ASSIGNMENT # 4

Date ________ 20____

NAME: SAAD-UR-REHMAN Pg # 1

ID: 19K-0218

SEC: C.

134

Q.1

	DIRECTED	UNDIRECTED	MULTIPLE EDGES	ONE MORE THAN LOOPS
3.	NO	Yes	NO	NO.
4.	NO.	Yes	Yes	NO.
5.	NO	Yes	Yes	Yes.
6.	NO	Yes	Yes	NO.
7.	Yes	NO.	Yes	Yes
8.	Yes	NO	Yes	Yes.
9.	Yes	NO.	Yes	Yes.

Q.2

1) $\sum d(V_i) = 2E.$

$d(a) = 2.$

$d(b) = 4$

$d(c) = 1$

$d(d) = 0.$

$d(e)\ 2$

$d(f) = 3.$

sum of degree = 12.

no. of edges = 6.

$\Rightarrow 12 = 2\times 6$

$\boxed{12 = 12}$ Proved

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Pg # 2

2-

deg(a) = 6
deg(b) = 6
deg(c) = 6
d(d) = 5
d(e) = 3.

Sum of deg = 26
No. of edge = 13.

26 = 2×E
26 = 2× 13
$\boxed{26 = 26}$

3-

d(a) = 3
d(b) = 2.
d(c) = ~~3~~ 4
d(d) = 0.
d(e) = 6.
d(f) = 0.
d(g) = 4.
d(h) = 2.
d(i) = 3.

Sum of degree = 24
No. of edge = 12.

24 = 2×12
$\boxed{24 = 24}$

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Q.3 Pg #3.

$$\sum^{n} d(v) = \sum d(e) + \sum d(o)$$
$$= e + 0$$
$$= e.$$

⇒ It conclude that whenever we add two even no. or two odd no. or one even & one odd, it will always give even no. sum.

2) No. of vertices = 4. No. of edges = 7.

$deg^-(a) = 3$	$deg^+(a) = 1$
$deg^-(b) = 1$.	$deg^+(b) = 2$.
$deg^-(c) = 2$.	$deg^+(c) = 1$
$deg^-(d) = 1$	$deg^+(d) = 3$.
⇒ 7	⇒ 7.

$$\therefore \frac{\sum}{2} = deg^-(V) = deg^+(V)$$
$$\boxed{7 = 7 = 7}$$

3) No. of vertices = 4. No. of edges = 8.

$deg^-(a) = 2$	$deg^+(a) = 2$.
$deg^-(b) = 3$	$deg^+(b) = \cancel{3}\ 4$
$deg^-(c) = 2$.	$deg^+(c) = 1$.
$deg^-(d) = 1$	$deg^+(d) = 1$
⇒ 8	⇒ 8

) No. of vertices = 5. No. of edges = 13

$deg^-(a) = 6$	$deg^+(a) = 1$.
$deg^-(b) = 1$	$deg^+(b) = 5$
$deg^-(c) = 2$.	$deg^+(c) = 5$
$deg^-(d) = 4$.	$deg^+(d) = 2$.
$deg^-(e) = 0$	$deg^+(e) = 0$
⇒ 13	⇒ 13.

Bareena

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Pg # 4

Q.4

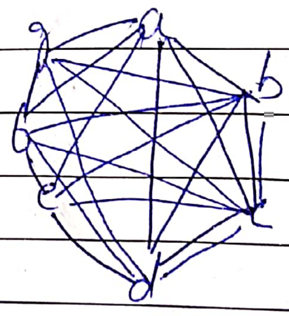
7) $G = deg^-(V) = deg^+(V)$
$7 = 7 = 7$
equal.

8) $G = deg^-(V) = deg^+(V)$
$8 = 8 = 8$
equal.

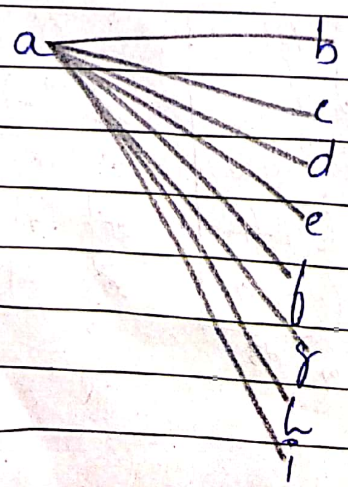
9) $G = deg^-(V) = deg^+(V)$
$13 = 13 = 13$
equal.

