lecture 21:-

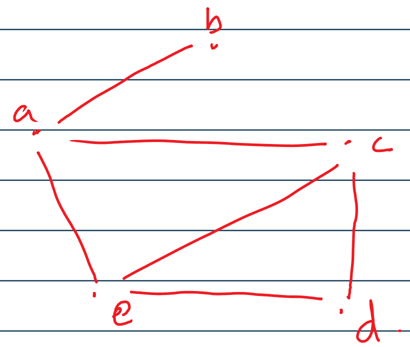
Bipartite	Vertices	Edges.
$K_{m,n}$	$m+n$	$m \times n$.

P 545 | 546 "Subgraph" "Graph Intersection"

Ex 545-549. (1-40).

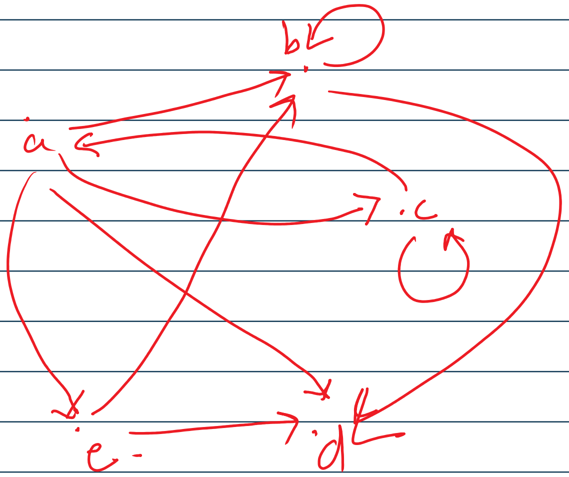
1- Adjacency List.

Ex1
550



Vertices	Adjacent Vertices.
a	b, c, e
b	a
c	a, e, d
d	c, e
e	a, c, d.

Ex2
550.

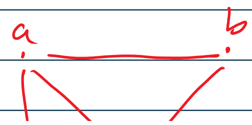


Initial Vertex	Terminal Vertex.
a	b, c, d, e
b	b, d
c	c, a
d	—
e	d, b.

2- Adjacency Matrix. $|V| \times |V|$.

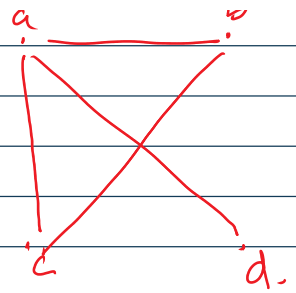
$V =$ Set of Vertices.

Ex3 :-
P551



$$\begin{array}{c|cccc} & a & b & c & d. \\ a & 0 & 1 & 1 & 1 \end{array} \quad 3$$

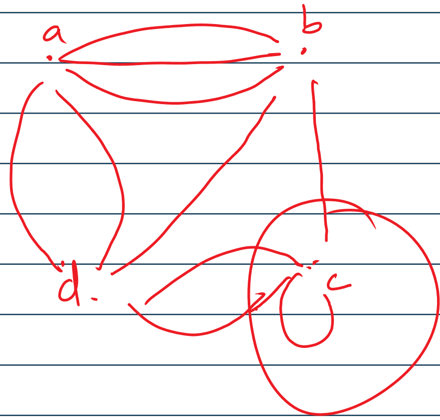
Ex3 :-
P551



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

Properties :- 1. No loop.
2- Zero-one matrix then No multiedges.
3- Row-wise | Col wise sum = degrees of Vertices.
4- Symmetric matrix.

Ex5

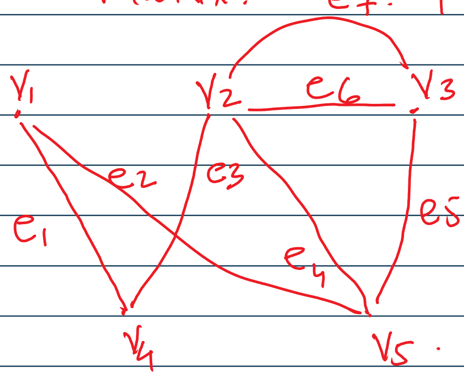


$$\begin{array}{c|cccc|c} & a & b & c & d & \\ \hline a & 0 & 3 & 0 & 2 & \\ b & 3 & 0 & 1 & 1 & \\ c & 0 & 1 & 1 & 2 & 4 \\ d & 2 & 1 & 2 & 0 & \end{array}$$

1- while Counting degree. if main diagonal Contain Value. x by 2. to Count degrees.

