Graphs and Algorithms

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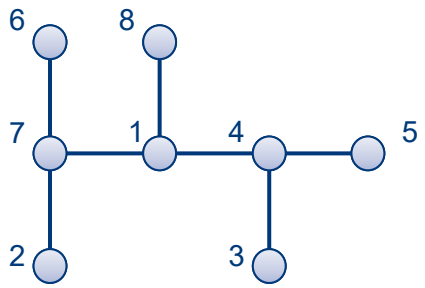
Lab Exercises
Week 9



This Week‘s Lecture Topics

4. Quickly Getting from A to B in a Graph (Cont'd.)
   4.4. Shortest Paths for Arbitrary Edge Weights
   4.5. Directing Shortest Path Search Towards a Goal

Part 2:
Python Programming Exercises

Remember: Always check the NetworkX reference manual
if there already exists a function that does what you want.
Or at least some part of it.

Exercise 9-2-1: Center & Periphery

- Load and draw the undirected graph contained in file “island_hopping.layout”.
  - Make sure that the node numbers are shown in the drawing!
- Read about the functions center() and periphery() of NetworkX.
  - https://networkx.org/documentation/stable/reference/algorithms/generated/networkx.algorithms.distance_measures.periphery.html
  - https://networkx.org/documentation/stable/reference/algorithms/generated/networkx.algorithms.distance_measures.center.html#networkx.algorithms.distance_measures.center
- Colour the nodes of the graph’s center in red.
- Colour the nodes of the graph’s periphery in green.

Exercise 9-2-2: Eccentricity, Radius, Diameter

- Use your code from Example 9-2-1.
- Read about the functions eccentricity(), radius() and diameter() of NetworkX.
  - https://networkx.org/documentation/stable/reference/algorithms/generated/networkx.algorithms.distance_measures.eccentricity.html
  - https://networkx.org/documentation/stable/reference/algorithms/generated/networkx.algorithms.distance_measures.diameter.html
  - https://networkx.org/documentation/stable/reference/algorithms/generated/networkx.algorithms.distance_measures.radius.html
- Print the radius and diameter of the graph.
- For each node, print its eccentricity.
- What is the minimum and maximum eccentricity? Why?

Exercise 9-2-3: Extremal Paths

- Use your code from Example 9-2-2.
- As you know, the diameter is the length of longest possible shortest path.
- There exists a path with this length. But where?
  - Use function shortest_path() for all pairs of vertices u,v.
  - Find the longest among these paths.
  - Mark this path in the graph drawing.
- Question: What is special about the endpoints of this path?

*Exercise 9-2-4: Tree Center

- Warning: This is an optional exercise. Only do it if there is some time left.
- Use your code from Exercise 9-2-1.
- Redo that exercise for several random trees with 16 to 20 nodes.
- How many nodes form the center of these trees?
- Think about this result. Can you explain why this happens?