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**Project 1**

1. Formulate an LP model for this problem (i.e., List what is the objective variable, what are the decision variables, what should be the objective function, and list the constraints in a mathematics way.)

**Objective variable**: Meeting market demand in order to reach maximum profit

**Decision variables**:

Let’s consider

* X1, pounds of Whole
* X2, pounds of Cluster
* X3, pounds of Crunch
* X4, pounds of Roasted

We know the selling price and the cost price of each product; therefore, we can determine the profit of selling one unit of each product.

We can then establish the following relationship:

**Objective Function**

Let’s call y, the maximum profit MNC can make:

Y = (5-3.15)X1+ (4-2.60)X2+ (3.20-2.16)X3+ (4.50-3.10)X4

Y = 1.85 X1 + 1.40 X2 + 1.04 X3 + 1.40 X4

**Constraints**:

1. Maximum and Minimum production quantity constraints:

MNC needs to produce at least 1000 pounds of the Whole product, between 400 and 500 pounds of the Cluster product, no more than 150 pounds of the Crunch product, and no more than 200 pounds of the Roasted product.

X1>=1000

400<=X2<=500

X3<=150

X4<=200

1. Ingredient’s constraints

Each pound of the Whole, Cluster, Crunch, and Roasted product contains, respectively, 60%, 40%, 20%, and 100% macadamia nuts with the remaining weight made up of chocolate coating

* Macadamia nuts constraint 0.6X1 +0.4X2 + 0.2X3 + 1X4 <= 1100
* Chocolate constraint 0.4X1 + 0.6X2 + 0.8X3 + 0X4 <= 800

1. Machine Hours constraints

Each machine has 60 hours of time available in the coming week

* Hulling 1X1 + 1X2 + 1X3 + 1X4 <= 3600
* Roasting 2X1 + 1.5X2 + 1X3 + 1.75X4 <= 3600
* Coating 1X1 + 0.7X2 + 0.2X3 + 0X4 <= 3600
* Packaging 2.5X1 + 1.6X2 + 1.25X3 + 1X4 <= 3600

Let’s assume all decision variables are positive

1. Create a spreadsheet model for this problem and solve it using Solver.

See excel sheet

**c.** What is the optimal solution?

According to solver, the optimal solution is:

For MNC to reach maximum profit, they need to produce

X1 = 1000 pounds

X2= 500 pounds

X3= 80 pounds

X4= 200 pounds