

MA2210 Math. Methods in Decision Making
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MA2210 Assignment 1

DUE DATE: Friday, March 16, 4:00pm in the Mathematical Sciences Dept Office, SH108.

Carefully read the presentation rules below. Problem statements begin on the next page.

BASIC RULES FOR MA2210 ASSIGNMENTS

- I) Each student must compose his/her assignments independently. However, rough work may be done in groups;
- II) Write legibly and use only one side of each sheet of paper; **Any paper submitted which is sloppy or uses two sides of a page will be returned immediately with no credit.**
- III) Show your work. Explain your answers using FULL SENTENCES;
- IV) All assignments are to be placed in the MA2210 assignment bin on Rhonda's desk in the department office. **DO NOT SLIP PAPERS UNDER MY DOOR.** (They will be tossed in the trash by the janitor.)
- V) No late assignments will be accepted for credit.

Please complete the following five problems:

1. Consider the following linear programming problem in standard form.

$$\begin{array}{rcll}
 \mathbf{max} & x_1 & + & 2x_2 & + & 3x_3 & & \\
 s.t. & 2x_1 & - & 3x_2 & + & x_3 & \leq & 120 \\
 & x_1 & & & + & 2x_3 & \leq & 150 \\
 & -x_1 & + & 4x_2 & + & 2x_3 & \leq & 320 \\
 & x_1, & & x_2, & & x_3 & \geq & 0
 \end{array}$$

(a) Introduce slack variables to convert the above LP problem to standard form (no inequalities, all equations).

(b) Construct the initial tableau as done with the example in class.

(c) Carry out the simplex method to optimality (see p17-19 from the handout). For each new tableau, first list the entering variable, the ratios, and the leaving variable.

(d) At optimality, give the optimal solution (including the values of the slack variables) and the optimal objective value.

2. Carry out the same steps as in Problem 1 for the following LP problem.

$$\begin{array}{rcll}
 \mathbf{max} & 2x_1 & + & 3x_2 & & \\
 s.t. & x_1 & + & x_2 & \leq & 400 \\
 & x_1 & + & 2x_2 & \leq & 450 \\
 & 2x_1 & + & 5x_2 & \leq & 1000 \\
 & x_1, & & x_2 & \geq & 0
 \end{array}$$

3. Complete Exercise #27 on page 72 in the text.

4. Complete Exercise #29 on page 73 in the text.

5. Consider the following linear programming problem

$$\begin{array}{rcll}
 \mathbf{Min} & -6x_1 & + & 3x_2 & - & x_3 & & \\
 s.t. & 4x_1 & + & 5x_2 & - & 6x_3 & \leq & 77 \\
 & -9x_1 & & & + & 10x_3 & \geq & 88 \\
 & 11x_1 & + & 12x_2 & - & 13x_3 & = & 99 \\
 & x_1, & & x_2, & & x_3 & \geq & 0
 \end{array}$$

(a) Convert the problem to our usual form, a maximization problem with less-than-or-equal-to constraints. Annotate your solution to show what changes were made.

(b) If you were to convert this new problem to standard form and construct an initial tableau, the conditions would not be satisfied for an initial basic feasible solution and more work is needed before we can apply our algorithm. List two difficulties that will arise in applying the simplex method from this point. (You are not asked to overcome these difficulties; just to clearly and briefly identify them.)