Q.5

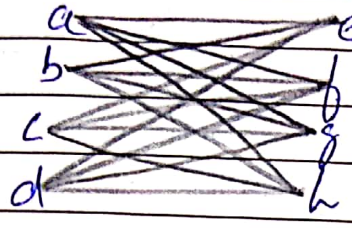
a) K7.



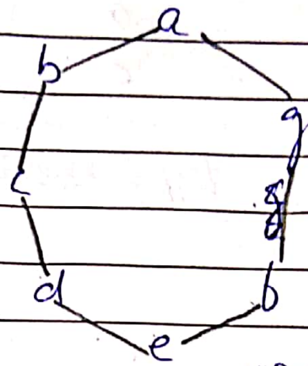
b) K 1,8.



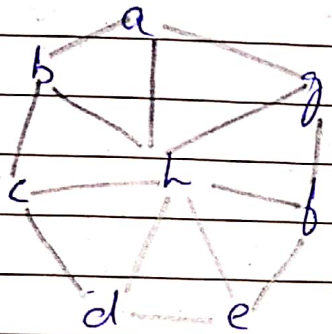
(c) $K_{4,4}$



(d) C_7 Pg-(5)

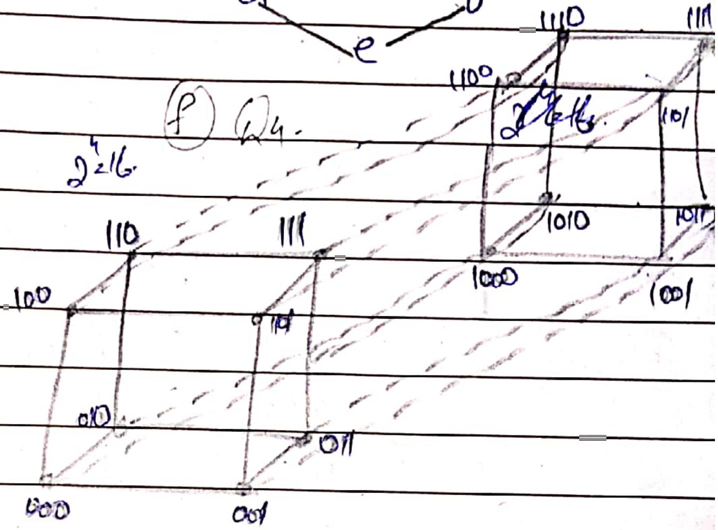


(e) W_7.



(f) Q_4.

$2^4 = 16$.



Q-6

21-

V_1	V_2
a	e
b	
c	
d	

Yes, it is bipartite.

22-

V_1	V_2
a	d
c	b
	e

Yes it is bipartite

Pg 81 (6).

23-	V1	V2.
		b
	a
	c	f
		d

Not bipartite as f is creating problem.

24-	V1	V2.
	a	f
	e	c
	b
	d

Yes, it is bipartite.

25.	V1	V2.
	a	b
	c	f
	e

It is not bipartite.

Date

Q.8 Pg #7

1- ADJACENCY LIST:-

a : b, c, d
b : a, d
c : a, d.
d : a, b, c.

ADJACENCY MATRIX

$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

INCIDENCE MATRIX:-

$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{ccccc} e_1 & e_2 & e_3 & e_4 & e_5 \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

2- ADJACENCY LIST:-

a: b, d.
b: a, d, e.
c: d, e.
d: a, b, c.
e: b, c.

ADJACENCY MATRIX:

$$\begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array}\begin{array}{c} \begin{array}{ccccc} a & b & c & d & e \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

INCIDENCE MATRIX

$$\begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array}\begin{array}{c} \begin{array}{cccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 \end{bmatrix} \end{array}$$

Teacher's Signature

3.)

ADJACENCY LIST:-

a: a, b, c, d.
b: d.
c: a, b.
d: d, c, b.

