STOR 415, Fall 2019
Homework Assignment No. 1

---

1. Furnco manufactures desks and chairs. Each desk uses 4 units of wood, and each chair uses 3. A desk contributes \$40 to profit, and a chair contributes \$25. Marketing restrictions require that the number of chairs produced be at least twice the number of desks produced. There are totally 20 units of wood are available. Let x_1 = number of desks produced, x_2 = number of chairs produced.

   Note: for all questions in this homework assignment, you do not need to consider integrality constraints (i.e., constraints that require variables to be of integer values).

   (a) Formulate an LP to maximize Furnco's profit: define the variables, write down the objective function, and all constraints.

   (b) Is $(0,0)$ a feasible solution?

   (c) Is $(-3,2)$ a feasible solution?

   (d) Is $(2,4)$ a feasible solution?

2. U.S. Labs manufactures mechanical heart valves from the heart valves of pigs. Different heart operations require valves of different sizes. U.S. Labs purchases pig valves from three different suppliers. The cost and size mix of the valves purchased from each supplier are given in the following table. For example, any K pig valves from supplier 1 will contain $0.4K$ large, $0.4K$ medium and $0.2K$ small ones; customers must purchase the mix.

   Each month, U.S. Labs needs at least 500 large, 300 medium, and 300 small valves. Because of limited availability of pig valves, at most 700 valves per month can be purchased from each supplier. Formulate an LP that can be used to minimize the cost of acquiring the needed valves: define the variables, write down the objective function, and all constraints. Do not try to solve the LP.

Supplier	Cost per Valve (\$)	Percent Large	Percent Medium	Percent Small
1	5	40	40	20
2	4	30	35	35
3	3	20	20	60

3. Consider a school district with I neighborhoods, J schools, and G grades at each school. Each school j has a capacity of C_{jg} for grade g. In each neighborhood i, the student population of grade g is S_{ig}. Finally, the distance from school j to neighborhood i is d_{ij}. Formulate an LP whose objective is to assign all students to schools, while minimizing the total distance traveled by all students. You may ignore the fact that numbers of students must be integer.