SCHOOL OF COMPUTING
Faculty of Engineering

ASSIGNMENT 4

DISCRETE STRUCTURE-07

GROUP-01:

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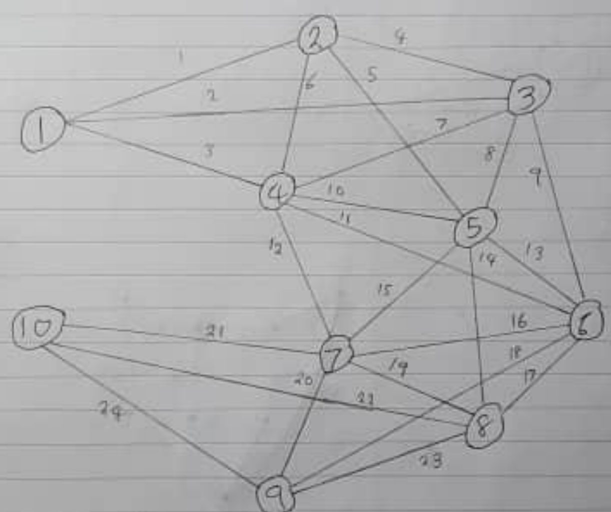
Q1:

Question 1

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

$|v - w| \leq 3$

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

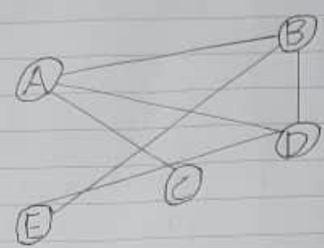


$e(G) = 24$

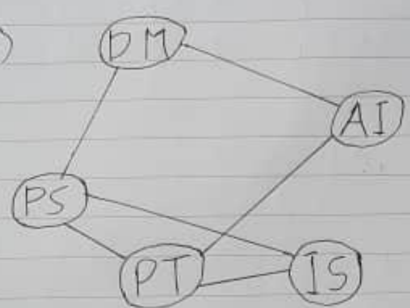
Q2 and Q3:

Question 2

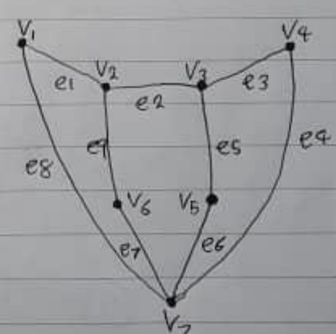
a)



b)



Question 3



Q4:

Question 4

$$A_G = \begin{array}{cc} & \begin{matrix} V_1 & V_2 & V_3 & V_4 \end{matrix} \\ \begin{matrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{matrix} & \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

$$I_G = \begin{array}{cc} & \begin{matrix} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{matrix} \\ \begin{matrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{matrix} & \begin{bmatrix} 2 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 \end{bmatrix} \end{array}$$

$$A_H = \begin{array}{cc} & \begin{matrix} V_1 & V_2 & V_3 & V_4 \end{matrix} \\ \begin{matrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{matrix} & \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 2 \\ 0 & 1 & 1 & 0 \\ 0 & 2 & 0 & 0 \end{bmatrix} \end{array}$$

$$I_G = \begin{array}{cc} & \begin{matrix} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{matrix} \\ \begin{matrix} V_1 \\ V_2 \\ V_3 \\ V_4 \end{matrix} & \begin{bmatrix} 2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 2 \\ 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

Q5:

Question 5

a)

G1 : 1 vertex has 1 edges
3 vertex has 2 edges
1 vertex has 3 edges

G2 : 1 vertex has 1 edges
3 vertex has 2 edges
1 vertex has 3 edges

$V_1 = U_5$
$V_2 = U_4$
$V_3 = U_2$
$V_4 = U_3$
$V_5 = U_1$

$\therefore$ G_1 and G_2 are isomorphic

b) H_1 : 2 vertex has 1 edges
1 vertex has 2 edges
1 vertex has 3 edges
1 vertex has 4 edges

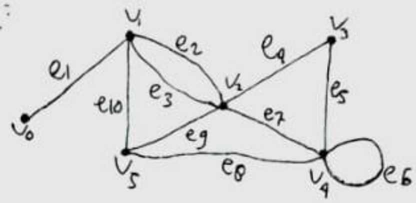
H_2 : 1 vertex has 1 edges
2 vertex has 2 edges
2 vertex has 3 edges

H_1 and H_2 don't have same degree for corresponding values

$\therefore$ H_1 and H_2 are not isomorphic

Q6:

Question 6 :



a.) $V_0 e_1 V_1 e_{10} V_5 e_9 V_2 e_2 V_1$: Trails (no repeated edge)

b.) $V_4 e_7 V_2 e_9 V_5 e_{10} V_1 e_3 V_2 e_9 V_5$ = Just Walk (repeated edge & Vertex)

c.) V_2 = this is not a 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 (start = end vertex, no repeated edge)

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 (Start = end vertex, repeated edge & vertex)

f.) $V_3 e_5 V_4 e_8 V_5 e_{10} V_1 e_3 V_2$ = Path (no repeated edge & Vertex)

Q7:

Question 7

a.) How many Paths are there from V_1 to V_4 ?

