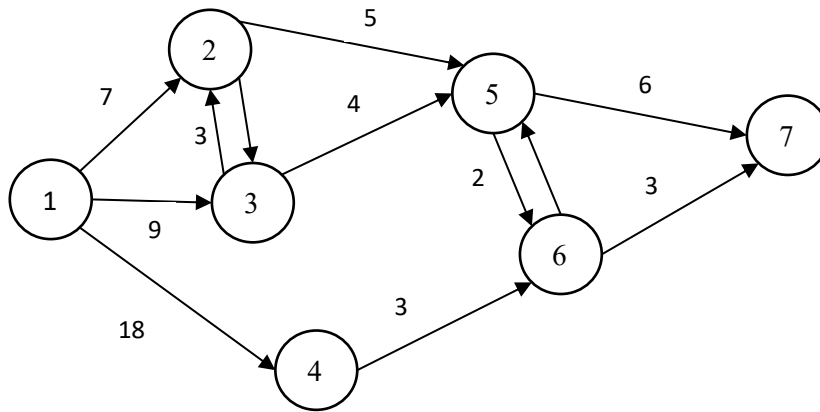# Homework 9

This is an individual assignment. All work that you submit for credit <u>must be your own</u>. Select two of the following problems to answer.

1. (50 points) Construct an optimization model using Python in a Jupyter network to find the shortest path from node 1 to node 7 in the network graph below.

2. (60 points) A rental car company has an imbalance of cars at seven of its locations. The following network shows the locations of concern (the nodes) and the cost to move a car between locations. A positive number by a node indicates an excess supply at the node, and a negative number indicates an excess demand.
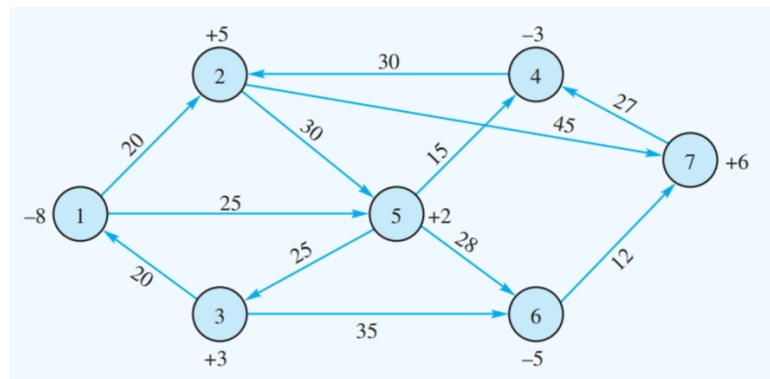
Construct an optimization model using Python in a Jupyter network to determine how the cars should be redistributed among the locations.

3. (50 points) Carpet Plus produces, distributes, and sells high-quality floor covering for commercial buildings. Its supply chain consists of three factories that produce the floor coverings in Chicago, Santa Maria, and Oklahoma City. The Chicago and Santa Maria factories can produce 3500 (sq. yd) floor coverings per week, and the larger factory in Oklahoma City can produce up to 7000 (sq. yd) floor coverings per week. The floor coverings are shipped from these factories to four distribution centers located in Iowa, Virginia, Oregon, and Tennessee. Each distribution center can process up to 5000 (sq. yd) floor coverings per week. The floor coverings are then shipped from the distribution centers to three major retailers: Dance & Floor, S&H Flooring, and Mike's Carpet. Dance & Floor requires 2000 (sq. yd) floor coverings per week, S&H Flooring requires 5000 (sq. yd) floor coverings per week, and Mike's Carpet requires 6500 (sq. yd) floor coverings per week. The two tables below indicate the shipping costs per sq. yd floor coverings from the factories to the distribution centers and from the distribution centers to the retailers.

Factory	Distribution Center			
	Iowa	Virginia	Oregon	Tennessee
Chicago	$2.50	$2.50	$3.70	$4.20
Santa Maria	$3.65	$4.50	$3.60	$4.55
Oklahoma City	$4.10	$4.00	$4.25	$3.35

Retailer	Distribution Center			
	Iowa	Virginia	Oregon	Tennessee
Dance & Floor	$3.00	$2.05	$3.50	$2.85
S&H Flooring	$2.75	$3.25	$4.20	$2.50
Mike's Carpet	$3.00	$4.00	$3.25	$4.25

a. Construct an optimization model in a Jupyter Notebook using Python to find the best distribution plan for the floor coverings.

b. Carpet Plus is considering an expansion of the Iowa DC to accommodate 8000 (sq. yd) floor coverings per week. The annual amortized cost of this expansion is $42,000 assuming 50 weeks per year. Should Carpet Plus invest in this expansion?