Linear Optimization (Spring 2023): Homework 4

- The total points (given in parentheses) add up to 140. You will be graded for 130 points (with the possibility of getting up to 10 points as extra credit).
- BT-ILO stands for the text (Bertsimas and Tsitsiklis: Introduction to Linear Optimization).
- **You must email your submission as a PDF file to kbala@wsu.edu**. You are welcome to write answers by hand, and scan the writings **into a PDF file**.
- **Your file name should identify you in the following manner. If you are Albert Einstein, you should name your submission AlbertEinstein_Hw4.pdf. If you want to add more bits to the title, e.g., Math464, you could name it AlbertEinstein_Math464_Hw4.pdf, for instance. But you should start the file name with AlbertEinstein; and NOT "Al Einstein" or "Albert_Einstein" or ...**
- **Begin the SUBJECT of your email submission with the same `FirstnameLastname`, e.g., "AlbertEinstein Hw4 submission".**
- **This homework is due by 4:59 PM on Thursday, February 9**.

1. (30) BT-ILO Problem 1.14 (b), (c) from Page 36–37. Clearly indicate the coordinates of the corner points of the feasible region, and the optimal solution as well as the optimal objective function value.

2. (30) BT-ILO Problem 1.15 (b) from Page 37. First solve the original LP graphically.

3. (30) Indicate which case does each of the following LPs belong to.

Case I. The LP has a unique optimal solution.

Case II. The LP has many optimal solutions.

Case III. The LP is unbounded.

Case IV. The LP is infeasible.

For each LP, also indicate if the feasible region is bounded, unbounded, or is empty.

(a)

$$\begin{array}{lll} \min & x_1 + x_2 & \\ \text{s.t.} & x_1 + x_2 & \leq \ 4 \\ & x_1 - x_2 & \geq \ 5 \\ & x_1, x_2 & \geq \ 0 \end{array}$$

(b)

$$\begin{array}{lll} \max & 4x_1 + x_2 & \\ \text{s.t.} & 8x_1 + 2x_2 & \leq \ 16 \\ & 5x_1 + 2x_2 & \leq \ 12 \end{array}$$

(c)

$$\begin{array}{lll} \min & 3x_1 + x_2 & \\ \text{s.t.} & x_1 - x_2 & \leq \ 4 \\ & x_1 + 2x_2 & \geq \ 4 \\ & x_1, x_2 & \geq \ 0 \end{array}$$

4. (25) BT-ILO Problem 2.1 from Page 75-76.

5. (25) BT-ILO Problem 2.2 from Page 76.