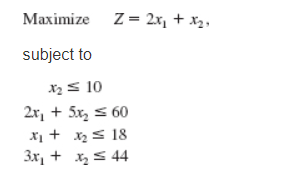
1. Use Microsoft Excel solver to solve the following problem. Report the decision variable values and objective value.



2. The Simpson’s & Sons Financial Company is introducing two new product lines: special risk insurance and mortgages. The expected profit is $5 per unit on special risk insurance and $2 per unit on mortgages.

Management wishes to establish sales quotas for the new product lines to maximize total expected profit. The work requirements are as follows:

|  |  |  |
| --- | --- | --- |
| **Work-Hours per Unit** | |  |
| **Department** | **Special Risk** | **Mortgage** | **Work-Hours Available** |
| Underwriting | 3 | 2 | 2400 |
| Administration | 0 | 1 | 800 |
| Claims | 2 | 0 | 1200 |

a. Formulate a linear programming model for this problem (You need to clearly define decision variables, generate the objective function and constraints).

**Decision variables;**

**Objective function;**

**Constraints;**

Underwriting

Administration

Claims

b. Solve the problem using excel solver. Report the decision variable and objective values.

c. Check the sensitivity analysis report. Analyze the shadow prices.



For the first equation underwriting: The shadow price is $1. This means that if we increase the RHS of this constraint by one unit, the objective function value would increase by $1 unit. Similarly, if you decrease the RHS by one unit, the objective function value would decrease by $1. The allowable increase in the RHS is $1000, and the allowable decrease is $600.

For the second equation administration: The shadow price is 0. This shows that changing its RHS does not affect the objective function value. The allowable increase in the RHS is very large, implying that increasing the RHS does not impact the solution. However, decreasing the RHS by 800 units would make this constraint binding, and it would start to impact the objective function.

For the third equation claims: The shadow price is $1. Like the interpretation of shadow price for first equation, increasing the RHS by one unit would increase the objective function value by approximately $1, and decreasing the RHS by one unit would decrease the objective function value by approximately $1. The allowable increase in the RHS is $400, and the allowable decrease is approximately $666.67.

3. Jason has decided to go on a steady diet of only steak and potatoes (plus some liquids and vitamin supplements) for all his meals. He realizes that this isn't the healthiest diet, so he wants to make sure that he eats the right quantities of the two foods to satisfy some key nutritional requirements. He has obtained the nutritional and cost information shown at the top of the next column.

|  |
| --- |
|  |
| **Grams of Ingredient per Serving** | |  |
| **Ingredient** | **Steak** | **Potatoes** | **Daily Requirement (Grams)** |
| Carbohydrates | 5 | 15 | ≥ 50 |
| Protein | 20 | 5 | ≥ 40 |
| Fat | 15 | 2 | ≤ 60 |
| Cost per serving | $8 | $4 |  |

Jason wishes to determine the number of daily servings (may be fractional) of steak and potatoes that will meet these requirements at a minimum cost.

(a) Formulate a linear programming model for this problem (You need to clearly define decision variables, generate the objective function and constraints).

**Constraints;**

Carbohydrates

Protein

Fat

(b) Use a Excel solver to solve this model by the simplex method.

4. You would like to invest up to $1, 000. You can invest your money in stocks and loans. Each dollar invested in stocks yields 10 cent profit, and each dollar invested in a loan yields 5 cent profit. At least 30% of all money invested must be in stocks, and at least $400 must be in loans.

a. Formulate an LP that can be used to maximize total profit earned from your investment (You need to clearly define decision variables, generate the objective function and constraints).

Decision variables:

Constraints:

b. Solve the linear problem using Excel solver.