There are 3 paths from V_1 to V_4 (a walk without repeating edge and vertex)

- $V_1 e_1 V_2 e_2 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_3 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_4 V_3 e_5 V_4$

b.) How many trails are there from V_1 to V_4 ?

There are 6 walks that are not repeating edge but repeated vertex plus 3 that are not repeating edge and vertex, total = 9 trails

- $V_1 e_1 V_2 e_2 V_3 e_3 V_2 e_4 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_2 V_3 e_4 V_2 e_3 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_3 V_3 e_2 V_2 e_4 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_3 V_3 e_4 V_2 e_2 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_4 V_3 e_2 V_2 e_3 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_4 V_3 e_3 V_2 e_2 V_3 e_5 V_4$

$+$

3 from Paths

- $V_1 e_1 V_2 e_2 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_3 V_3 e_5 V_4$
- $V_1 e_1 V_2 e_4 V_3 e_5 V_4$

c.) How many walks are there from V_1 to V_4 ?

There are 9 walks that are not repeating edge and if walks that repeating edge, it could be infinity because if only walk we can repeating the edge and vertex as much as we want.

Q8:

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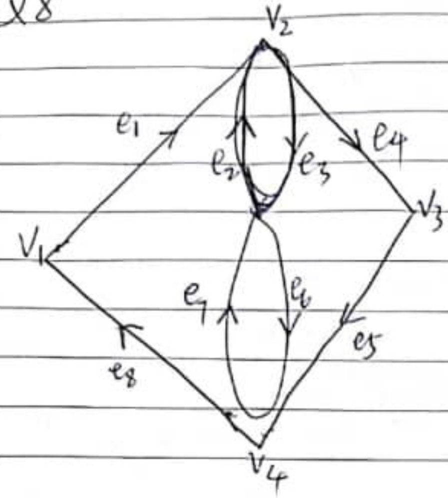
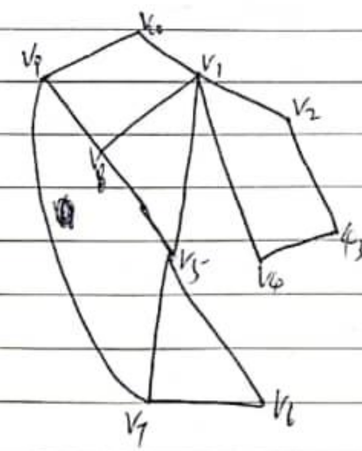
Q8



It's an eular circuit for the graph we can see if $v_1, e_1, V_2, e_4, V_5, e_5, V_4, e_6, V_5, e_2, V_2, V_4, e_7, V_5, e_3, V_2$ V_4 e_8, V_1

~~The eular travels every edge once~~ only once. and ends at the same vertex so It's an eular circuit as well.



The eular travels every edge once, only once and starts at different vertexes, ~~the~~ this graph cannot have an eular circuit because no eular path can start and end ~~at~~ at the same vertex

Q9, Q10, and Q11:

Q9

An eular path is a path that covers all the edge of graph once.

a). ~~As~~ as all ~~the deg~~ degree is even. so an ~~eal~~ eular path will ~~be e~~ exist.

if → $U, V_1, V_0, V_7, U, V_2, V_3, V_4, V_6, V_2, V_4, W, V_5, V_6, W$.

b) Because of more than 2 vertexe have degree ODD. so that there will not exist an eular path.

Q10

The hamiltonian path exist vertex once.

for (a) and (b) there are more than one connection. So that there ~~will~~ will not exist any hamiltonian path

Q11

how to leave 3-ary tree with 100 vertexes.

$m=3 \quad n=100$

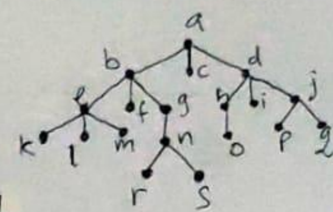
$$l = \frac{(m-1)n+1}{m}$$

$$= \frac{(3-1)(100)+1}{3}$$

$$= 67$$

Q12, Q13, and Q14:

Question 12



a.) Root = a

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

c.) Leaves = k, l, m, f, r, s, c, o, i, p, q

d.) Children of n = r, s

e.) Parent of e = b

f.) Siblings of k = l, m

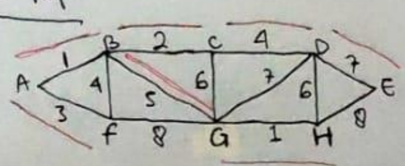
g.) Proper ancestors of q = a, d, j

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

Question 13

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

Question 14



Find the minimum spanning tree with kruskal's algorithm.

GH = 1 ✓
AB = 1 ✓
BC = 2 ✓
Af = 3 ✓
Bf = 4
CD = 4 ✓
BG = 5 ✓
CG = 6
DH = 6
DE = 7 ✓
DG = 7
fG = 8
EH = 8

AB = 1
GH = 1
BC = 2
AF = 3
CD = 4
BG = 5
DE = 7 +

23

Q15: