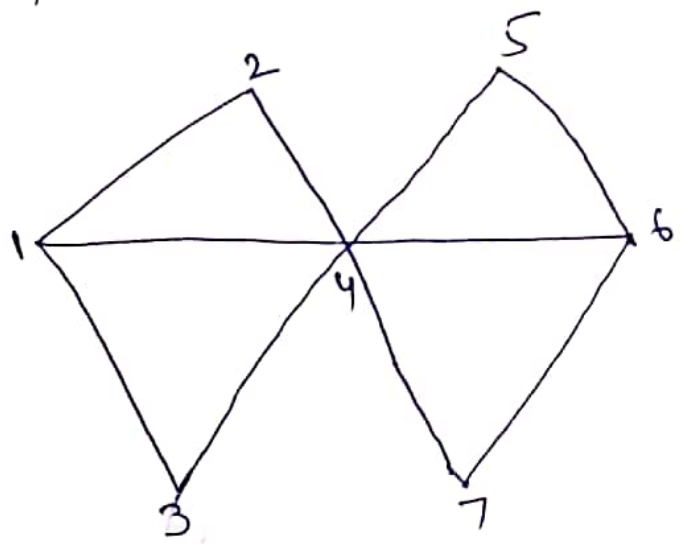
Distance of a graph

The distance between two vertices in a graph is the length of shortest path between the vertices in a connected graph. i.e.

Diameter of a graph

The diameter is the maximum distance between any two vertices in a connected graph G and it is denoted by Diam(G).

Example



$d(1,7) = 2$ $d(1,6) = 2$

Eccentricity, Radius & Diameter of a graph

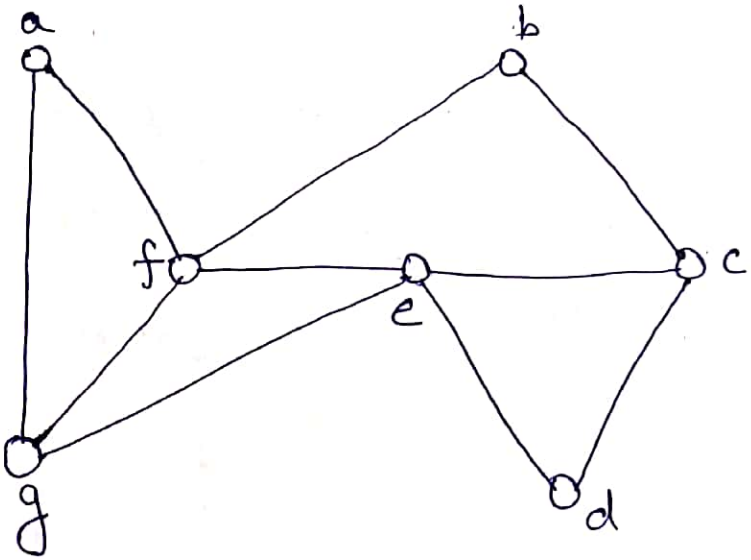
Let G be a graph and v be a vertex of G.

The **eccentricity** of the vertex v is the maximum distance from v to any vertex.

The **radius** of G is the minimum eccentricity of the vertices of G.

The ~~center~~ **Diameter** of G is the maximum eccentricity of vertices of G.

The **Center** of G is the set of vertices of eccentricity equal to the radius.



For vertex a

$d(a,a)=0$
$d(a,b)=2$
$d(a,c)=3$
$d(a,d)=3$
$d(a,e)=2$
$d(a,f)=1$
$d(a,g)=1$

$e(a)=3$

For vertex b

$d(b,a)=2$
$d(b,b)=0$
$d(b,c)=1$
$d(b,d)=2$
$d(b,e)=2$
$d(b,f)=1$
$d(b,g)=2$
~~$d(b,h$~~

$e(b)=2$

For vertex c

$d(c,a)=3$
$d(c,b)=1$
$d(c,c)=0$
$d(c,d)=1$
$d(c,e)=1$
$d(c,f)=2$
$d(c,g)=3$

$e(c)=3$

For vertex d

$d(d,a)=3$
$d(d,b)=2$
$d(d,c)=1$
$d(d,d)=0$
$d(d,e)=1$
$d(d,f)=2$
$d(d,g)=2$

$e(d)=3$

For vertex e

$d(e,a)=2$
$d(e,b)=2$
$d(e,c)=1$
$d(e,d)=1$
$d(e,e)=0$
$d(e,f)=1$
$d(e,g)=1$

$e(e)=2$

For vertex f

$d(f,a)=1$
$d(f,b)=1$
$d(f,c)=2$
$d(f,d)=2$
$d(f,e)=1$
$d(f,f)=0$
$d(f,g)=1$

$e(f)=2$

For vertex g

$d(g,a) = 1$
$d(g,b) = 2$
$d(g,c) = 2$
$d(g,d) = 2$
$d(g,e) = 2$
$d(g,f) = 1$
$d(g,g) = 0$

$e(g) = 2$

∵ Maximum eccentricity in a graph is 3.

