Shortest Path Lenght: it's an interesting metric, because given two nodes it tells us the minimum number of links we need to traverse.

If we have weighted links, I may be interested in finding the shortest path lenght not only in the number of links to be traversed, but in the minimum weight (for example) in doing so

If we consider an oriented graph, we use the Dijkstra algorithm

In each iteration, the group of N total nodes is divided in:

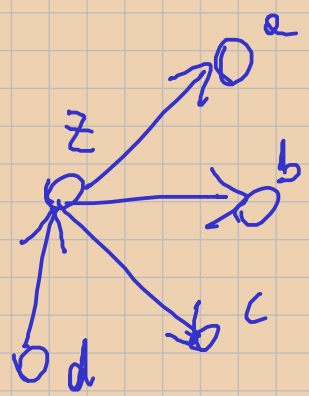
- V, visited nodes
- F, next to the visited nodes
- S, nodes to be yet examinated

$N = F + V + S$ in the initial step

1) We start from a node z, and we set a minimum d_z $(d_z = 0)$

2) We move the z node from F to V

3) We move all successors of z in F



here a,b,c are successors, d is not

4) for every successor w of z, we update the valor d_w and u_w (they will be explained later)

$$d_w = \min \{ d_w, d_z + p_a \}$$

p_a → distance between dz and w successor

If the value of d_w was actually modified, we make: $u_w = z$

the name of the first node

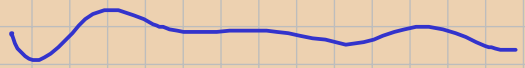
$$U = \{ u_1, u_2, \ldots, u_n \}$$

We do this for every successor of z

5) we go to the node (not z) that has the minimum d (We cannot go to a node that was already visited)

If some nodes have the same d, we must make a choice, this must be implemented in our algorithm but it's complicated

This code works with a starting node, but no ending node is selected.
We run the algorithm trough the whole network (from a starting node), and then we can look into u for looking how we moved between nodes to reach a certain node of arrival of interest.



pajek takes as argument a .net file written in a certain way (there's an example on the shared files of the course), it contains information about every node and every edge.
In pajek we can do visualization, with radatool we can isolate every different connected component and output them as separate networks in separate files.

with <./Connected_Subgraphs.exe Airport_net 1> we can isolate every connected component through radatool with at least 1 node in it.

Cytoscape is a cooler alternative to pajek.