



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING
Faculty of Engineering

ASSIGNMENT 4

SUBJECT:
DISCRETE STRUCTURE (SECI1013-03)

TOPIC:
GRAPH

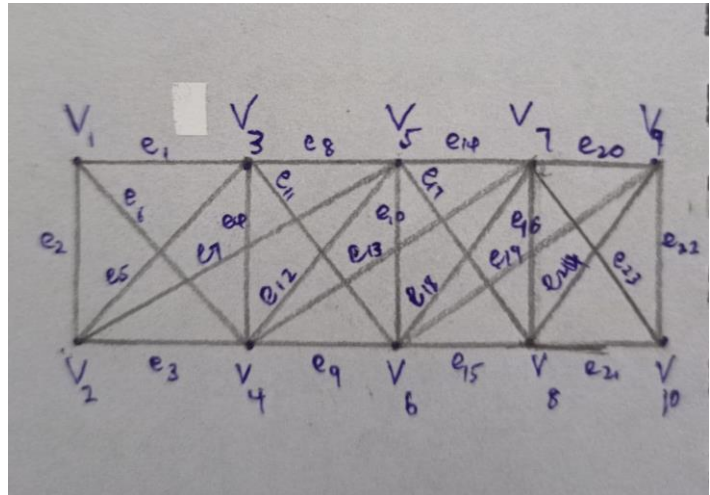
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GROUP MEMBERS:

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Question 1

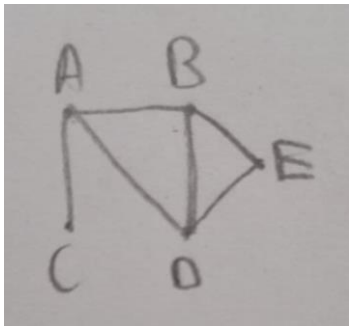
$$A_G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 10 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 2 & 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 3 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 4 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 & 0 \\ 5 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 6 & 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 & 0 \\ 7 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 & 1 \\ 8 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 & 1 \\ 9 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 1 \\ 10 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$$



Edge = 24

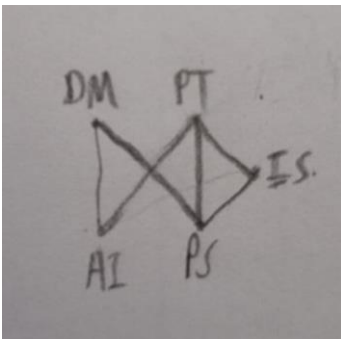
Question 2

a)



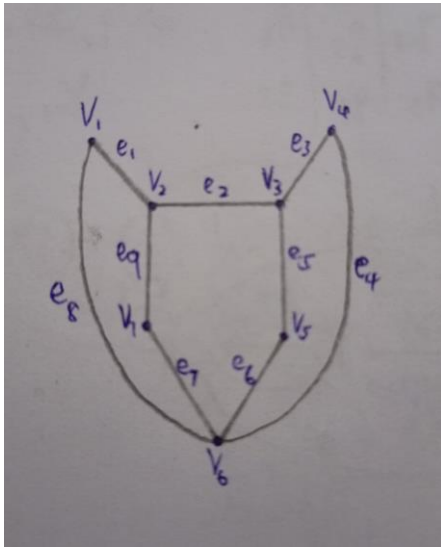
	A	B	C	D	E
A	0	1	1	1	0
B	1	0	0	1	1
C	1	0	0	0	0
D	1	1	0	0	1
E	0	1	0	1	0

b)



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

Question 3



Question 4

Vertex set, $V = \{1,2,3,4\}$

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

G :

Adjacency

	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

Incidence

	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

H :

Adjacency

	v ₁	v ₂	v ₃	v ₄
v ₁	1	0	0	0
v ₂	0	1	1	2
v ₃	0	1	1	0
v ₄	0	2	0	0

Incidence

	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

Question 5

a) - Both graph G1 and G2 are simple graph and have the same number of vertices and the same number of edges.

- Both graphs have 1 vertex with degree of 1 (v5 & u1), 3 vertices with degree of 2 (v1, v2, v4 & u3, u4, u5) and 1 vertex with degree of 3 (v3 & u2)

∴ Hence, graph G1 and G2 are **isomorphic**.

b) - Both graph H1 and H2 are connected graph and have the same number of vertices and the same number of edges.

- Graph H1 has 2 vertices with degree of 1 (a1, a2), 1 vertex with degree of 2 (a4), 1 vertex with degree of 3 (a3) and 1 vertex with degree of 4 (a5). - However, graph H2 has 1 vertex with degree of 1 (x2), 1 vertex with degree of 2 (x5) and 3 vertices with degree of 3 (x1, x4, x3).

∴ Hence, graph H1 and H2 are **not isomorphic**.

