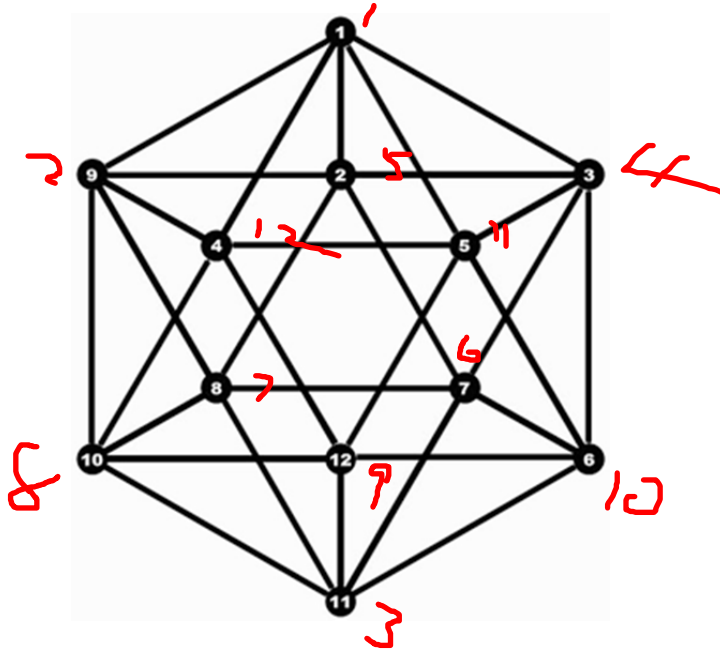


Assignment 5

Motivate and explain all your answers clearly. When you use Python, do not forget to show both your code and the results.

1) Hamiltonian path

Find a Hamiltonian path in the following graph



2) Weighted matrix to weighted graph

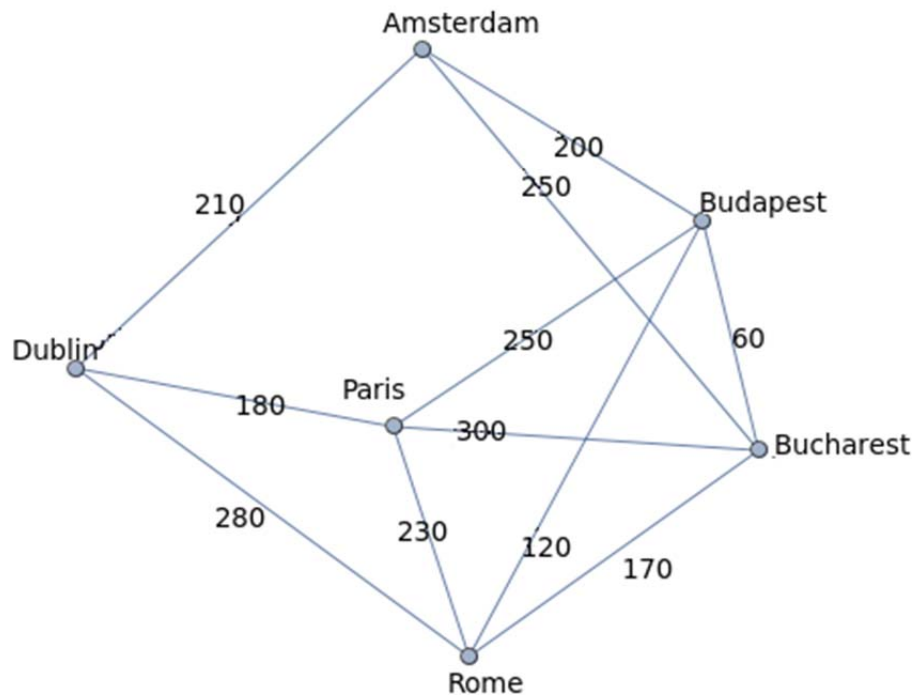
Given is the following weighted matrix:

	A	B	C	D	E	F
A	-	2	3	4	-	-
B	-	-	1	-	-	7
C	3	2	-	-	-	6
D	-	-	-	-	8	-
E	-	-	-	7	-	4
F	-	6	6	-	-	-

- Draw the corresponding weighted graph in Python.
- Explain what kind of graph this is.
- Show and explain what the shortest path is from A to F.
- Is this a connected graph? Motivate your answer.
- Is there a path to get from D to A? Motivate your answer.