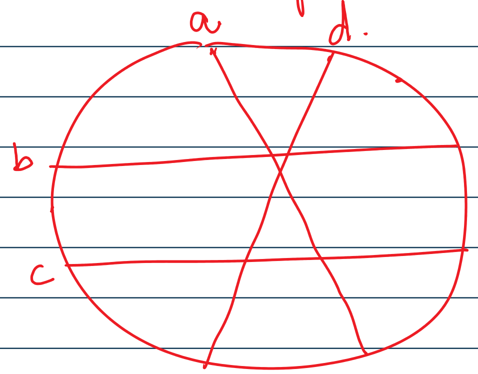
Incident Matrix :- e_7. $|V| \times |E|$.

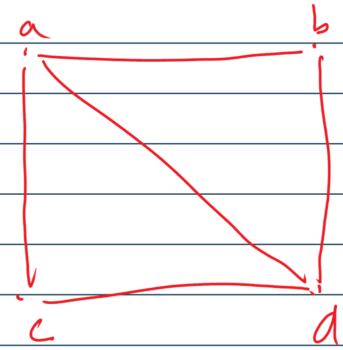
Ex6
552.



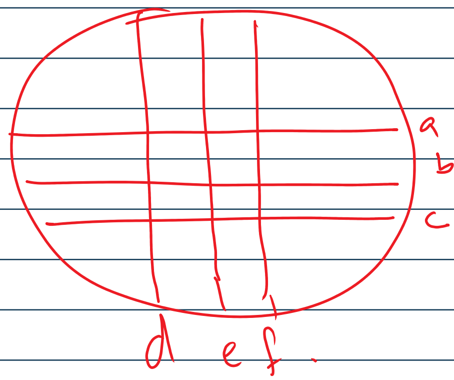
$$\begin{array}{c|cccccc|c} & e_1 & e_2 & e_3 & e_4 & e_5 & e_6 & \\ \hline V_1 & 1 & 1 & 0 & 0 & 0 & 0 & 2 \\ V_2 & 0 & 0 & 1 & 1 & 0 & 1 & 3 \\ V_3 & 0 & 0 & 0 & 0 & 1 & 1 & 2 \\ V_4 & 1 & 0 & 1 & 0 & 0 & 0 & 2 \\ V_5 & 0 & 1 & 0 & 1 & 1 & 0 & 3 \end{array}$$

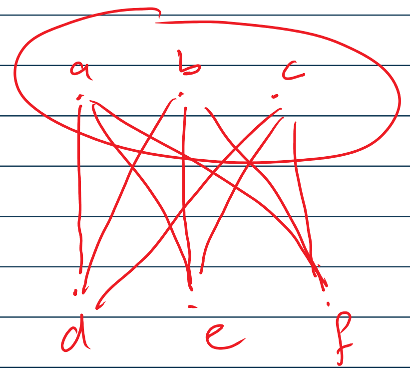
Circular Graph.





$K_{3,3}$.



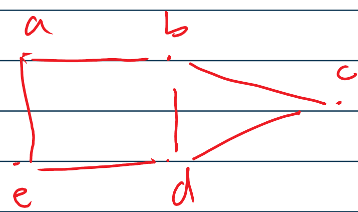


Ex 556-559.
1-50.

Connectivity: path 'a' to "b".

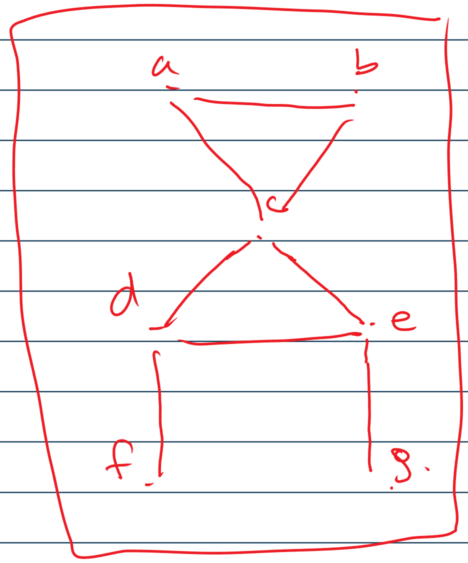
$$(a, x_1)(x_1, x_2)(x_2, x_3) \cdots (x_{n-1}, x_n), (x_n, b).$$

