

Basics of Graph Algorithms

Motivation

Why are we looking at graphs? Why should we care?

They are a powerful tool for simulating things like:

- social networks
- abstraction of a geographical map
- Interaction of genes in an organism

what is a graph?

A graph is basically a network. A network made up of connected [Nodes](#). The connections between those nodes are called [Edges](#).

let's look at the Graph view of this document. Try and describe what you see.

Excercise 0: what would you use a graph for? In connection with your field of study?

Nodes

The things in a graph that are connected to each other. Nodes always need a label, so we can indentify them. For our purposes, use capital letters for that like A,B,C

Edges

A connection between two nodes.

We assume that two nodes can only have one unique edge between them.

An edge can be identified by the two nodes it connects:

$e = (a,b)$

If we want to talk about the entirety of all edges in a graph, we use the letter **E**.

Now it's time for the [first excercise](#)

how to write down a Graph (Notation)

for our purposes we will use a so-called **adjacancy list**. The list contains entries that look like this:

node: {list of nodes it is connected to}

for the example graph in the graph v* what are ieuw it looks like this:

A: {B}

B: {A, D, C}

C: {B, E}

D: {B}

E: {C}

directed/undirected

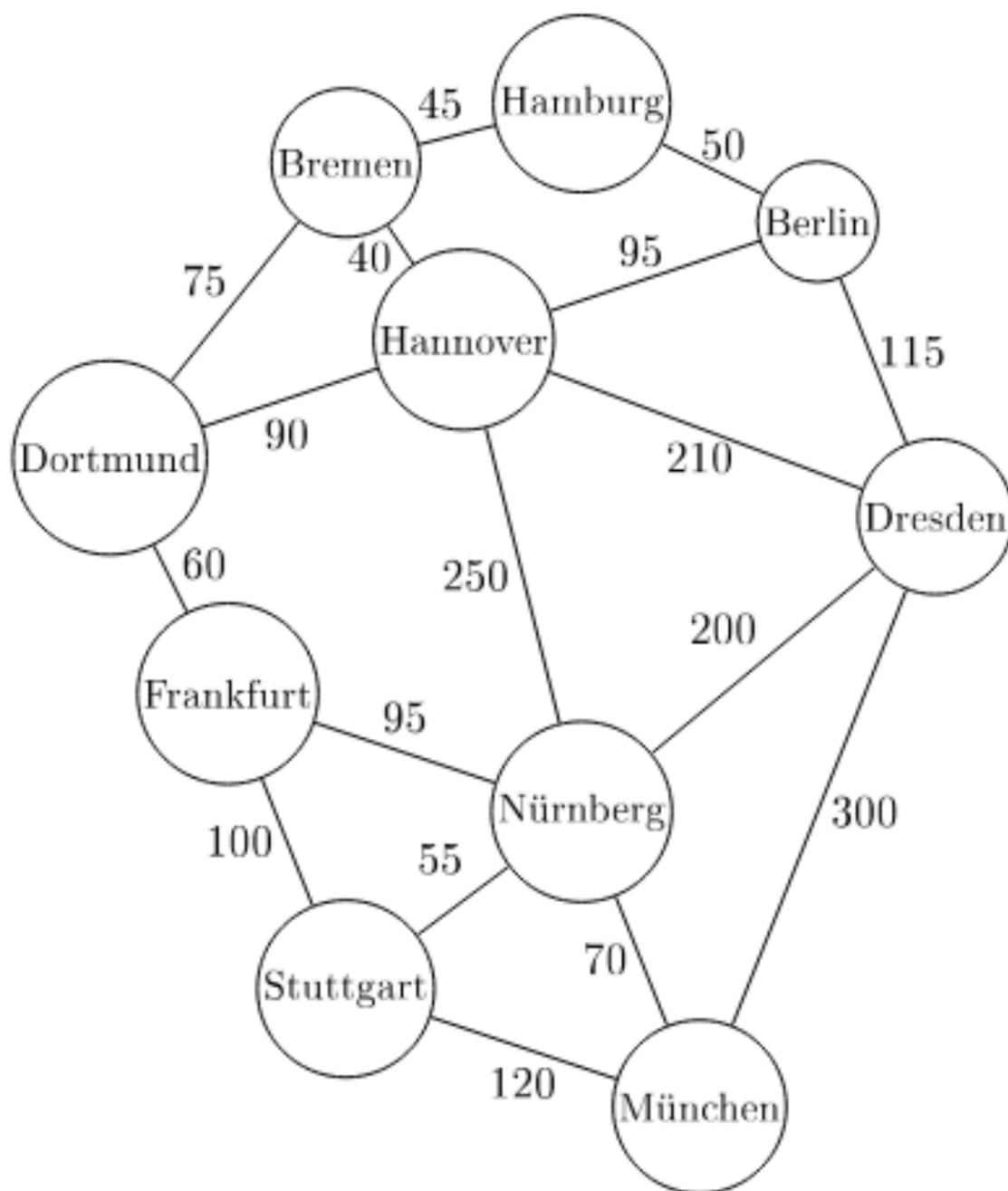
An edge can either be undirected, that means it is just a straight line between the two nodes A and B.

Now it's time for the [second exercise](#)

Weights

edges can have weights. In a graph that represents the a network of train connections between cities, you can imagine the weights as the duration in minutes a train needs to get from one city

to another



Breadth first search

Commonly called BFS search.

Our goal is to hop through the graph and find the shortest path to all the other nodes.

choose a node A to start with

- make a list of all the nodes that A is connected to
- we consecutively visit each node in that list, and mark them as visited when

- i'm too fucking tired to finish this, i'll just explain it orally tomorrow