dec 20 :- # Graphs.

Set of Vertices. $= V$

Set of Edges. $= E$.

$G = (V, E)$.

Graph Types:-

1. Simple Graph:- 1 x loop.
   2 x multiedge.

2- Multigraph:- Multiedges

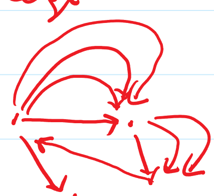
3- Psuedograph:- Loop and possibly multiedges.

4- Undirected:-

5- Directed:-

6- Simple directed:- 1- x loop.
   2- x Multiedge

7- Directed Multigraph. (multiplicity). $m=4$.

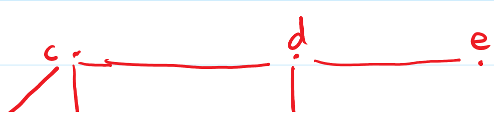


8- Directed Psuedograph.

Terminologies.

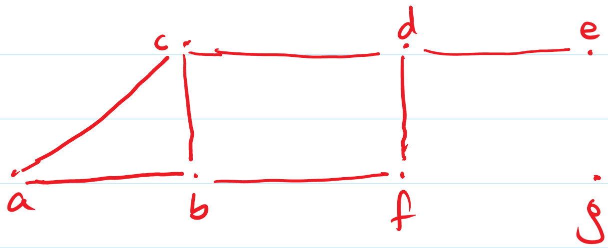
1- Degree. (Undirected).

Ex 2 :-
P536



$deg(a) = 2$

Ex 2 :-
P536



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

$V = \{a, b, c, d, e, f, g\}$.

Total Degree :- $\sum_{v \in V} \deg(u)$.

$= \deg(a) + \deg(b) + \cdots + \deg(g) = 2+3+3+\cdots+0$
$= 14$.

Hand Shaking theorem :-

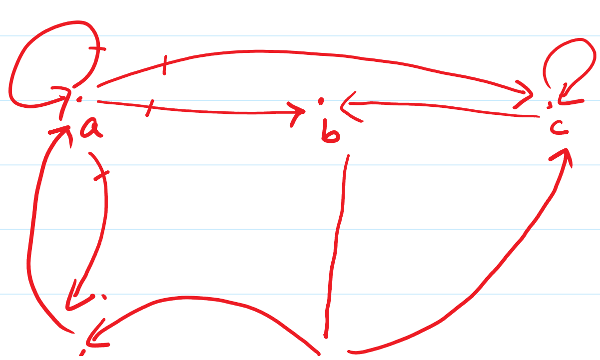
$$2e = \sum_{v \in V} \deg(u). \qquad e = |E|.$$

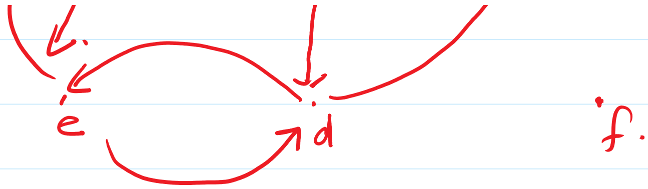
Ex3 :- e = ? 10 Vertices Each having degree = 6.
537 HW.

Theorem :- In an undirected graph we have <u>even</u> number of vertices of odd degree.

Directed :- INDEGREE $\deg^-(u)$.
OUT " $\deg^+(v)$.

Ex4 :-
538





$\deg^-(a) = 2$ $\quad$ $\deg^+(a) = 4$

$\deg^-(b) = 2$ $\quad$ $\deg^+(b) = 1$

$\deg^-(c) = 3$ $\quad$ $\deg^+(c) = 2$

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

$\deg^-(e) = 2$ $\quad$ $\deg^+(e) = 2$

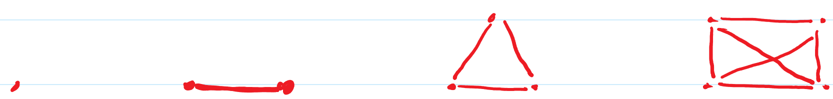
$\deg^-(f) = 0$ $\quad$ $\deg^+(f) = 0$

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

Special Types of Simple Graphs.

