Solutions to Problems 3.8-3.11

Adithya Hosapate
Sushant Meena

IIT Hyderabad

ee16btech11040@iith.ac.in

es16btech11021@iith.ac.in

February 27, 2019

Question 1

A transportation problem for which the costs, origin and availabilities, destination and requirements are given as follows:

	D_1	D_2	D_3	
Q_1	2	1	2	40
Q_2	9	4	7	60
Q_3	1	2	9	10
	40	50	20	

Check whether the following basic feasible solution

$$x_{11} = 20, x_{13} = 20, x_{21} = 10, x_{22} = 50$$
$$x_{13} = 10 \text{ and } x_{12} = x_{23} = x_{32} = x_{33} = 0$$

is optimal. If not, find an optimal solution.

Solution (Linear Programming)

We can formulate the problem as:

$$\min_x 2x_{11} + x_{12} + 2x_{13} + 9x_{21} + 4x_{22} + 7x_{23} + x_{31} + 2x_{32} + 9x_{33}$$

The supply constraints are as follows:

$$\begin{aligned} x_{11} + x_{12} + x_{13} &\leq 40 \\ x_{21} + x_{22} + x_{23} &\leq 60 \\ x_{31} + x_{32} + x_{33} &\leq 10 \end{aligned}$$

The demand constraints are:

$$\begin{aligned} -x_{11} - x_{21} - x_{31} &\leq -40 \\ -x_{12} - x_{22} - x_{32} &\leq -50 \\ -x_{13} - x_{23} - x_{33} &\leq -20 \end{aligned}$$

Also:

$$-x_{ij} \leq 0 \; \forall i, j$$

This is in standard LP form and can be solved using cvxpot/cvxpy

Solution(MODI method)

	D_1	D_2	D_3	
Q_1	2	1	2	40
Q_2	9	4	7	60
Q_3	1	2	9	10
	40	50	20	

UV table is:

	2	3	-2
0	2	1	2
7	9	4	7
-1	1	2	9

Penalty table is:

-	-4	-
-	-	2
-	-6	-8

Loop would be as: C(2,3), C(1,3), C(1,1), C(2,1) with signs (+), (-), (+) (-) respectively. On updating the transportation table, we get:

30	0	10
0	50	10
10	0	0

Updated UV table is:

	2	-1	-2
0	2	1	2
5	9	4	7
-1	1	2	9

Updated penalty table is:

-	-2	-
-2	-	-
-	-4	-8

All negative entries. Hence, optimal.

Transporation matrix X is:

30	0	10
0	50	10
10	0	0

On multiplying cost matrix with transportation matrix, we get minimized cost to be 360.