Subject: Business Economics

Course: B.A., 6th Semester, Undergraduate.

Paper No: 631

Paper Title: Advance Mathematical Techniques.

Unit No.: 3 (Three)

Title: Linear Programming.

Lecture No: 1 (One)

Title: Duality in Linear Programming.

Summary

- For every LPP, there is another LPP called the primal and dual respectively. When the primal is maximization problem, the dual is a minimization problem and vice versa.
- For an $m-$variables and $n-$constraints primal, the dual has $n-$variables and $m-$constraints.
- To write the dual, ensure that all its constraints are with "≤" sign when the objective function is of maximization and variables are all non-negative.
- A constraint of the type "≥" should be multiplied by '– 1' to have "≤" sign, while a constraint with an "=" sign is to be replaced by a pair of inequalities with "≤" and "≥".
- An unrestricted variable is set equal to the difference of two non-negative variables.
- When all the conditions given above are satisfied, dual variables are introduced and three matrices involved in the primal are transposed. For every unrestricted variable in the primal, the dual has an equation in one of the constraint, while for every constraint as equation, the dual has an unrestricted variable.
- If the primal has an optimal solution, then the dual also has an optimal solution with same value of the objective functions.
- If the primal has an infeasible solution, the dual will have an infeasible solution and vice versa.
- The $z_j - C_j$ values (ignoring minus signs) corresponding to the slack/surplus variables of the primal problem represent optimal values of the dual variables.

The $z_j - C_j$ values (ignoring minus signs) corresponding to the slack/surplus variables indicate the marginal profitability or shadow prices of the resources/variables they are related to. Thus, the shadow price of a given constraint of an LPP is the amount by which the optimal value of the objective function is improved if the right hand side of the constraint is increased by one unit.