Introduction to Optimization
University of California Davis
Fall 2021
Prof. Stefan C. Schonsheck

Homework 3

Due Nov. 7

1 Problem Set

NOTE: The first two problems are the same LPs as the previous homework, but you must use the specified method to solve them.

1: Use the two-phase simplex algorithm **in matrix form** to solve (i.e. introduce the auxiliary problem OR use a modified objective function) (25 pts):

$$\begin{aligned} max \quad & 2x_1 - 6x_2 \\ s.t. \quad & -x_1 - x_2 - x_3 \leq -2 \\ & 2x_1 - x_2 + x_3 \leq 1 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

2: Use the parametric self-dual simplex algorithm to solve (25 pts):

$$\begin{aligned} max \quad & 2x_1 - 6x_2 \\ s.t. \quad & -x_1 - x_2 - x_3 \leq -2 \\ & 2x_1 - x_2 + x_3 \leq 1 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

3: Find the ranges for c_2, c_3 for which the optimal dictionary of the following problem remains feasible (20 pts):

$$\begin{aligned} max \quad & 5x_1 + 4x_2 + 3x_3 \\ s.t. \quad & 2x_1 + 3x_2 + x_3 \leq 5 \\ & 4x_1 + x_2 + 2x_3 \leq 11 \\ & 3x_1 + 4x_2 + 2x_3 \leq 8 \\ & x_1, x_2, x_3 \geq 0 \end{aligned}$$

(**Hint:** We did the analysis for c_1 in the notes. You may begin with the optimal dictionary we used in that example)

4: Suppose you are a shipping manager for a small company in Northern California. You have production facilities in San Francisco and Sacramento. Each production facility can produce 11k units per month. You also have retail stores in Davis, Winters, and Woodland. The monthly demand at the stores are 10k, 8k and 4k units per month receptively. The transportation cost (in cents per unit) from each of the facilities to each of the stores is given in the table below:

	Davis	Winters	Woodland
SF	10	8	12
Sac	4	11	6

Write down, then solve (using https://online-optimizer.appspot.com/?model=builtin:default.mod) the linear program to determine the minimal shipping costs of supplying each store. Include a .txt file and/or screenshot of the inputs and outputs to the solver you used. (30 pts)

2 Collaboration

Please use this space to recognize any and all collaborations which assisted you on the completion of this assignment.

3 Academic Integrity

Please copy and sign the following statement of academic integrity:

> On my personal integrity as a student and member of the UCD community, I have not given, nor received and unauthorized assistance on this assignment.