Question 6

- a) Trails
- b) Walk
- c) Trivial walk
- d) Circuit
- e) Closed walk
- f) Path

Question 7

- a) 3 paths
 - V1, e1, v2, e2, v3, e5, v4
 - V1, e1, v2, e3, v3, e5, v4
 - V1, e1, v2, e4, v3, e5, v4

- b) 9 trails
 - v1, e1, v2, e2, v3, e5, v4
 - v1, e1, v2, e3, v3, e5, v4
 - v1, e1, v2, e4, v3, e5, v4
 - v1, e1, v2, e2, v3, e3, v2, e4, v3, e5, v4
 - v1, e1, v2, e2, v3, e4, v2, e3, v3, e5, v4
 - v1, e1, v2, e3, v3, e2, v2, e4, v3, e5, v4
 - v1, e1, v2, e3, v3, e4, v2, e2, v3, e5, v4
 - v1, e1, v2, e4, v3, e2, v2, e3, v3, e5, v4
 - v1, e1, v2, e4, v3, e3, v2, e2, v3, e5, v4

c) infinite, ∞

Question 8

a) Have Euler circuit

Vertex	1	2	3	4	5
Degree	2	4	2	4	4

All vertices have even degree

(v1, e1, v2, e2, v5, e3, v2, e4, v3, e5, v4, e6, v5, e7, v4, e8, v1)

b) Don't have Euler circuit

Vertex	0	1	2	3	4	5	6	7	8	9
Degree	2	4	2	2	2	4	2	3	3	3

Vertex v8, v9, v7 and v1 have odd degree.

Question 9

a) Have Euler path

Vertex	u	0	1	2	3	4	5	6	7	w
Degree	3	2	2	4	2	4	2	4	2	3

Only starting (v) vertex and ending (w) vertex is odd number and the others is even.

(u, v1, v0, v7, u, v2, v3, v4, v2, v6, v4, w, v6, v5, w)

b) Don't have Euler path

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

There are other vertex (e, f, h) have odd number besides starting vertex (v) and ending vertex (w).

Question 10

There is no Hamiltonian circuit in both graphs. This is because in Graph (a), the path from vertex u to v2 must be passing through twice in order to complete the circuit.

While for Graph (b), the path from vertex u to vertex f must be passing through twice as well in order to complete the Hamiltonian circuit.

Question 11

$$m=3$$

$$n=100$$

$$l = [(m-1)n+1] / m$$

$$l = [(3-1)100+1] / 3$$

$$l = 201 / 3$$

$$l = 67$$

Question 12

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

Question 13

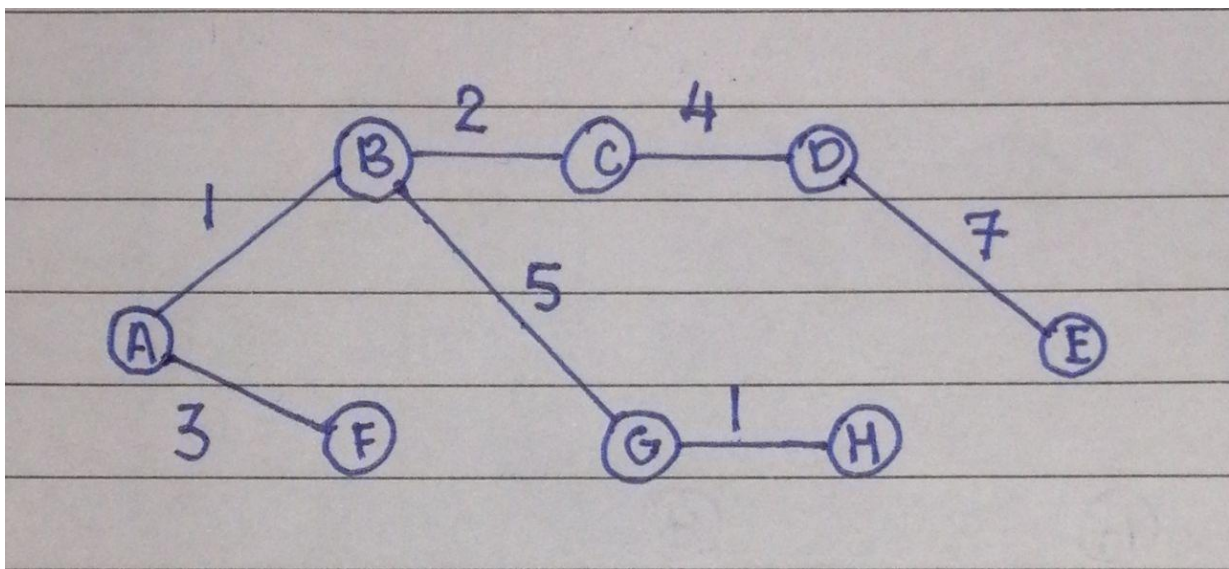
preorder : a, b, e, k, l, m, f, g, n, r, s, c, d, h, o, i, j, p, q

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

Question 14

Edge	Weight	Will adding edge make circuit?	Action taken	Cumulative weight of subgraph
$e_1=(v_A,v_B)$	1	No	Added	1
$e_2=(v_G,v_H)$	1	No	Added	2
$e_3=(v_B,v_C)$	2	No	Added	4
$e_4=(v_A,v_F)$	3	No	Added	7
$e_5=(v_B,v_F)$	4	Yes	Not added	7
$e_6=(v_C,v_D)$	4	No	Added	11
$e_7=(v_B,v_G)$	5	No	Added	16
$e_8=(v_C,v_G)$	6	Yes	Not added	16
$e_9=(v_D,v_H)$	6	Yes	Not added	16
$e_{10}=(v_D,v_E)$	7	No	Added	23
$e_{11}=(v_D,v_G)$	7	Yes	Not added	23
$e_{12}=(v_F,v_G)$	8	Yes	Not added	23
$e_{13}=(v_H,v_E)$	8	Yes	Not added	23



Question 15

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

Shortest path : $M \rightarrow R \rightarrow T$

Shortest length : 6