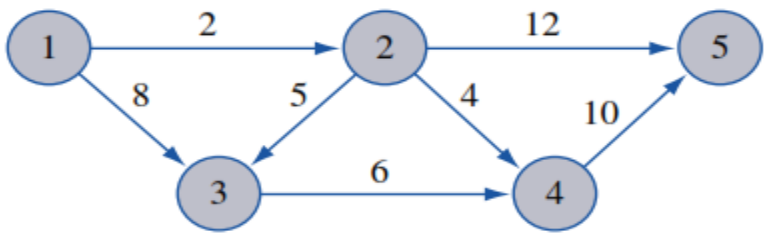
MS3530: Advanced Operations Research

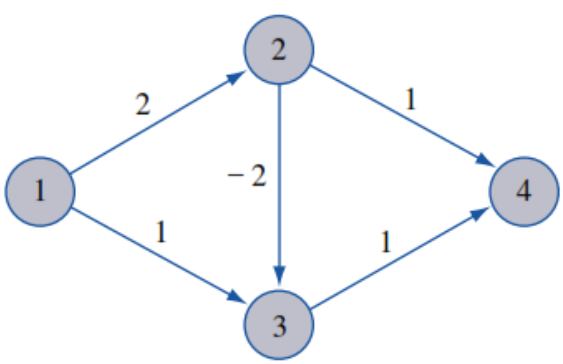
Practice Assignment 4

Network Flows

Q1 Find the shortest path from node 1 to node 5



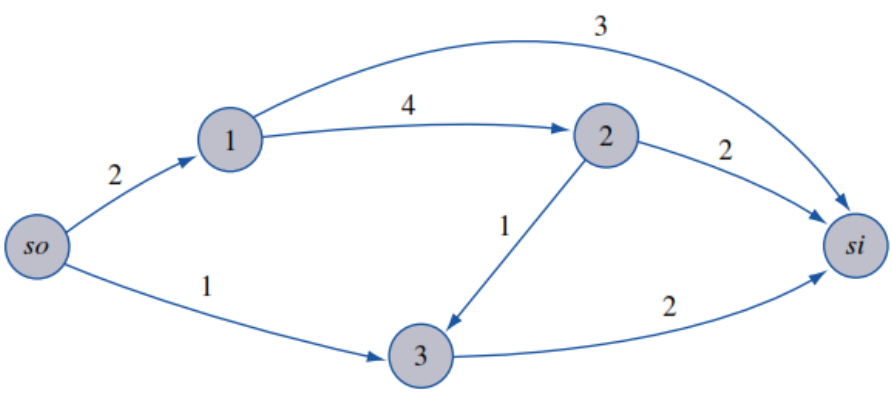
Q2 Use Dijkstra's algorithm to find the shortest path from node 1 to node 4. Why does Dijkstra's algorithm fail to obtain the correct answer?



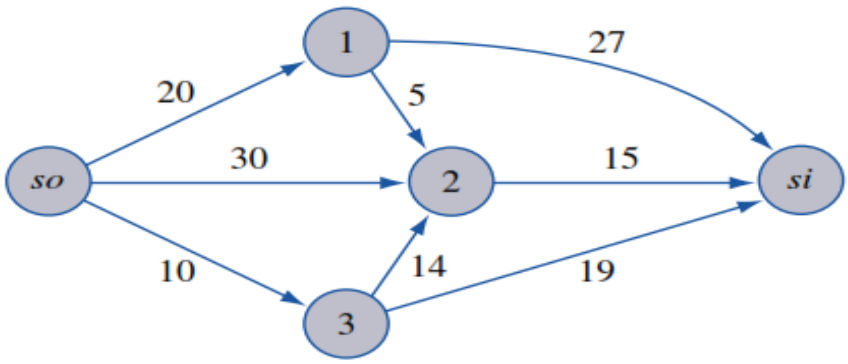
Q3 A company sells seven types of boxes, ranging in volume from 17 to 33 cubic feet. The demand and size of each box is given in Table below. The variable cost (in dollars) of producing each box is equal to the box's volume. A fixed cost of $1,000 is incurred to produce any of a particular box. If the company desires, demand for a box may be satisfied by a box of larger size. Formulate and solve a shortest-path problem whose solution will minimize the cost of meeting the demand for boxes.

	Box						
	1	2	3	4	5	6	7
Size	33	30	26	24	19	18	17
Demand	400	300	500	700	200	400	200

Q4 Find the maximum flow from source to sink in each network. Find a cut in the network whose capacity equals the maximum flow in the network. Also, set up an LP that could be used to determine the maximum flow in the network.



Q5 Find the maximum flow from source to sink. Also find a cut whose capacity equals the maximum flow in the network.



Q6 During the next four months, a construction firm must complete three projects. Project 1 must be completed within three months and requires 8 months of labor. Project 2 must be completed within four months and requires 10 months of labor. Project 3 must be completed at the end of two months and requires 12 months of labor. Each month, 8 workers are available. During a given month, no more than 6 workers can work on a single job. Formulate a maximum-flow problem that could be used to determine whether all three projects can be completed on time. (Hint: If the maximum flow in the network is 30, then all projects can be completed on time.)