Math 251/Buad427 ACTIVITY 1: Forming teams; Formulating Linear Programming models, Solution concepts

Why

Linear programming is the best-known and most commonly-used mathematical programming tool. The human part of this involves identifying and setting up the models and interpreting the results of computations, but it is very helpful to see why the solutions are always at extreme points—some constraints are satisfied exactly (as equalities). In this activity, you will practice modeling a problem as a linear programming problem and also work with the basic concepts involved in solving a problem

Vocabulary

solution
feasible solution
feasible region
extreme point
boundary point
interior point
optimal solution

LEARNING OBJECTIVES

1. Work as a team, using the team roles
2. Be able to determine the variables and objective, and write the constraints, for a problem that fits the conditions for a linear programming model
3. Understand the meanings of the feasible region for a linear programming problem
4. Understand why the optimal solution is at an extreme point of the feasible region

CITERIA

1. Success in working as a team and in fulfilling the team roles.
2. Understanding of the material by all team members
3. Success in completing the exercises.

RESOURCES

1. Your text sections 2.2 – 2.3 [Setup example and graphical solution]
2. The two worked examples in the document Setup and graphical solution of Linear Programming Problems [2-variables] available on Blackboard (Notes>Linear Programming Models—Notes)
3. 50 minutes

PLAN

1. Select roles, if you have not already done so, and decide how you will carry out steps 2 and 3 (5 minutes)
2. Work through the exercises given below you will submit one (team) copy of the work, with the usual reports [see the syllabus]
3. Assess the team's work and roles performances and prepare the Reflector's and Recorder's reports including team grade (5 minutes).
4. Be prepared to discuss your results

EXERCISES

1. Information on team members. For each member:
   (a) Name
   (b) Hometown – How long have you lived there?
   (c) Favorite college course (before this wonderful & exciting course)–why?
   (d) One surprising/interesting thing about yourself that other people would probably not know

2. Syllabus/Course structure

   (a) When will the final exam be given in this course?

   (b) What written materials must be turned in for each in-class activity?

3. Setting up a linear Programming Model: Create the Linear Programming model for Problem #16 on p. 105 in your text. [Define variables, write the objective, determine Max or min, write the constraints. [Interpret the probability as an "expected ratio of sales" - on the average the store will sell .12 bicycles for every bicycle displayed, - use average profit in objective function] Do not solve this problem

4. Solution of a Linear Programming Model: Problem # 7 on p. 103 of your text [including data in part c] leads to the LP model given here.

   A.) graph the feasible region

   B.) By graphing the appropriate lines, show that a total (daily) profit of \$4000 is feasible (possible)—in fact, there are many feasible combinations that give this profit—and a total daily profit of \$7000 is infeasible (impossible).

   C.) Use the graphical method to find the optimal solution the most profitable feasible combination. What is the best possible profit, and [more important] what is the most profitable combination of products?

   D.) Which constraints are *binding* (satisfied as equations, not just inequalities) at the optimal solution? What is the *slack* (leftover/unused amount of the resource) in each of the others?

   THE MODEL:
   X_1 = dozens of baseballs produced
   X_2 = dozens of softballs produced
   Objective: [maximize] $Z = 7X_1 + 6X_2$
   Subject to constraints
   $5X_1 + 6X_2 \leq 3600$ [cowhide]
   $X_1 + 2X_2 \leq 960$ [time available]
   $X_1 \leq 500$ [limit on baseballs]
   $X_2 \leq 500$ [limit on softballs]
   $X_1, X_2 \geq 0$
   Since this is production per day fractional values make sense – production of a dozen balls can be carried over & finished the next day.

READING ASSIGNMENT (in preparation for next class meeting)

Read Sections 2.4, 2.5

SKILL EXERCISES:(hand in - individually - at next class meeting)

Text p. 101: #3, 10 [you can answer a, b by evaluating the objective at appropriate points], 17 [invest minimum amont of *money*, not *month*]