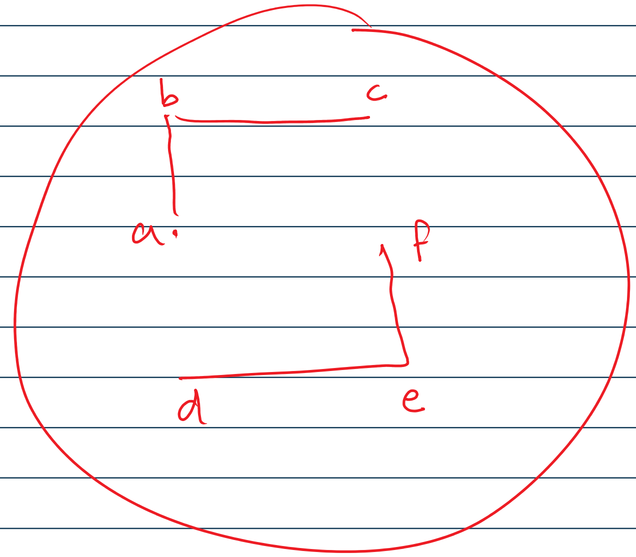
Ex 1
560



Connected Graph: If $\exists$ a path btw all pair of vertices.

Ex6
563.

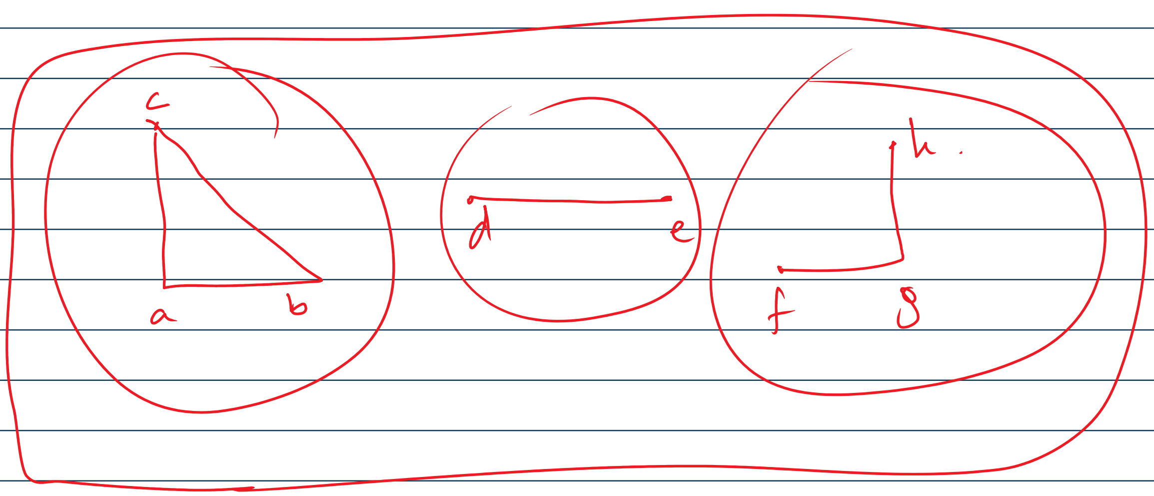




G ✓ ✗ H.

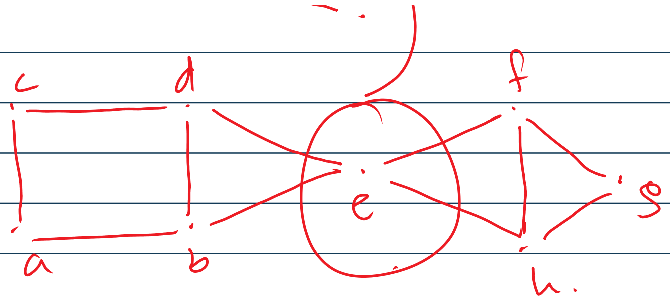
Connected Component:

1- Subgraph.
2- Connected.
3- Maximally Connected.



Cut Vertex.

