MB106
QUANTITATIVE TECHNIQUES

MODULE I

LECTURE 1

Linear Programming: Introduction, Formulating minimization problems

LINEAR PROGRAMMING

- Linear Programming deals with the optimization(maximization/minimization) of a function of variables known as OBJECTIVE FUNCTION
- Subject to a set of linear equalities and/or inequalities known as CONSTRAINTS

LINEAR PROGRAMMING CAN BE USED WHEN...

- A well defined objective function which must either be maximized or minimized exists.
- Objective can be expressed as a linear function of decision variables.
- Constraints on the extent of achievement of objectives exists.
- Constraints should be linear equalities or inequalities
- Decision variables should be non-negative.

FORMULATION OF LINEAR PROGRAMMING MODEL –A MINIMIZATION PROBLEM

- A company has two grades of inspectors 1 and 2 to undertake quality control inspection. At least 1500 pieces must be inspected in an 8 hour day. Grade 1 inspector can check 20 pieces in an hour with an accuracy of 96%. Grade 2 inspector checks 14 pieces an hour with an accuracy of 92%. The daily wages of grade 1 inspector are Rs. 5/- per hour while those of grade 2 inspector are Rs. 4/- per hour. An error made by an inspector costs Rs. 3/- to the company. If there are 10 grade 1 inspectors and 15 grade 2 inspectors, in all, find the optimal assignment of inspectors that minimize the daily inspection cost.

FORMULATION OF LINEAR PROGRAMMING MODEL –THE SOLUTION(OBJECTIVE FUNCTION)

- To find: number of grade 1 and 2 inspectors
- Let x_1 be the number of grade 1 inspectors
- Let x_2 be the number of grade 2 inspectors
- Therefore $x_1 \geq 0$, $x_2 \geq 0$ →non-negativity constraints
- The objective-Minimization of daily inspection cost
- Cost of grade 1 inspector per hour→Rs(5+3x0.04x20)=Rs. 7.40
- Cost of grade 2 inspector per hour→Rs(4+3x0.08x14)=Rs. 7.36
- Therefore the objective function is

Minimize $Z=8(7.40\ x_1 +7.36\ x_2)=59.20\ x_1 +58.88\ x_2$

FORMULATION OF LINEAR PROGRAMMING MODEL –THE SOLUTION(CONSTRAINTS)

- $x_1 \leq 10$ →number of grade 1 inspectors
- $x_2 \leq 15$ →number of grade 2 inspectors
- 20x8 x_1 +14x8 $x_2 \geq 1500$ or $160x_1 + 112x_2 \geq 1500$ →pieces inspected daily

FORMULATION OF LINEAR PROGRAMMING MODEL –THE MODEL

Minimize $Z=59.20\ x_1 + 58.88\ x_2$

Subject to

$x_1 \geq 0, x_2 \geq 0$ → non-negativity constraints

$x_1 \leq 10$ → number of grade 1 inspectors

$x_2 \leq 15$ → number of grade 2 inspectors

$160x_1 + 112x_2 \geq 1500$ → pieces inspected daily

- TILL WE MEET AGAIN IN THE NEXT CLASS.....