Operations Research, Spring 2017

Pre-lecture Problems for Lecture 2:
Introduction to Linear Programming

Instructor: Ling-Chieh Kung
Department of Information Management
National Taiwan University

Note. The deadline of submitting the pre-lecture problem is ***9:20am, March 2, 2017***. Please submit a hard copy of your work to the instructor in class. Late submissions will not be accepted. Each student must submit her/his individual work. Submit ONLY the problem that counts for grades.

1. (0 point) Graphically solve the following LP:

$$\begin{aligned} \max \quad & 5x_1 + 3x_2 \\ \text{s.t.} \quad & x_1 + x_2 \leq 16 \\ & x_1 + 4x_2 \leq 20 \\ & 2x_1 + x_2 \geq 6 \\ & x_1 \geq 0, x_2 \geq 0. \end{aligned}$$

2. (0 point) Bob is the owner of a furniture shop. He uses woods to make tables and chairs. Each day, he buys woods from his supplier at a cost of $50 per unit. Each table requires 2 units of woods while each chair requires 1 unit. He, as well as his employees, needs to spend time on making these products. He can make 1 chair or 0.5 table in 1 hour. Each of his two employees, who are not as experiences as him, can make 0.8 chair or 0.3 tables in 1 hour. The outputs are always proportional to the amount of time they spend. Each of the two employees works 8 hours per day. Bob can work 12 hours per day. A table can be sold at $200 and a chair can be sold at $80. Formulate an LP that can find a production plan for Bob to maximize his daily profit.

3. (10 points) Tom is the owner of a furniture shop. He uses woods to make tables and chairs. Each day, he buys woods from his supplier at a cost of $40 per unit. The maximum amount of woods that may be purchased is 15 units. Each table requires 3 units of woods while each chair requires 2 units. He needs to spend time on making these products. He can make 1 chair or 0.6 table in 1 hour. The outputs are always proportional to the amount of time they spend. Tom can work 12 hours per day. His experiences told him that the maximum number of chairs that can be sold is no greater than two times the number of tables sold. Therefore, the production quantity of chairs should not be greater than two times the product quality of tables. A table can be sold at $100 and a chair can be sold at $80.

   (a) (5 points) Formulate an LP that can help make a production plan for Tom to maximize his daily profit.

   (b) (5 points) Graphically solve the LP. Interpret your solution to make a suggestion to Tom.

   Note. You are required to formulate a "linear program." Double check whether your program is really a linear one!