201110 Intrgrated Math SC

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Optimization

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Optimization Model

1. Decision variables
2. Ojective function(s)
3. Constraints

- Optimal Solution
- Feasible Solution

Example

1. We need to enclose a field with a fence. We have 500m of fencing material and a building is on one side of the field and so won't need any fencing. Determine the dimensions of the field that will enclose the largest area.

Example

2. We want to construct a box whose base length is 3 times the base width. The material used to build the top and bottom cost 10 baht/ ft^2 and the material used to build the sides cost 6 baht/ft^2. If the box must have a volume of 50 ft^3 determine the dimensions that will minimize the cost to build the box.

Example

3. We want to construct a box with a square base and we only have 10 m^2 of material to use in construction of the box. Assuming that all the material is used in the construction process determine the maximum volume that the box can have.

Linear Programming

Linear Programming

Decision variables -- X

Ojective function $\max\{c^T X\}$ or $\min\{c^T X\}$

Constraints $AX \leq b$

$X \geq 0$

Linear Programming in 2D

Example of Linear Programming

1. A company manufactures 3 products a, b and c, which sells €14, €15 and €22 per unit respectively. These prices are constant and independent of the market state they are addressed to, and it is also supposed that any produced quantity can be sold. For the manufacturing of these products four types of raw materials are required. The prices of raw materials, the raw material units needed for each product type and the corresponding available quantities within a certain time period are included in the following table.

Raw material	Unit price (€)	Products			Available raw material units
		a	b	c	
1	3	0	2	3	50
2	2	3	2	1	200
3	0. 5	4	4	6	200
4	1	0	0	2	100

The company's goal is to determine the quantities of each product which should be produced in order to achieve the highest profit. Define in detail the decision variables and form the objective function and all constraints of the problem.

2. The management of an industry, in which some machines are under employed, considers the case to produce the products 1, 2 and 3 during the idle time of the machines. This time is estimated at 500, 350 and 150 machine hours per week for machine types A, B and C respectively. The machine hours needed for the production of each product unit are presented in the table below. The sales department estimates that the demand of products 1 and 2 higher than the production capacity, while the sales of product 3 cannot exceed 20 units per week. This department also predicts that the profit from the sale of each unit of product 1, 2 and 3 is €30, €12 and €25 respectively.

Machines \ Product	1	2	3
A	9	3	5
B	5	4	0
C	3	0	2

Which mathematical model should solve the industry to identify the quantities of products that should be produced, in order to maximize the net profit?

References

- http://tutorial.math.lamar.edu/Classes/CalcI/Optimization.aspx
- http://aetos.it.teithe.gr