

Lab Assignment 2: Optimization for Machine Learning

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Write python codes of the following problems:

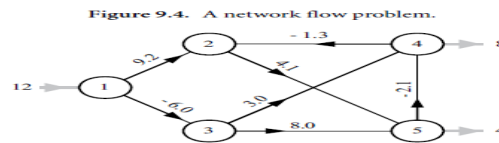
(1) Construct an LP and solve the assignment problem:

The Funny Toys Company has four men available for work on four separate jobs. Only one man can work on any one job. The cost of assigning each man to each job is given in the following table. The objective is to assign men to jobs in such a way that the total cost of assignment is minimum.

Person	Job			
	1	2	3	4
A	20	25	22	28
B	15	18	23	17
C	19	17	21	24
D	25	23	24	24

Figure 1: Network flow

(2) Solve least cost problem:



Problem 9.A. For the directed network in Figure 9.4, each arc has 0 as its lower bound and has $+\infty$ as its upper bound. Find a least-cost flow.

Figure 2: Network flow

(3) Solve the following quadratic problem.

$$\begin{aligned} \min f(x) &= 3x_1^2 + x_2^2 + 2x_1x_2 + x_1 + 6x_2 + 2 \\ \text{s.t. } 2x_1 + 3x_2 &\geq 4 \\ x_1, x_2 &\geq 0 \end{aligned}$$

Figure 3: Network flow

(4) Solve the following quadratic problem.

$$\begin{aligned} \text{Maximize } f(x) &= 2x_1 + 3x_2 - x_1^2 - x_2^2 \\ \text{subject to} \\ x_1 + x_2 &\leq 2 \\ 2x_1 + x_2 &\leq 3 \\ x_1, x_2 &\geq 0. \end{aligned}$$

Figure 4: Network flow