1. Product mix

A furniture cabinet maker produces two types of cabinets; Mission style and Rustic style. The Mission-style cabinet requires $340 in materials and 15 labor hours to produce and it yields a profit of $910 per cabinet. The Rustic-style cabinet requires $430 in materials and 20 hours to produce, and it yields a profit of $1,200. The firm has a budget of $30,000 to spend on materials and 1,200 labor hours available. What is the best combination of furniture cabinets to be made to make maximum profit?

a) Please formulate this problem as a LP.
   - MUST define the decision variables first! Then, identify the objective function and constraints.
b) Solve this problem using graphical method.
c) Solve the problem using LINDO or Solver and attach the output.
d) Please explain the diet plan based on your LP model's input and output.

2. Diet Problem

A diet is a combination of available foods to be consumed daily while it must meet the minimum daily requirements (MDR) of each nutrient. It is a classic problem formulated as an LP, and published by G. J. Stigler under the title "The cost of subsistence" in the journal of Farm Economics, vol. 27, 1945. He considered 77 different available foods; the model had 77 decision variables subject to nine inequality constraints.

Stigler found an approximate solution with a trial and error search procedure. The annual cost he found was $39.93 in 1939 prices. After Dantzig developed the simplex algorithm in 1947, it gave the optimum with an annual cost of $39.67 in 1939 prices. Stigler won the 1982 Nobel Prize in economics for his work on the diet problem.

Here is data for a simplified diet problem.

Nutrient	Nutrient units/kg of grain type		MDR of nutrient in units
	White Rice	Brown Rice	
Potassium (mg)	3	5	8
Protein (mg)	8	12	50
Dietary fiber (mg)	3	9	25
Cost ($/kg) of food	0.78	0.95	

a) Please formulate this problem as a LP to find the minimum cost while satisfying the MDR.
   - MUST define the decision variables first! Then, identify the objective function and constraints.
b) Solve this problem using graphical method.
c) Solve the problem using LINDO or Solver and attach the output.
d) Please explain the diet plan based on your LP model's input and output.

3. Simple Blending Problem

There is a company to make mixed juice products. The company wants to maintain the taste of juice by adding and mixing juices, such as orange, banana and pineapple. The sugar content of three juices – orange, banana, and pineapple – is 15, 18, 25 percent, respectively. The cost per quart is 20 cents for orange juice, 30 cents for banana juice, and 40 cents for pineapple juice. How many quarts of each must be mixed together to achieve one gallon (four quarts) that has a sugar content of at least 19 percent to minimize cost?

a) Please formulate this problem as a LP to find the minimum cost while satisfying the sugar content.
    - MUST define the decision variables first! Then, identify the objective function and constraints.
b) Solve the problem using LINDO or Solver and attach the output.
c) Please explain the blending plan based on your LP model's input and output.

1. Find extreme point(s) at the interval (-∞,∞) and decide if the extreme points are min or max.

a) $f(x) = x^2 + x - 6$

b) $f(x) = x^3 + x^2$

2. Use Graphical method to solve the following problems

- Draw a graph
- Identity the feasible area
- Find all corner point feasible solutions (CPFS) and identify the optimal solution if they have any

a) Max x1 + x2
s.t.
2x1 + 5x2 <= 5
x1 + x2 <= 5
3x1 + x2 <= 15

x1, x2 >= 0

b) Min x1 + x2
s.t.
-x1 + x2 <= 5
x2 <= 3
3x1 + x2 >= 7
x1, x2 >= 0