ADJACENCY MATRIX:

$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 \end{bmatrix} \end{array}$$

INCIDENCE MATRIX:-

$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{cccccccccc} e_1 & e_2 & e_3 & e_4 & e_5 & e_6 & e_7 & e_8 & e_9 & e_{10} \end{array} \\ \begin{bmatrix} 1 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

4) **ADJACENCY LIST:-**

a: b, d.
b: a, d, e, c.
c: c, b
d: a, e
e: e, c.

ADJACENCY MATRIX:-

$$\begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array}\begin{array}{c} \begin{array}{ccccc} a & b & c & d & e \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 \end{bmatrix} \end{array}$$

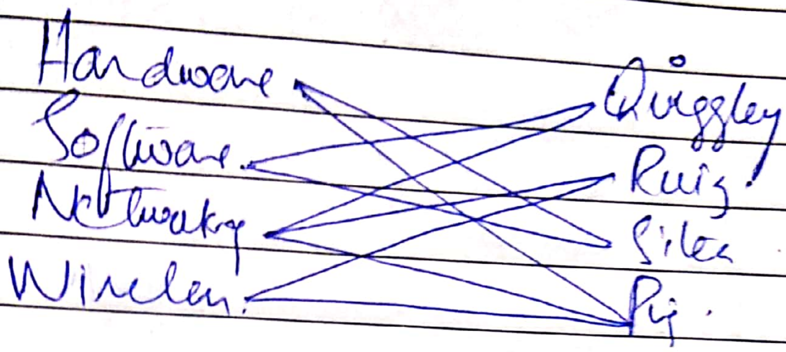
INCIDENCE MATRIX:-

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

Date

Q#7 Pg # 9

a).



Solve

b) The Hall's theorem is valid if Pig is assigned hardware, Quiggley is assigned networking, Ruiz is assigned wireless & Sitea is assigned software.

-2

c) There are multiple possible assignments of employees to support areas.

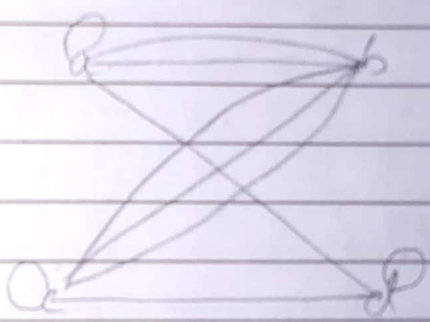
Let us choose Pig for hardware there are only one possible area for each of other three employees.

16.

$$\begin{array}{cc} & \begin{array}{ccc} a & b & c \end{array} \\ \begin{array}{c} a \\ b \\ c \end{array} & \begin{bmatrix} 1 & 3 & 2 \\ 3 & 0 & 4 \\ 2 & 4 & 0 \end{bmatrix} \end{array}$$

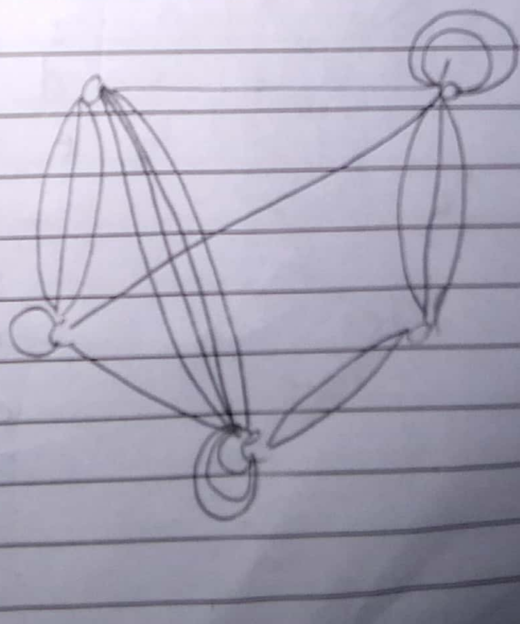
17.

$$\begin{array}{cc} & \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{array}{c} a \\ b \\ c \\ d \end{array} & \begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 1 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$



18.

$$\begin{array}{cc} & \begin{array}{ccccc} a & b & c & d & e \end{array} \\ \begin{array}{c} a \\ b \\ c \\ d \\ e \end{array} & \begin{bmatrix} 0 & 1 & 3 & 0 & 4 \\ 1 & 2 & 1 & 3 & 0 \\ 3 & 1 & 1 & 0 & 1 \\ 0 & 3 & 0 & 0 & 2 \\ 4 & 0 & 1 & 2 & 3 \end{bmatrix} \end{array}$$