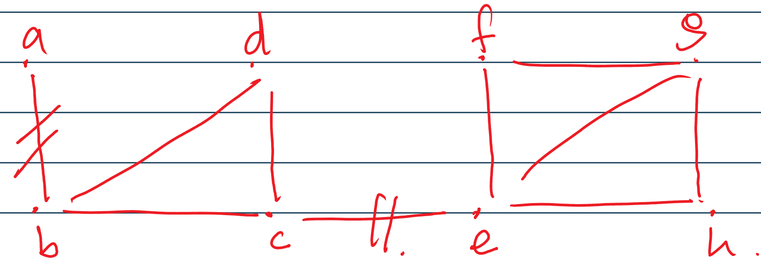
c d f



Cut Vertices: e

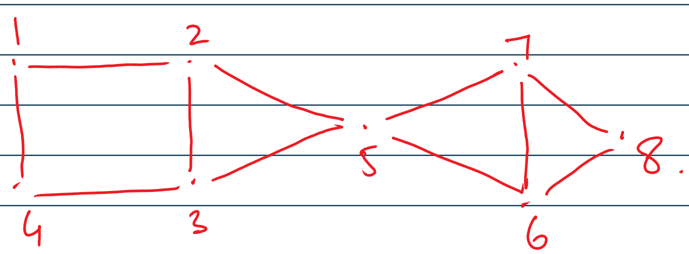
Cut Edge:-

Ex8
564.



Cut Edges: (a,b)
(c,e).

Cut Set
$= \{(2,5), (3,5)\}$.

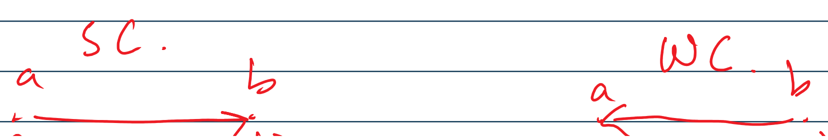


Strongly Connected | weakly Connected.

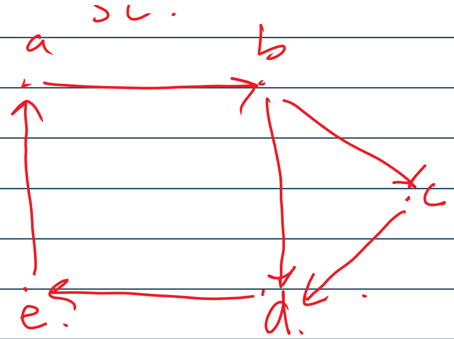
- directed.
- $\forall_{a,b \in V}$ there must be path from a to b
  ^ b to a.

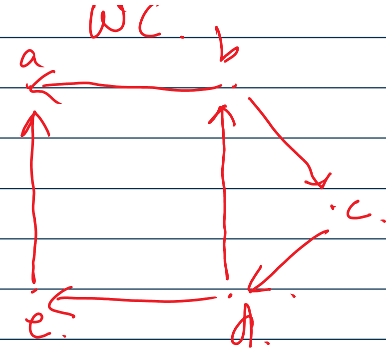
- directed.
- $\forall_{a,b \in V}$ there exist a path from a to b V b to a.

Ex 12.



Ex 12.
565

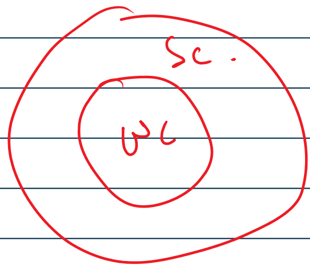


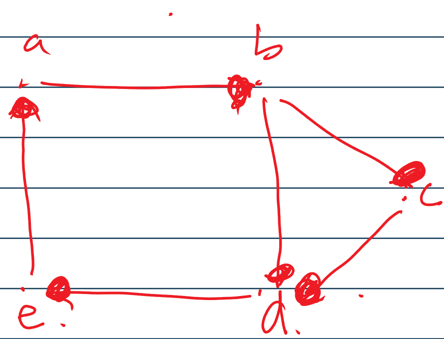


a to b. ✓   b to a ✓.
a to c ✓   c to a ✓.
a to d ✓   d to a ✓.
a to e ✓   e to a ✓.

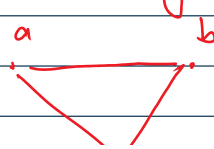
b to c ✓   c to b ✓.
b to d ✓   d to b ✓.
b to e ✓   e to b ✓

a to b ✗.



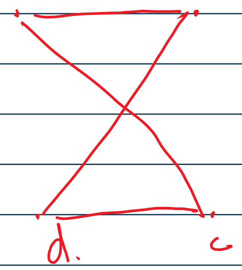


How many paths.



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

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



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

$$A^4 = \begin{array}{c|cccc} & a & b & c & d \\ \hline a & 8 & 0 & 0 & 8 \\ b & 0 & 8 & 8 & 0 \\ c & 0 & 8 & 8 & 0 \\ d & 8 & 0 & 0 & 8 \end{array}.$$

a to a.

1. abdca.
2. ababa.
3. abdba.
4. abaca.
5. acaca.
6. acdba.
7. acaba.
8. acdca.

Ex P567-569.
(1 - 45).