Graphs and Algorithms

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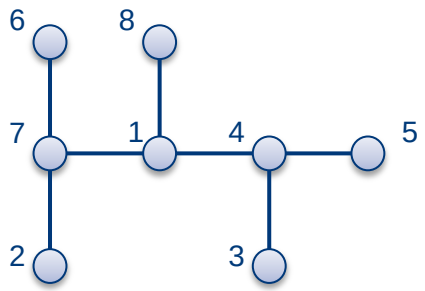
Lab Exercises
Week 12



This Week‘s Lecture Topics

- 4. Quickly Getting from A to B in a Graph (Cont'd.)
  4.5. Directing Shortest Path Search Towards a Goal

- 5. Tour Planning 순회 여행 / 순회 여행이 수행된다
  5.1. Eulerian and Hamiltonian Circuits 오일러/해밀턴 투어
  5.2. Traveling Salesman Problem 외판원 순회 문제

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 12-2-1: Eulerian Graph

- Load and draw the undirected graph contained in file “eulerian.layout”.
  - Make sure that the node numbers are shown in the drawing!
- Read about the functions is_eulerian() of NetworkX.
  - https://networkx.org/documentation/stable/reference/algorithms/generated/networkx.algorithms.euler.is_eulerian.html
- Check if the given graph is indeed Eulerian.
- Remove one edge from the graph.
- Check if the remaining graph is still Eulerian.

Exercise 12-2-2: Euler Tour

- Load and draw the undirected graph contained in file “eulerian.layout”.
  - Make sure that the node numbers are shown in the drawing!
- Read about the function eulerian_circuit() of NetworkX.
  - https://networkx.org/documentation/stable/reference/algorithms/generated/networkx.algorithms.euler.eulerian_circuit.html
- Compute an Euler Tour for the graph.
- Print the list of vertices of the tour.
- Add numbered arrows to the drawing to illustrate this tour.

Exercise 12-2-3: Decomposing a Tour

- **Warning: This is a hard exercise. Only do it if you want a challenge.**
- Re-use your code from Exercise 12-2-2.
- Write code to process the Euler Tour you found as follows:
  1. Stop if the current tour has <3 elements in it.
  2. Check the current tour for vertices that appear more than once.
  3. If such vertices exist, say at positions i and j:
     - Create a sub-tour by copying all vertices from positions i to j-1.
     - Remove the copied vertices from the current tour.
  4. Repeat from step 1.
- Colour the sub-tours in the graph.
- If you did it correctly, then they will be disjoint (i.e. share no common edges).