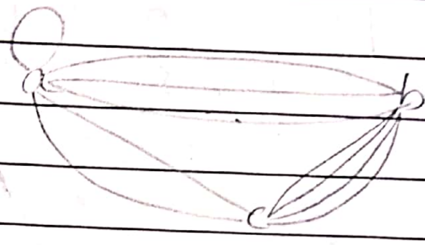
Date

Pg (10)

Q.09

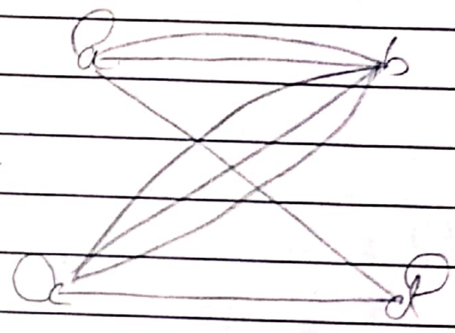
16.

$$\begin{array}{c|c} & \begin{matrix} a & b & c \end{matrix} \\ \begin{matrix} a \\ b \\ c \end{matrix} & \begin{bmatrix} 1 & 3 & 2 \\ 3 & 0 & 4 \\ 2 & 4 & 0 \end{bmatrix} \end{array}$$



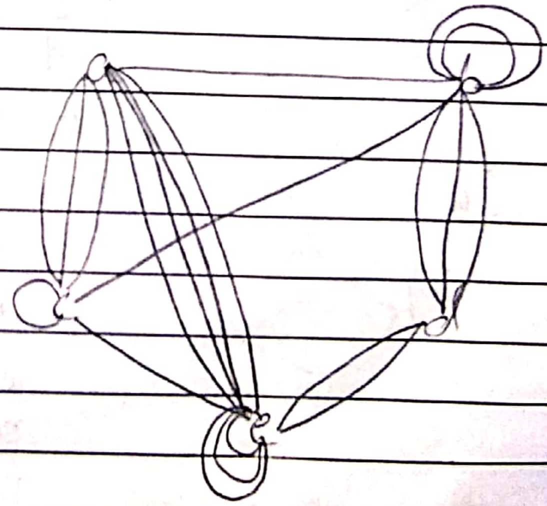
17!

$$\begin{array}{c|c} & \begin{matrix} a & b & c & d \end{matrix} \\ \begin{matrix} a \\ b \\ c \\ d \end{matrix} & \begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 1 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$



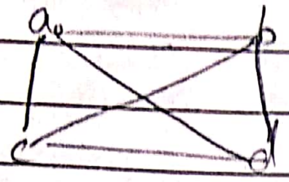
18!

$$\begin{array}{c|c} & \begin{matrix} a & b & c & d & e \end{matrix} \\ \begin{matrix} a \\ b \\ c \\ d \\ e \end{matrix} & \begin{bmatrix} 0 & 1 & 3 & 0 & 4 \\ 1 & 2 & 1 & 3 & 0 \\ 3 & 1 & 1 & 0 & 1 \\ 0 & 3 & 0 & 0 & 2 \\ 4 & 0 & 1 & 2 & 3 \end{bmatrix} \end{array}$$



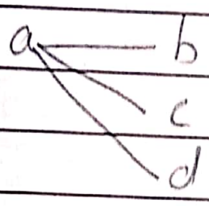
Q.10

a) K4



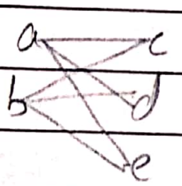
$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix} \end{array}$$

b) K1, 4.



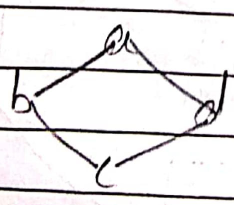
$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

c) K2, 3.



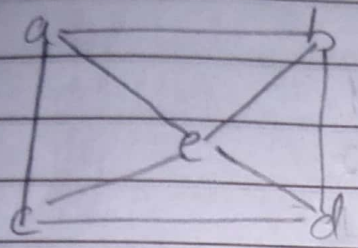
$$\begin{array}{c} \\ a \\ b \\ c \\ d \\ e \end{array}\begin{array}{c} \begin{array}{ccccc} a & b & c & d & e \end{array} \\ \begin{bmatrix} 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 & 1 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

d) C_4.