1- Complete Graph :- $K_1, K_2, K_3, \dots, K_n$.

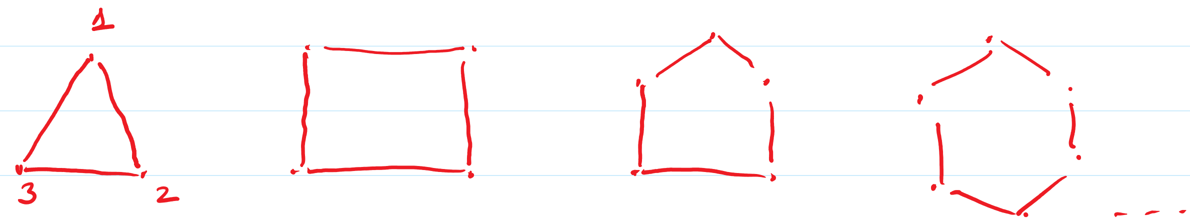
Every Vertex is Connected to every other Vertex.



K_1 $\quad$ K_2 $\quad$ K_3 $\quad$ K_4.

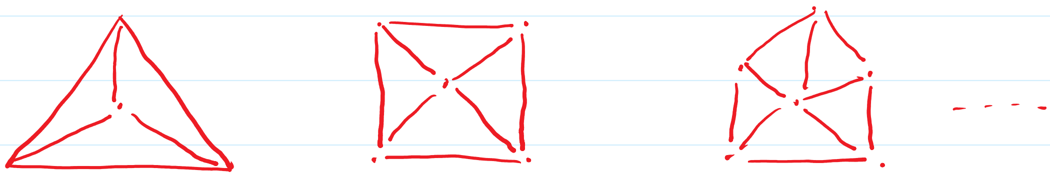
Cycles :- C_n, $n \geq 3$.

Cycles: C_n $n \geq 3$.



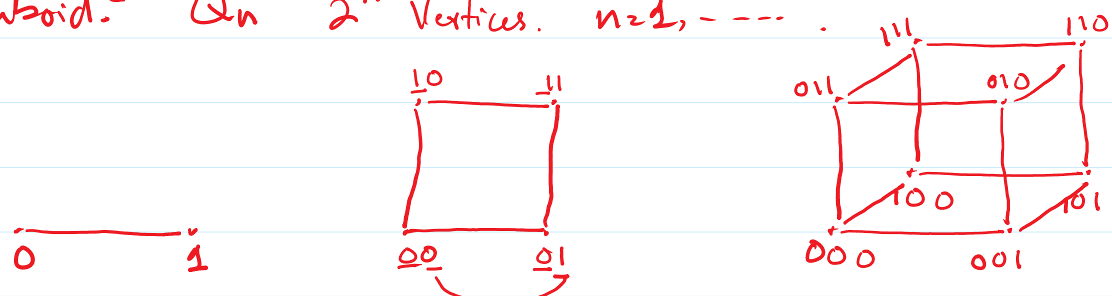
C_3 C_4 C_5 C_6

Wheels:- W_n $n \geq 3$.



W_3 W_4. W_5

Cuboid:- Q_n 2^n Vertices. $n = 1, \ldots$.



Q_1. Q_2 Q_3.

	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	14.

K_6	6	14.
	⋮	
K_n	n	?

	Vertices	Edges.
C_3	3	3
C_4	4	4
C_5	5	5
⋮		
C_n	n	n.

	Vertices	Edges.
W_3	4	$3+3=6$.
W_4	5	8
W_5	6	10
⋮		⋮
W_n	$n+1$.	$2n$.

	Vertices	Edges.
Q_1	2	1
Q_2	4	4
Q_3	8	12
⋮		⋮
Q_n.	2^n	$\underline{?}$