∴ diameter = 3

∵ Minimum eccentricity in a graph is 2

∴ Radius = 2

center = {b, e, f, g}

Walk – An alternating sequence of points (vertices) and lines (edges), which begins with a point and ends in a point is called a walk.

(Walk may repeat both vertices and edges)

Trial – A trial is an open walk in which no edge is repeated.

Circuit – A closed trial is called circuit

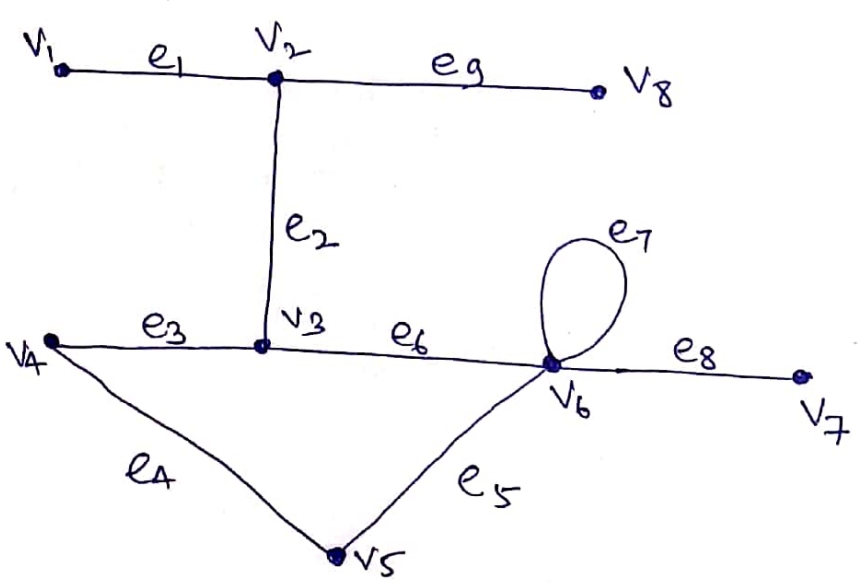
OR

A closed walk in which no vertex, except the initial and terminal vertices, appears more than once is called circuit.

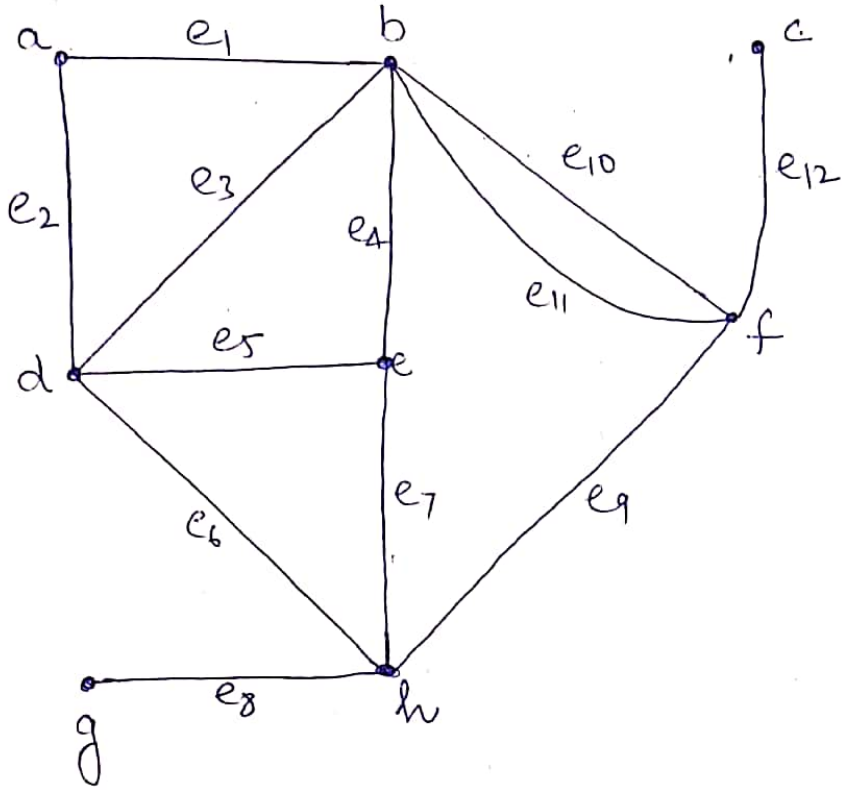
path – A path is an open walk in which ~~neither~~ an edge nor a vertex is repeated. An open path is called an Eulerian line.

Cycle – A closed path is called a cycle. So in a closed path the first & last vertex is repeated.

Example



Consider a graph



Path → a, e_2, d, e_3, b, e_4, e, e_7, h, e_6, d, e_3, b.

This path is not a trial as it has repeated edges.

h, e_6, d, e_3, b, e_{10}, f, e_9, h is an closed path of length 4

c, e_{12}, f, e_{10}, b, e_4, e is an open path.

a, e_1, b, e_{10}, f, e_{11}, b, e_4, e. is a trial with no repeated edges but repeated vertex

h, e_6, d, e_5, e, e_4, b, e_{10}, f, e_9, h is a cycle of length 5.