MSIS 638

Jia Liang Ma

Case3.2ai

1. A coffee manufacturing company needs to blend three types of coffee to produce their new coffee brand. The cost of the three types and their characteristics along with the requires range for each characteristic are as follows. What do you think should be objective function in this problem?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Acidity (0-9) | Bitterness (0-9) | Aroma (0-9) | Cost ($/lb.) |
| Type 1 | 4 | 8 | 6 | 0.95 |
| Type 2 | 6.5 | 6 | 9 | 1.25 |
| Type 3 | 8 | 4 | 7 | 1.15 |
| Range |  |  |  |  |

In my option, the objective function would be the total cost and profit of these three coffee types blended.

1. What are the decision variables? Clearly define the decision variables (*remember to include the unit of the decision variables*)*.* Pick a notation for each decision variable.

The decision variables are the variable that need to be decided as main decisions in an optimalization problem. In this case, the decision variables are the total number of types of coffee produced and mixture. Another is its total costs.

The total profit: y = ax1 + bx2 + cx3 (Max)

The costs of three types blended:　0.95x1+1.25x2+1.15x3 (Min)

1. What are the constraints? Remember to include the non-negativity constraints as well. *Hint: You also need a constraint to make sure the sum of all types will be exactly equal to 1 lb.*

For the constraints, acidity larger than 5.5, bitterness and aroma between 7 and 8 are the constraints. Also, the last constraints will be the total weight for 1 lb.

1. Write the whole formulation (i.e., the objective function and the constraints).

Min 0.95x1+1.25x2+1.15x3 (The cost)

x1 + x2 +x3 = 1 lb. (Total weight)

x1 + x2 + x3 ≥ 0 (Nonnegativity)

4x1 + 6.5x2 + 8x3 ≥ 5.5 (Acidity)

8x1 + 6x2 + 4x3 ≤ 7 (Bitterness)

1. ≤ 6x1 + 9x2 + 7x3 ≤ 8 (Aroma)
2. The supplier of the three coffee types imposes another restriction indicating that the amount of type 1 must be at least twice the amount of type 2. How can this constraint be written in terms of the decision variables?

ax1 + 2ax2 + bx3 = 1 lb. (x1 ≥ 2x2)

1. The regulatory rules require that at most 30% of the blend be of type 3. How can this constraint be written in terms of the decision variables?

ax1 + 2ax2 + 0.3x3 = 1 lb.

1. The environmental protection regulations require that type 1 in the blend be no more than types 2 and 3 combined. How can this constraint be written in terms of the decision variables?

ax1 ≤ 2ax2 + 0.3x3 => x1 ≤ 2x2 + (0.3/a) x3