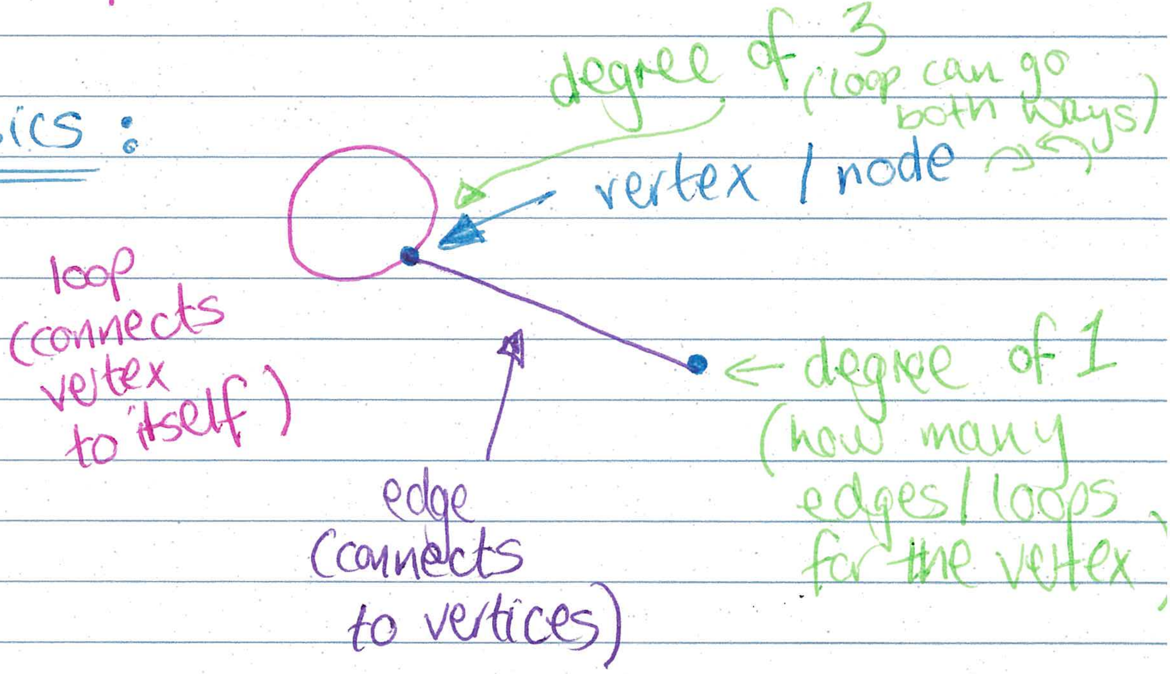
chapter 10 : NETWORKS

A network is a set of nodes (or vertices) connected by lines (or edges).

we talked about them WAY WAY back in term 1 during matrices.

Basically we can blame the German city of Königsberg and a swiss dude called EULER (sounded as OILER) for this topic .....

The basics :



Do Ex 10 A questions

ALSO NOTE :

can be very handy

$$\frac{\text{sum of vertex degrees}}{2} = \text{number of edges}$$

in above network sum of vertex degrees $= 3 + 1 = 4$

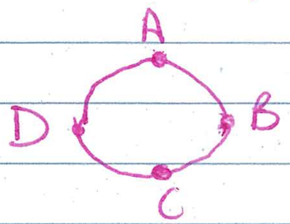
$\frac{4}{2} = 2$ ← number of edges

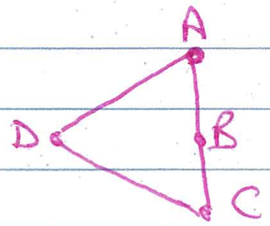
Types of Networks :

The study of networks is called Graph Theory (a graph is simply a group of objects joined by lines so it makes sense)

ISOMORPHIC GRAPHS - means they are equivalent
- edges and vertices same
- corresponding vertices have same degree
- corresponding edges connect same vertices

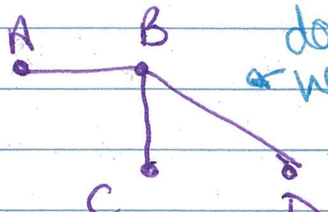
• may look diff
• but are equivalent !!



