

Graph algorithms

David Svaty

Faculty of Information Technology, BUT

May 5, 2023



What is a graph

- Non-linear data structure

What is a graph

- Non-linear data structure
- Consists of vertices and edges

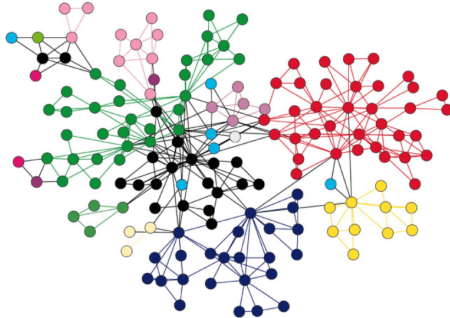
What is a graph

- Non-linear data structure
- Consists of vertices and edges
- Vertices are nodes and edges connect them

What is a graph

- Non-linear data structure
- Consists of vertices and edges
- Vertices are nodes and edges connect them
- Denoted by $G(E, V)$

Graph example



Example of a graph. Graph consists of nodes connected by lines.

Examples of graph algorithms

- Breadth-first search

Examples of graph algorithms

- Breadth-first search
- Depth-first search

Examples of graph algorithms

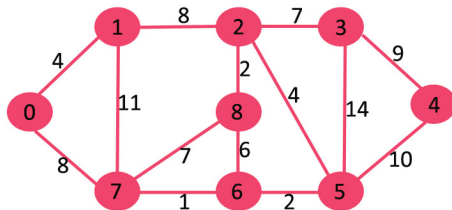
- Breadth-first search
- Depth-first search
- Shortest path

Examples of graph algorithms

- Breadth-first search
- Depth-first search
- Shortest path
- Minimum spanning tree

Dijkstra's algorithm

- Used in weighted graphs
- Finds the shortest path in between nodes



Example of a weighted graph

Time complexity

Pseudocode

```
Input:  $G, V$ 
Output:  $distance[ ], previous[ ]$ 
1: foreach vertex  $V$  in  $G$  do
2:    $distance[V] \leftarrow \text{inf}$ 
3:    $previous[V] \leftarrow \text{null}$ 
4:   if  $V \neq S$  then
5:     add  $V$  to Priority Queue  $Q$ 
6:   end if
7:    $distance[S] \leftarrow 0$ 
8: end foreach
9: while  $Q$  is not empty do
10:   $U \leftarrow \text{Extract MIN from } Q$ 
11:  foreach unvisited neighbour  $V$  of  $U$  do
12:     $tempDistance \leftarrow$ 
13:       $distance[u] + \text{edge\_weight}(U, V)$ 
14:    if  $tempDistance < distance[V]$  then
15:       $distance[V] \leftarrow tempDistance$ 
16:       $previous[V] \leftarrow U$ 
17:    end if
18:  end foreach
19: end while
return  $distance[ ], previous[ ]$ 
```

Thank you for your attention