networks and graphs lecture 2

Graph isomorphisms

Are 2 graphs the same?

> *g1 and g2 are isomorphic if there is a one-to-one mapping*
>
> *all vertices of g1 must also be all vertices in g2*
>
> *if there is a edge from one to another vertex in g1 it must also be in g2*

algorithms to determine isomorphism:

1. naive algorithm
    - try all combinations and test if it holds
    - this is very show, n = 10, n! =3628800
2. babai and luks
    - relatively fast

hwo to deterimine two graphs are not isomorphic?

1. if the number of vertices or edges is not the same in the two graphs
2. if the degree sequence is different for the two graphs

then the two graphs not isomorphic

Havel-Hakimi

let the degree sequence [s,t1,t2,...,ts,d1,d2,dn] be an ordered sequence, then the sequence is graphic iff the sequence [t1-1,t2-1,...,ts-1,d1,...,dn] is graphic.

> *remove highest number and decrese all others connected to is by one (the vertices with the highest degrees)*
>
> *check if it is graphic, if it cannot be determined repeat this process util it is easy to determine*

the proof of this lies in doing the oposite of the algorithm above.

there has to be a simple graph corresponding to the degree sequence,

1. if all nabougrs of s are Ti just remove s and all of its edges an we are done
2. if the nabougrs set is not exactly Ti, then another must be a nabougr of s whitch degree must be the same as that of the original vertex.then just swap the labels
3. if the degree is less than the original and s is connected to Di and Ti is connected with W and W is not connected to Di than you remove [s,Di] and

[Ti,w] and add [s,Ti] and [w,Di] (the degree sequence has not changed)

Paths, Cycles and Connectivity

paths an cycles

a (v0,vk)- walk sequence is a sequence of vertices and edges that starts in v0 and ends in vk with all edges only between the sequence vertices.

a (u,v)- path is a (u,v)-walk sequence of vertices and edges that do not repeat vertices.

a cycle in a simple graph is a (u,u)- path of at least 3 different edges beginning and ending in the same vertex

a simple graph is acyclic if it does not contain a cycle

Connectivity

- two vertices are connected if there is a path between them
- a graph is connected if all vertices are connected

connectivity of vertices is equilialence, = reflexive, symmetric and transitive.

a Component of a graph is the largest pieces of a graph, a graph only has multiple components if the graph is not connected.