(V2) = 4
Deg(V3) = 2
Deg(V4) = 4
Deg(V5) = 4

Diagram b does not have Euler circuit because is has an odd degree

Deg(V0) = 2
Deg(V1) = 5
Deg(V2) = 2
Deg(V3) = 2
Deg(V4) = 2
Deg(V5) = 4
Deg(V6) = 2
Deg(V7) = 3
Deg(V8) = 3
Deg(V9) = 3

9)For each of graph in (a) – (b), determine whether there is an Euler path from u to w. If there is, find such a path.



(a) Euler path = ($u, v_7, v_0, v_1, u, v_2, v_3, v_4, v_2, v_6, v_4, w, v_6, v_5, w$)
(b) No Euler path

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

-Both graph in (a) and (b) could not form to Hamiltonion circuit because exist the only one degree on vertices, between vertice (u) and (v2) for the graph in (a) and also between vertices (u) and (v) for the graph in (b), this happens to both graph unable to complete the circuit.

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

m = 3
n = 100
i = (100-1)/3
= 33
l = [(3-1)100 + 1] / 33
= 6 leaves

12. Find the following vertex/vertices in the rooted tree illustrated below.

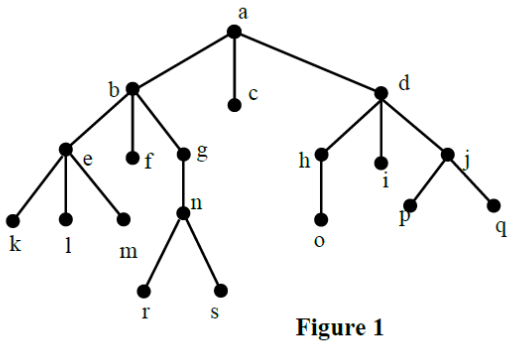


Figure 1

a) Root = **a**

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

c) Leaves = **c, f , i**

d) Children of n = **r and s**

e) Parent of e = **b**

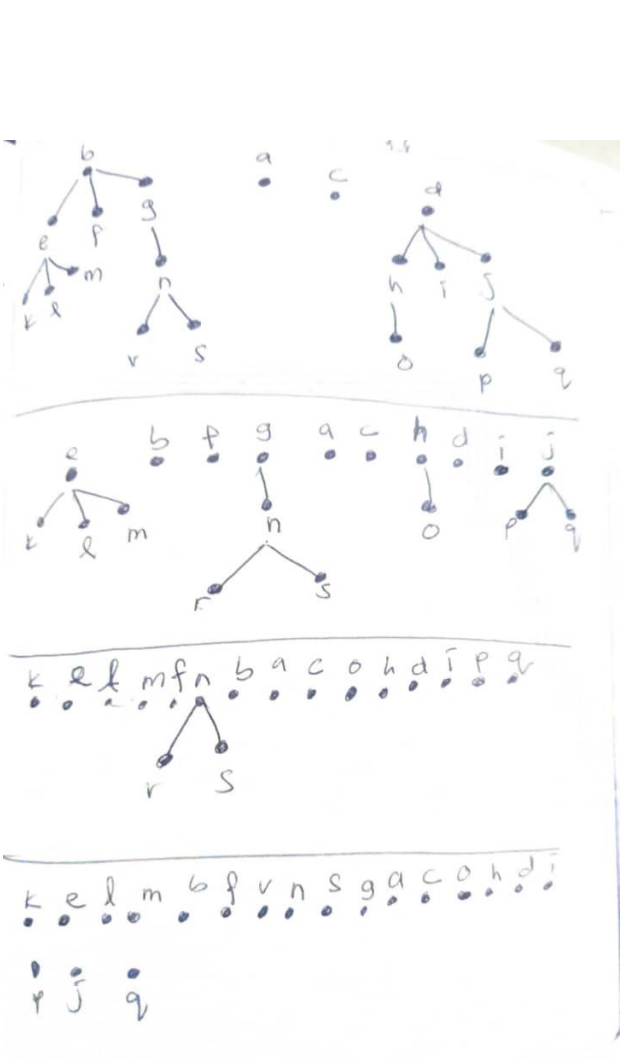
f) Siblings of k = ***l and m***

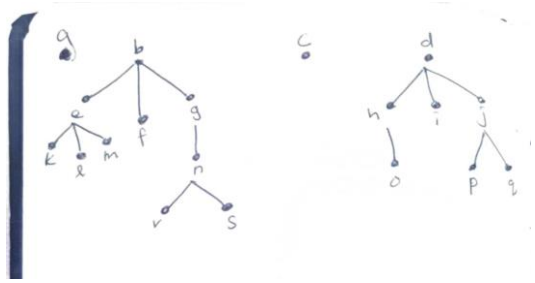
g) Proper ancestors of *q* = ***a, d , j***

