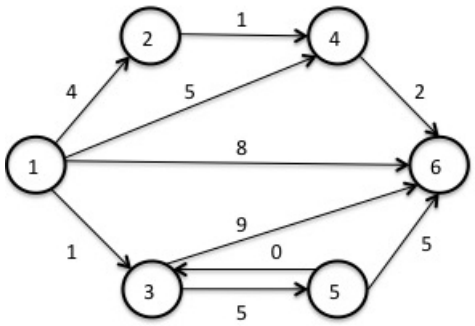
BGSE MSc in Data Science - Stochastic Models and Optimization
Instructor: Mihalis G. Markakis

Problem Set 2

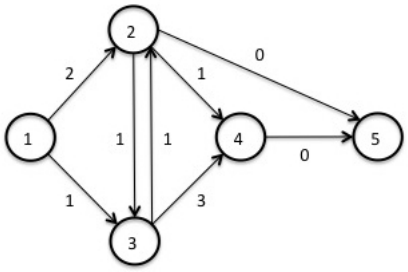
Problem 1 (Shortest Path via DP - [B05] Exercise 2.1)

Find a shortest path from each node to node 6 for the graph below by using the DP algorithm.



Problem 2 (Shortest Path via Label Correcting Methods - [B05] Exercise 2.2)

Find a shortest path from node 1 to node 5 for the graph below by using both the Bellman-Ford and Dijkstra's methods.



Problem 3 (Clustering - [B05] Exercise 2.8)

We have a set of N objects, denoted $1, 2, \ldots, N$, which we want to group in clusters that consist of consecutive objects. For each cluster $i, i+1, \ldots, j$, there is an associated cost a_{ij}. We want to find a grouping of the objects in clusters such that the total cost is minimum. Formulate the problem as a shortest path problem, and write a DP algorithm for its solution.

Note: An example of this problem arises in typesetting programs such as LATEX, which break down paragraphs into lines in a way that optimizes the paragraph's appearance.

Problem 4 (Path Bottleneck Problem - [B05] Exercise 2.15)

Consider the framework of the shortest path problem. For any path P, define the *bottleneck arc* of P as an arc that has maximum length over all arcs of P. We wish to find a path whose length of bottleneck arc is minimum, among all paths connecting the origin node to the destination node. Develop and justify an analog of the label correcting algorithm that solves this problem.

Problem 5 (TSP Computational Assignment)

Visit the website: http://www.math.uwaterloo.ca/tsp/world/countries.html

Solve the Traveling Salesman Problem for Uruguay based on the dataset provided. You can use your favorite programming language and solution method for the TSP. Provide a printout of your code with *detailed documentation*, and compare the optimal solution you obtain to the one available at the website.