3) Cheapest flight*

You want to travel from Dublin to Bucharest. Unfortunately, there is no direct flight. All the available flights are illustrated in the graph below. The weights of the edges represent the price in Euro to travel on a direct flight from one city to another.



You want to book the cheapest flight from Dublin to Bucharest.

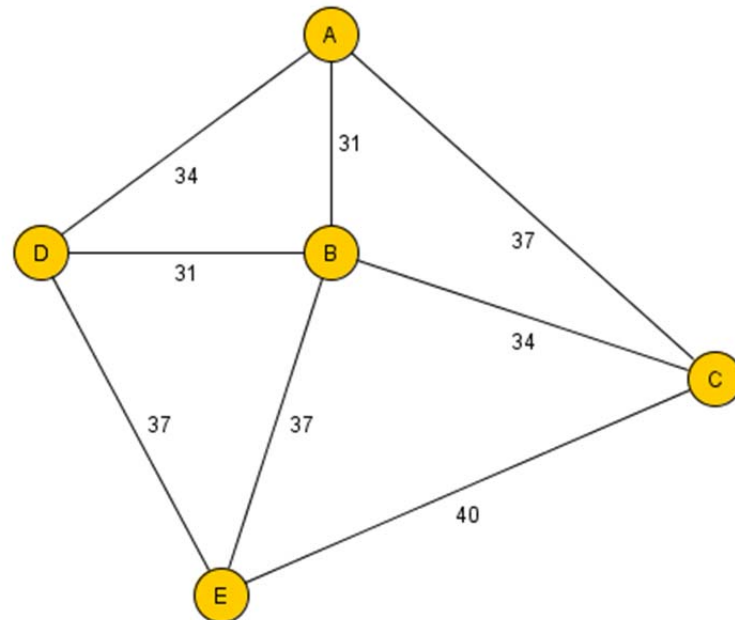
- Use Dijkstra's algorithm to find the cheapest flight.
- Draw the minimum spanning tree of the network using Prim's algorithm. Show Prim's intermediate steps.
- Draw the minimum spanning tree of the network using Kruskal's algorithm. Show Kruskal's intermediate steps.
- What is the weight of the minimum spanning tree?

4) The traveling salesman problem *

A traveling salesman has to go to Amsterdam, Alkmaar, The Hague, Hilversum, Utrecht, and IJmuiden. What is the shortest route he can take visiting all these places? This question is an old problem known as the *traveling salesman problem*. Using brute force and trying every single solution is an option, but if the number of places to visit grows, the number of solutions to go through grows as well and becomes prohibitive. Also choosing the route so you visit every place once only is not easy to solve. As a matter of fact, this problem is an unsolved problem. But finding an answer to this question is a matter of importance in modern technology, think for example of routing on a microchip.

It is possible though to solve a simplified form of the traveling salesman problem with the Greedy algorithm.

Assume an agent of a commercial courier service has to deliver five packages to five different addresses. The agent wants to be home as early as possible to celebrate her daughter's birthday so she needs to find the shortest route to deliver her freight. See the graph pictured below.



In the graph A to E denote the addresses, with A being the home of the agent and B to E the delivery places. The edges between the addresses represent the roads, the numbers are the distances. The agent delivers the packages in a certain order and tries to travel the shortest distance between the addresses.

- Determine the shortest route to travel for the agent if she wants to be home early. Show and motivate your answer.
- Are there other routes the agent can travel which are of equal length in order to be home early? If so, show and explain.
- Assume the agent has to deliver 42 packages to 25 addresses. How many different routes can she travel? Motivate your answer.

5) Present

Robin receives some money as a present from his grandmother. He immediately spends half of it plus 1 Euro. The next day he does the same with the money that is left. After three days he runs out of money. How much money did Robin receive from his grandmother? Motivate your answer and explain which strategy you have used.