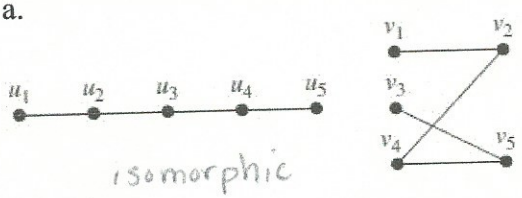
CIS 185
Practice 16
Objective:

- Be able to determine whether two graphs are isomorphic
- Be able to determine connectivity of a graph.

Name: Timothy Bryant
ID: Date:

Exercise 1:
Determine whether the given pair of graphs is isomorphic. Exhibit an isomorphism or provide a rigorous argument that none exists.

a.

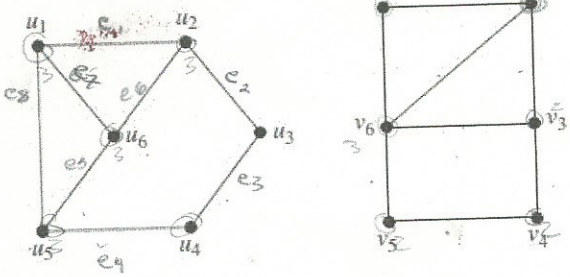


isomorphic

$f(u_1) = v_1$
$f(u_2) = v_2$
$f(u_3) = v_4$
$f(u_4) = v_5$
$f(u_5) = v_3$

12 = 12
23 = 24
34 = 45
45 = 53

b.



$f(u_1) =$

not isomorphic

Exercise 2:
Are the simple graphs with the following adjacency matrices isomorphic?

a.

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

isomorphic

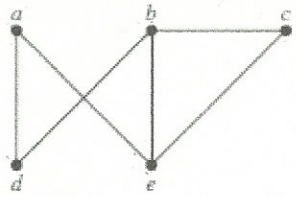
b.

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

not isomorphic

Exercise 3:

Does each of these lists of vertices form a path in the following graph? Which paths are simple? Which are circuits? What are the lengths of those that are paths?



a) a, e, b, c, b

It is a path of length 4 but not simple path

b) a, e, a, d, b, c, a

Not a path because c is not connected to a

c) e, b, a, d, b, e

Not a path because b is not connected to a

d) c, b, d, a, e, c

It is a circuit of length 5

Exercise 4:

Determine whether the given graph is connected.

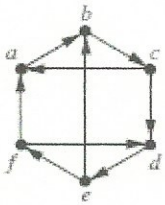
a.

disconnected

b.

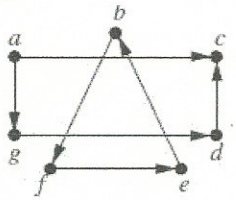
connected

Exercise 5:
Determine whether this graph is strongly connected and if not, whether it is weakly connected.
a.



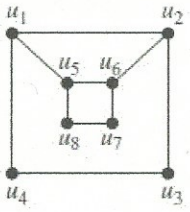
strongly connected

b.

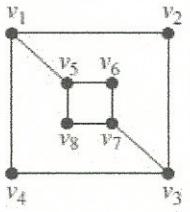


not strongly nor weakly connected

Exercise 6: Use paths either to show that these graphs are not isomorphic or to find an isomorphism between these graphs.



G



H

Both graphs have 8 vertices and 10 edges

Both graphs have 4 vertices w/ degree 3

Both graphs have 4 vertices w/ degree 2

V_3 deg(3)

No such circuit in G

∴ not isomorphic

V_7 deg(3)

V_6 deg(2)

V_5 deg(3)

V_1 deg(3)

V_4 deg(2)

V_3 deg(3)