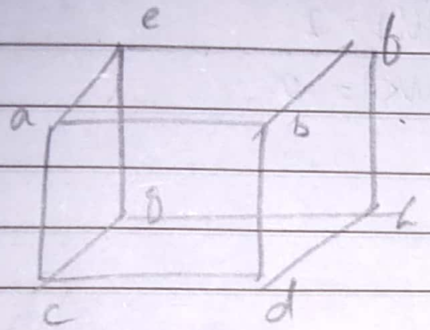
$$\begin{array}{c} \\ a \\ b \\ c \\ d \end{array}\begin{array}{c} \begin{array}{cccc} a & b & c & d \end{array} \\ \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

(e) W_4.



$$\begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & 1 & 0 & 1 \\ b & 1 & 0 & 0 & 1 & 1 \\ c & 1 & 0 & 0 & 1 & 1 \\ d & 0 & 1 & 1 & 0 & 1 \\ e & 1 & 1 & 1 & 1 & 0 \end{array}$$

1) Q_3-



$$\begin{array}{c|cccccccc} & a & b & c & d & e & f & g & h \\ \hline a & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ b & 1 & 0 & 0 & 1 & 0 & 1 & 0 & 0 \\ c & 1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ d & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 1 \\ e & 1 & 0 & 0 & 0 & 0 & 1 & 1 & 0 \\ f & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 1 \\ g & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ h & 0 & 0 & 0 & 1 & 0 & 1 & 1 & 0 \end{array}$$

Q.11

19.

$$\begin{array}{c|cccc} & a & b & c & d \\ \hline a & 0 & 1 & 0 & 0 \\ b & 0 & 1 & 1 & 0 \\ c & 0 & 1 & 1 & 1 \\ d & 1 & 0 & 0 & 0 \end{array}$$

20-

$$\begin{array}{c|cccc} & a & b & c & d \\ \hline a & 1 & 1 & 1 & 1 \\ b & 0 & 1 & 0 & 1 \\ c & 1 & 0 & 1 & 0 \\ d & 1 & 1 & 1 & 1 \end{array}$$

21-

$$\begin{array}{c|cccc} & a & b & c & d \\ \hline a & 1 & 1 & 2 & 1 \\ b & 1 & 0 & 0 & 2 \\ c & 1 & 0 & 1 & 1 \\ d & 0 & 2 & 1 & 0 \end{array}$$

Date

Q. 12

38.

deg $(U_1) = 1$.
deg $(U_2) = 2$.
deg $(U_3) = 2$.
deg $(U_4) = 2$
deg $(U_5) = 1$.

deg $(V_1) = 1$
deg $(V_2) = 2$.
deg $(V_3) = 1$
deg $(V_4) = 2$
deg $(V_5) = 2$.

$f(U_1) = V_1$
$f(U_2) = V_2$.
$f(U_3) = V_4$.
$f(U_4) = V_5$.
$f(U_5) = V_3$.

It is isomorphic.

39.

deg $(U_1) = 2$.
deg $(U_2) = 2$.
deg $(U_3) = 2$.
deg $(U_4) = 2$.
deg $(U_5) = 2$.

deg $(V_1) = 2$.
deg $(V_2) = 2$.
deg $(V_3) = 2$.
deg $(V_4) = 2$.
deg $(V_5) = 2$.

It is isomorphic.

40.

$deg(U_1) = 3$.
$deg(U_2) = 2$.
$deg(U_3) = 3$.
$deg(U_4) = 3$.
$deg(U_5) = 3$.

$deg(V_1) = 2$.
$deg(V_2) = ~~3~~\ 4$
$deg(V_3) = 2$.
$deg(V_4) = 3$.
$deg(V_5) = 3$

Not isomorphic as degrees of vertices are not same.

41.

$deg(U_1) = ~~3~~\ 2$
$deg(U_2) = ~~4~~\ 2$
$deg(U_3) = 2$
$deg(U_4) = 2$
$deg(U_5) = 2$
$deg(U_6) = 2$
$deg(U_7) = 2$

$deg(V_1) = 2$
$deg(V_2) = 2$
$deg(V_3) = 2$
$deg(V_4) = 2$
$deg(V_5) = 2$
$deg(V_6) = 2$
$deg(V_7) = 2$

Yes, it is isomorphic.

