Advance Engineering Mathematics(AEM)

Branch :Information Technology, Sem:IIIrd

Dr. Kashish Parwani

Associate Professor, Dept. of Mathematics

JECRC, Sitapura Jaipur

Vision of the Institute

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities

Mission of the Institute

- Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.
- Identify, based on informed perception of Indian, regional and global needs, the areas of focus and provide platform to gain knowledge and solutions.
- Offer opportunities for interaction between academia and industry.
- Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders may emerge.

Course Outcomes

- **CO2:** To learn the formulation of different mathematical problems into optimization problems.
- **CO3:** Apply the principles of optimization using differential calculus.
- **CO4:** To understand the concepts of Linear Programming
- **CO1:** To learn the concepts and principles of Random variables and Probability distribution.

Linear Programming

- Simplex Method
- Two Phase Method,
- Duality in Linear Programming,
- Assignment Problems,
- Transportation Problems

Dr. Kashish Parwani
Associate Professor (Mathematics, JECRC, Jaipur

Simplex Method

- When decision variables are ***more than 2,*** *it is always advisable to use Simplex Method of avoid lengthy graphical procedure.*
- *The simplex method is not used to examine all the feasible solutions.*
- *I deals only with a small and unique set of feasible solutions the set of vertex points (i.e. extreme points) of the convex feasible space that contains the optimal solution*
- *The most popular method used for the solution of Linear programming problesm (LPP) is the simplexmethod. Simplex method is developed by George Dantigin 1946*
-

When decision variables are ***more than 2,*** we always use Simplex Method

❑ **Slack Variable:** Variable added to a ≤ constraint to convex it to an equation (=).

❖ A slack variable represents unused resources .

❖ A slack variable contributes nothing to the objective function value.

❑**Surplus Variable:** Variable subtracted a ≥ constraint to convert it to an equation (=).

❖ A surplus variable represents an excess above constraint requirement level.

❖surplus variables contribute nothing to the calculated value of the objective function.

- **Basic Solution (BS) :** This solution is obtained by setting any n variables (among m+n variables) equal to zero and solving for remaining ***m*** variables, provided the determinant of the coefficients of these variables is non-zero. Such ***m*** variable are called **basic variables a**nd remaining *n zero* valued variables are called **non basic variables**
- **Basic Feasbile Solutio (BFS)** : It is a basic solution which also satisfies the non negativity restrictions.

- **BFS are of two types :**
  - ***Degenerate BFS*** : If once or more basic variables are zero
  - ***Non-Degenerate BFS*** : All basic variables are non-zero.

Optimal BFS: BFS which optimizes the objective function

Examples:

$$\text{Max. } Z = 13x_l + 11x_2$$

Subject to constraints:

$$4x_1 + 5x_2 \leq 1500$$

$$5x_1 + 3x_2 \leq 1575$$

$$x_1 + 2x_2 \leq 420$$

$$x_1 , x_2 \geq 0$$

- **Step 1:** Convert all the inequality constraints into equalities by the use of slack variables

  Let S_1, S_2, S_3 be three slack variables.

  Introducing these slack variables into the inequality constrains and rewriting the objective function such that all variables are on the left-hand side of the equation. Model can rewritten as :

$$Z - 13x_1 - 11x_2 = 0$$

Subject to Constraints:

$$4X_1 + 5X_2 + S_1 = 1500$$

$$5X_1 + 3X_2 + S_2 = 1575$$

$$X_1 + 2X_2 + S_3 = 420$$

$$X_1 , X_2 , S_1 , S_2 , S_3 = 0$$

Reference:

- https://www.slideshare.net/sachin.mk/simplex-method
- Engineering Mathematics III CS/IT Engineering

Vardhan Publication

Thank You

Dr. Kashish Parwani
Associate Professor (Mathematics, JECRC, Jaipur