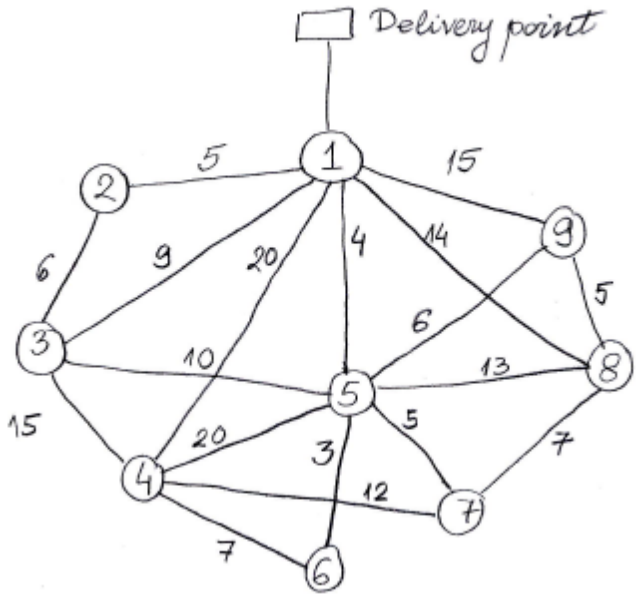
Homework #1

1. Implement Dijkstra's algorithm in the language you are familiar with (C++, Java, or Matlab). Your implementation will provide a simple interface for users to input the graph information (you can specify a particular format you want users to use for such information).

   Deliverable: pre-compiled implementation code (it is your responsibility to specify the language you choose and to make sure your code will work once it is downloaded to your instructor's PC)

2. Gives mileage of the feasible links connecting nine offshore natural gas wellheads with an inshore delivery point. Because wellhead 1 is the closest to shore, it is equipped with sufficient pumping and storage capacity to pump the output of the remaining eight wells to the delivery point. Determine the minimum length pipeline tree that links the wellheads to the delivery point. Please calculate the lengths both manually (e.g., list progressive tables showing how distances are updated over time) and automatically calculated by your program code designed in Problem 1 (e.g., screenshorts of your program outputs).



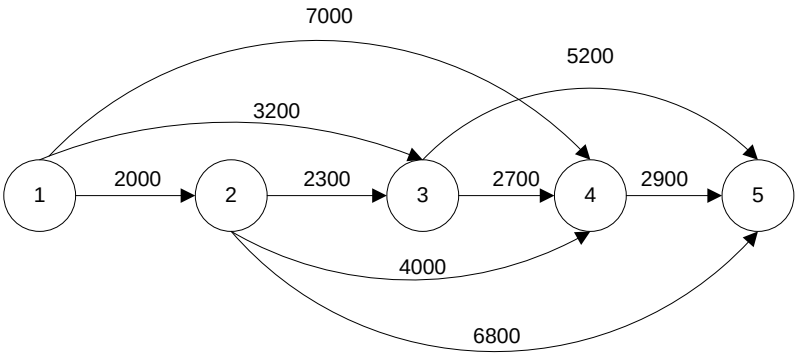
   Solution:

	1	2	3	4	5	6	7	8	9
1	(0, p)	(5, t)	(9, t)	(20, t)	(4, t)	(inf, t)	(inf, t)	(14, t)	(15, t)
	(0, p)	(5, t)	(9, t)	(20, t)	(4, p)	(inf, t)	(inf, t)	(14, t)	(15, t)
5	(0, p)	(5, t)	(9, t)	(20, t)	(4, p)	(7, t)	(9, t)	(14, t)	(10, t)
	(0, p)	(5, p)	(9, t)	(20, t)	(4, p)	(7, t)	(9, t)	(14, t)	(10, t)
2	(0, p)	(5, p)	(9, t)	(20, t)	(4, p)	(7, t)	(9, t)	(14, t)	(10, t)
	(0, p)	(5, p)	(9, t)	(20, t)	(4, p)	(7, p)	(9, t)	(14, t)	(10, t)
6	(0, p)	(5, p)	(9, t)	(14, t)	(4, p)	(7, p)	(9, t)	(14, t)	(10, t)
	(0, p)	(5, p)	(9, p)	(14, t)	(4, p)	(7, p)	(9, t)	(14, t)	(10, t)
3	(0, p)	(5, p)	(9, p)	(14, t)	(4, p)	(7, p)	(9, t)	(14, t)	(10, t)
	(0, p)	(5, p)	(9, p)	(14, t)	(4, p)	(7, p)	(9, p)	(14, t)	(10, t)
7	(0, p)	(5, p)	(9, p)	(14, t)	(4, p)	(7, p)	(9, p)	(14, t)	(10, t)
	(0, p)	(5, p)	(9, p)	(14, t)	(4, p)	(7, p)	(9, p)	(14, t)	(10, p)
9	(0, p)	(5, p)	(9, p)	(14, t)	(4, p)	(7, p)	(9, p)	(14, t)	(10, p)
	(0, p)	(5, p)	(9, p)	(14, p)	(4, p)	(7, p)	(9, p)	(14, t)	(10, p)
4	(0, p)	(5, p)	(9, p)	(14, p)	(4, p)	(7, p)	(9, p)	(14, t)	(10, p)
	(0, p)	(5, p)	(9, p)	(14, p)	(4, p)	(7, p)	(9, p)	(14, p)	(10, p)

3. Car-rental company is developing a replacement policy for its car fleet for a 4-year period. At the start of the first year, the company must purchase a car. At the start of each subsequent year, a decision can be made as to keep a car or to replace it. The car has to be in service for at least 1 year and no more than 3 years. The replacement cost is shown below as a function of the period when it is purchased and the years kept in operation. Form this question as a graph model and determine the best decision that minimizes the total cost incurred over the period of 4 years. Again, you should calculate the answer manually (e.g., list progressive tables showing how distances are updated over time) and using your programming code designed in Problem 1.

Start of a year	Years in operation		
	1	2	3
1	2000	3200	7000
2	2300	4000	6800
3	2700	5200	-
4	2900	-	-

Solution:



The best decision corresponds to the shortest path from node 1 to node 5, which is 1→ 3 → 5 with the cost of 8400. This path corresponds to the decision of purchasing the car in years 1 and 3.