h) Proper descendants of b = **e, k, l, m, f, g, n, r, s**

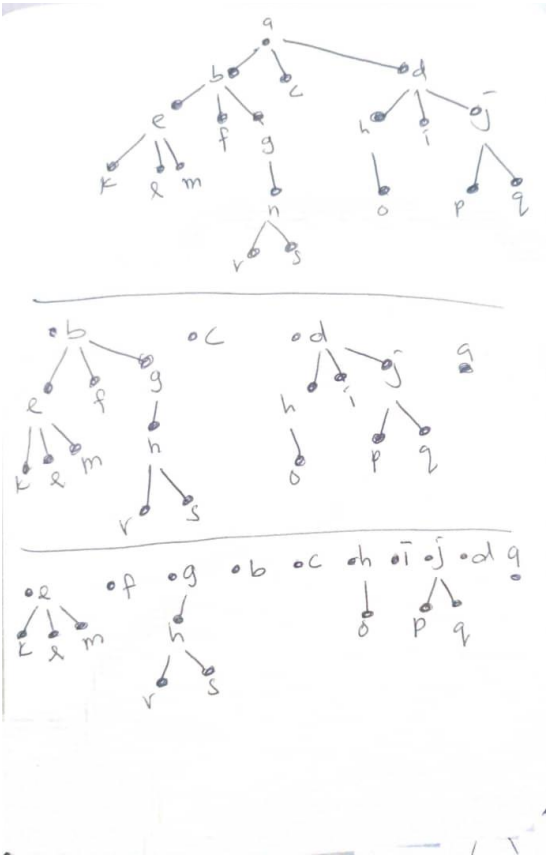
13. In which order are the vertices of ordered rooted tree in Figure 1 is visited using preorder, inorder and postorder.

- Preorder

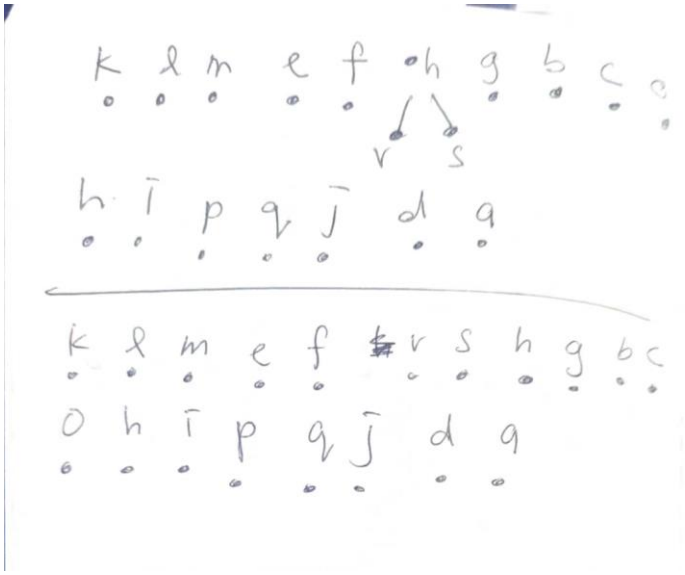




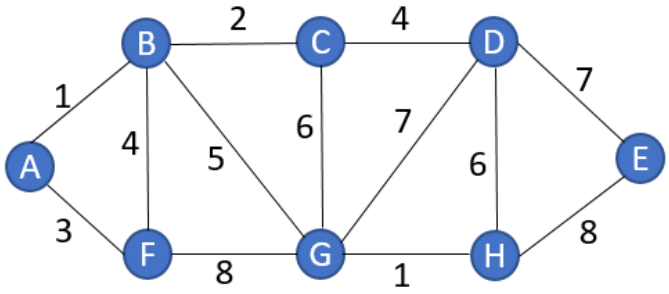
- Inorder


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

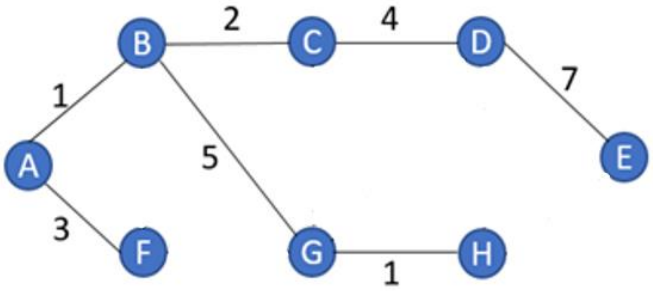
postorder


k l m e f h g b c
r s
h ī p q j d q
k l m e f r s h g b c
0 h ī p q j d q

14. Find the minimum spanning tree for the following graph using Kruskal's algorithm.



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



Total weight = 7 + 5 + 4 + 3 + 2 + 1 + 1
= 23

15.

iteration	S	N	L(M)	L(N)	L(P)	L(R)	L(S)	L(Q)	L(O)	L(T)
0	{}	{M,N,P,R,S,Q,O,T}	0	∞	∞	∞	∞	∞	∞∞	∞
1	{M}	{N,P,R,S,Q,O,T}	0	4	2	5	∞	∞	∞	∞
2	{M,P}	{N,R,S,Q,O,T}	0	4	2	5	5	6	∞	∞
3	{M,P,N}	{R.S.Q.O.T}	0	4	2	5	5	6	10	∞
4	{M,P,N,R}	{S.Q,O,T}	0	4	2	5	7	6	7	6

Shortest distance = {M,R,T}=M→R→T=5+1=6