

lec #20

Graphs.

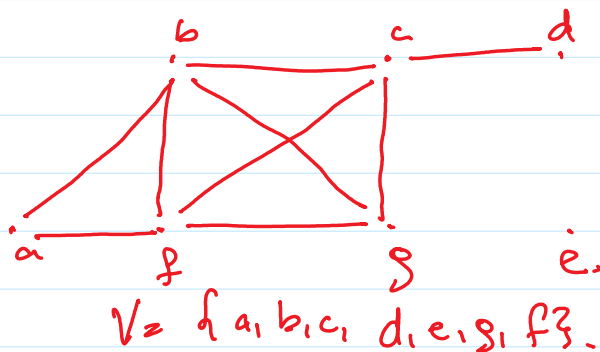
PS28:-

- 1- Simple Graph - loops x
- multi-Edge x.
- 2- Multi-Graph - multi-Edge ✓
- 3- Pseudo-Graph - loops and possibly multi-edge.
- 4- Undirected Graph
- 5- Directed Graph.
- 6- Directed Simple Graph.
- 7- Directed multigraph.
multiplicity (m).
- 8- Directed pseudograph.

Hand Shaking theorem:-

Degree.

Ex1 :-
PS36



$\deg(a) = 2$
" $\deg(b) = 4$
" $\deg(c) = 4$
" $\deg(d) = 1$
" $\deg(e) = 0$
" $\deg(f) = 3$
" $\deg(g) = 4$
" $\deg(h) = 4$

18.

$$= \deg(a) + \deg(b) + \dots + \deg(f).$$
$$= 2 + 4 + \dots + 4 = 18.$$

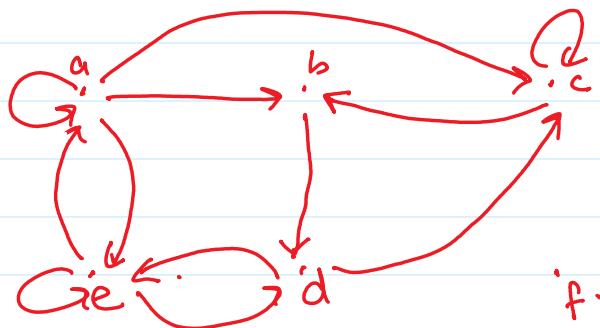
$e_2 q.$

Directed Graphs Degree.

$$\text{In degree} = \text{Deg}^-(a)$$

$$\text{out } u = \text{Deg}^+(a).$$

Ex 4 :-
P 538



$$n - (d) = 2$$

$$11 + (1) = 12$$

$$\deg^-(c) = 3$$

$$\deg^-(d) = 2$$

$$\deg^-(e) = 3$$

$$\deg^-(f) = \frac{0}{12}$$

$$\deg^+(c) = 2$$

$$\deg^+(d) = 2$$

$$\deg^+(e) = 3$$

$$\deg^+(f) = \frac{0}{12}$$

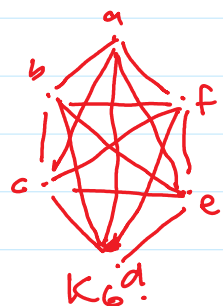
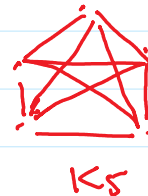
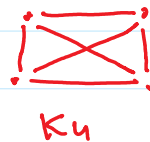
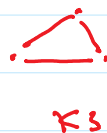
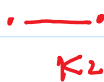
$$e = \sum_{u \in V} \deg(u) = \sum_{u \in V} \deg^+(u)$$

Theorem:- In an Undirected graph.
Even # of Vertices with odd degree.

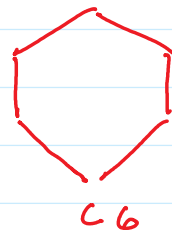
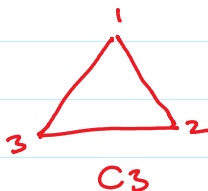
Special types of Simple Graphs.

1- Complete graph.

$K_1, K_2, K_3, \dots, K_n$.

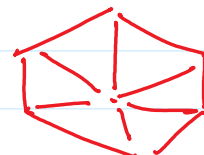
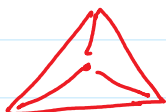


2- Cycles. $C_3, C_4, C_5, \dots, n \geq 3$



3- Wheels W_3, W_4, \dots

$n \geq 3$.





w_3



w_4



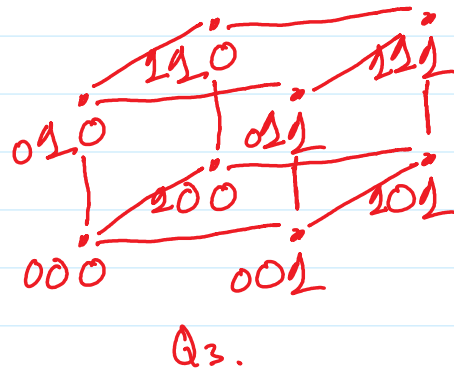
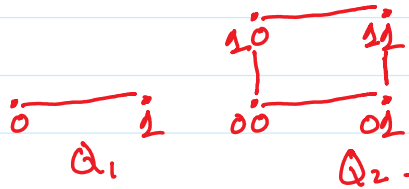
w_5



w_6

...

4- Quboid. $Q_1, Q_2 \dots Q_n$. $n \geq 1$.



	Vertices	Edges.
K_1	1	0
K_2	2	1
K_3	3	3
K_4	4	6
K_5	5	10
K_6	6	15
:		
K_n	n	$\frac{n(n-1)}{2}$
C_3	3	3
C_4	4	4
C_5	5	5

C_4	4	4
C_5	5	5
\vdots		
C_n	n	n .
W_3	4	6
W_4	5	8
W_5	6	10
W_6	7	12
\vdots		
W_n	$n+1$	$2n$.