



UNIT 3- GRAPHS

Graph Isomorphism

Graph Isomorphism:

Two graphs G_1 and G_2 are said to be isomorphic to each other, if there exist a one to one correspondence b/w the vertex sets which preserve adjacency of the vertices.

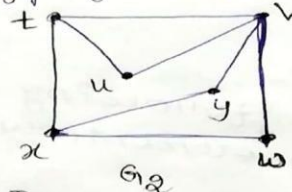
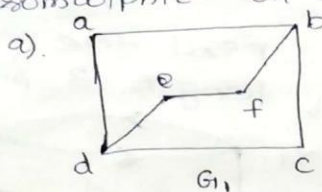
Note:

If G_1 and G_2 are isomorphic then G_1 and G_2 have,

- i). The same number of vertices
- ii). The same number of edges
- iii). An equal no. of vertices with a given degree.

However, these conditions are not sufficient for graph isomorphism.

Q. Examine whether the following pair of graphs are isomorphic or not. Justify your answer.

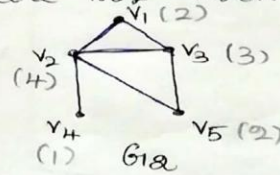
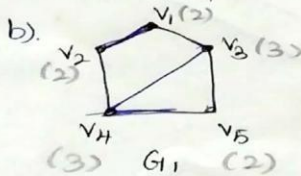


Soln. No. of vertices

In	G_1	G_2
	6	6
	7	8

No. of edges

Here the no. of edges are not same. Hence G_1 and G_2 are not isomorphic.



Soln.

	G_1	G_2
The no. of vertices	5	5
No. of edges	6	6

Degree sequence: $G_1 : (3, 3, 2, 2, 2)$

$G_2 : (4, 3, 2, 2, 1)$ since the degree

sequence are not same.

Hence G_1 and G_2 are not isomorphic.



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c.)

G_1

H

No. of vertices	G_1	H	
	6	6	
No. of edges	7	7	
Degree sequence	$G_1 : (3, 3, 2, 2, 2, 2)$		
	$H : (3, 3, 2, 2, 2, 2)$		

Adjacency :

If $f: G \rightarrow H$ is defined by

$u_4 \rightarrow v_5$	(u_4 - deg 3, adj: 2, 2, 2)	$u_1 \rightarrow v_4$	
$u_3 \rightarrow v_4$	(u_3 - deg 2, adj: 3, 3)	$u_2 \rightarrow v_3$	$u_2 \rightarrow v_3$
$u_2 \rightarrow v_3$	(u_2 - deg 3, adj: 2, 2, 2)	$u_3 \rightarrow v_4$	$u_3 \rightarrow v_6$
$u_6 \rightarrow v_2$	(u_6 - deg 2, adj: 3, 2)	$u_4 \rightarrow v_5$	$u_4 \rightarrow v_5$
$u_5 \rightarrow v_1$	(u_5 - deg 2, adj: 3, 2)	$u_5 \rightarrow v_1$	$u_5 \rightarrow v_1$
$u_1 \rightarrow v_6$	(u_1 - deg 1, adj: 3, 3)	$u_6 \rightarrow v_2$	$u_6 \rightarrow v_2$

$f(u_4) = v_5$

$f(u_2) = v_3$

$f(u_3) = v_4$

$f(u_4) = v_5$

$f(u_5) = v_1$

$f(u_6) = v_2$

\therefore adjacency is preserved.

$\therefore G_1$ and H are isomorphic.

How determine whether the graphs given below are isomorphic or not.

(G_1)

(G_2)

not isomorphic

(G_1)

(H)

isomorphic

$f(u_1) = v_1$

$u_2 \rightarrow v_3$

$u_3 \rightarrow v_2$

$u_4 \rightarrow v_4$