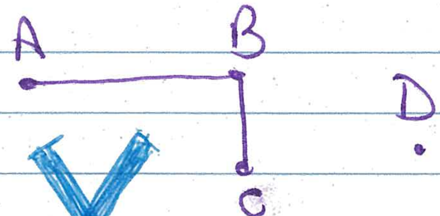


yes they are isomorphic

CONNECTED GRAPHS - means you can get to each vertex from each vertex along edges



does not have to be direct

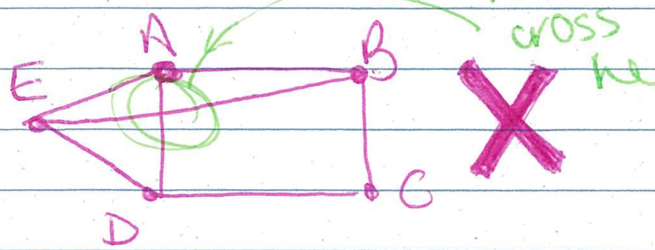


number of edges = vertices - 1 ← for connected ONLY

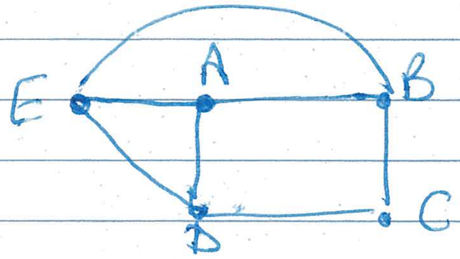
Do Ex 10 B set questions

PLANAR GRAPHS

- no edges cross each other
- may be asked to redraw a network graph so it is planar



* MUST BE EQUIVALENT TO ORIGINAL *



redrawn so is now planar

NOTE: You can't make every graph planar!!

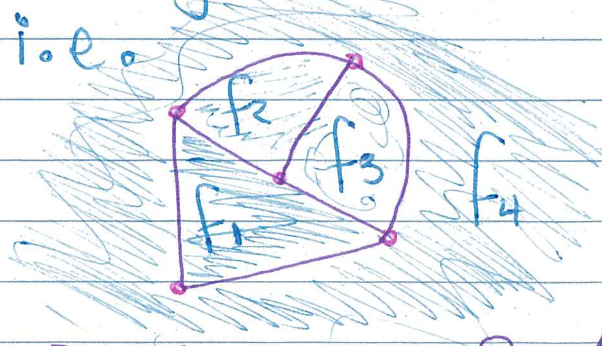
EULER'S FORMULA

* ALWAYS TRUE *
* FOR PLANAR *
* GRAPHS / NETWORKS *

$$v - e + f = 2$$

vertices, edges, faces

* A face is the area bound by edges
Note: There is always a face on the outside i.e.



$v = 5$
$e = 7$
$f = 4$

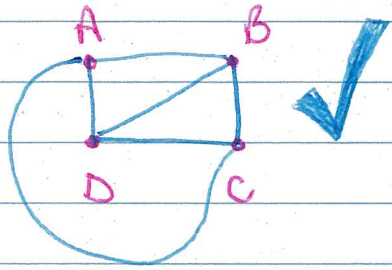
Check: $5 - 7 + 4 = 2$

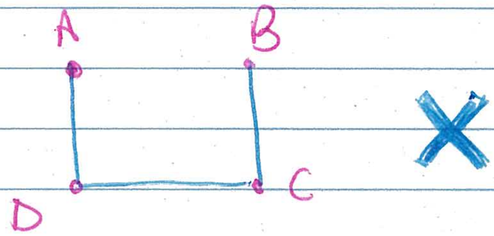
Yay, it works!

Some more terminology .....

SUBGRAPH - contains all the vertices of the original graph BUT not all the edges

COMPLETE GRAPH - each pair of vertices is linked by one edge





For complete graphs : n = number of vertices

: each vertex has degree of $(n-1)$

: there are $\frac{n(n-1)}{2}$ edges.

check this using above graph.

$n = 4$

degree is $(n-1) = 3$

edges should be $= \frac{4 \times 3}{2}$

$= \frac{12}{2}$

$= 6$

yay - it works !!