42.

$d(U_1) = 3$
$d(U_2) = 4$
$d(U_3) = 2$.
$d(U_4) = 4$.
$d(U_5) = 3$.
~~$d(U_6)$~~.

$d(V_1) = 3$.
$d(V_2) = 2$.
$d(V_3) = 4$.
$d(V_4) = 3$.
$d(V_5) = 4$.

$f(U_1) = V_1$
$f(U_2) = ~~V_5~~\ V_3$.
$f(U_3) = V_2$.
$f(U_4) = V_5$
$f(U_5) = V_4$.

Teacher's Signature

Pg # 18

Date

43.

$d(U_1) = 3.$	$d(V_1) = 3.$
$d(U_2) = 3.$	$d(V_2) = 3.$
$d(U_3) = 3.$	$d(V_3) = 3$
$d(U_4) = 3.$	$d(V_4) = 3$
$d(U_5) = 3.$	$d(V_5) = 3.$
$d(U_6) = 3.$	$d(V_6) = 3.$

It is isomorphic.

44- degree of vertices are not same, hence not isomorphic.

45-

$d(U_1) = 1.$	$d(V_1) = 1$
$d(U_2) = 2.$	$d(V_2) = 3$
$d(U_3) = 3.$	$d(V_3) = 1$
$d(U_4) = 1$	$d(V_4) = 2$
$d(U_5) = 2.$	$d(V_5) = 2$
$d(U_6) = 3$	$d(V_6) = 3$
$d(U_7) = 1$	$d(V_7) = 1$
$d(U_8) = 1$	$d(V_8) = 1$

Not isomorphic.

Date

Q.13.

1. → Not Euler path because there are more than Two vertices with odd degree.
→ Not a Euler circuit as well.

2. Not Euler path & Euler circuit.

3. It has a Euler path.
a → b → e → b → d → e → c → e → a → e → d.
↳ Not a Euler circuit.

4. It has an Euler path as only two vertices have Odd degree.
a → b → d → a → e → f → b → e → d → e → c.

5. Euler circuit : a → b → c → d → c → e → b → d → e → a → e → a.
→ Not Euler path as it doesn't contain any odd degree of vertices.

6. ~~Euler~~ Euler path.

b → i → c → d → f → e → d → a → h → i → g → d → i → a → b.

Date

d → b → c

Q-15

18- d(a) = 3, d(b) = 4, d(c) = 4, d(d) = 5.
Euler path exists.
→ a → b → d → c → a → d → b → c → d.

19- d(a) = 3, d(b) = 4, d(c) = 4, d(d) = 3.
Neither path nor circuit.

20- d(a) = 2, d(b) = 6, d(c) = 2, d(d) = 4, d(e) = 4.
Euler circuit exists.
(a → d → b → d → e → b → e → c → b → a).

21- d(a) = 3, d(b) = 6, d(c) = 4, d(d) = 4, d(e) = 7.
Euler path exists.
a → d → e → b → a → e → d → b → e → c → b → c → e → b.

22- d(a) = 4, d(b) = 7, d(c) = 5, d(d) = 4, d(e) = 6,
d(f) = 6.
Euler path exists.
~~b → d → c → b → c → e → b → f → e.~~
c → b → c → b → f.
c → e → b → c → b → d → c → b → f → a → f → e → f
→ d → e → a → b

Q.16

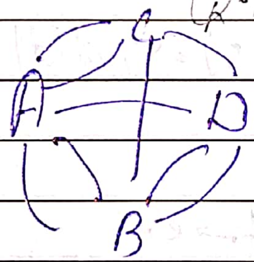
30. It is not hamilton circuit because Vertex are repeating when moving $e \to f$.

31. It is a hamilton circuit.
(a, b, c, d, e, f)

32. Not hamilton circuit. because once it reaches vertex f, no way to return, in this way vertex is repeating!

33. Not hamilton circuit.
e, g, f vertex can't be returned without repeating a edge.

Q-14.



d(A) = 5, d(B) = 5; d(C) = 4, d(d) = 4.

No, it is not possible for an euler circuit degree of each vertex should be even.

END

17? —4