

[Summary]

Game Theory

Subject:

Business Economics

B. A., 4th Semester,

Course:

Paper No. & Title:

Unit No. & Title:

Undergraduate

Paper – 403 Quantitative Techniques for Management

Unit – 4 Theory of Game, Decision Theory and Decision Analysis

Lecture No. & Title:

Lecture – 1 (One) Game Theory

Summary

- The competitive situations with two or more competitors, having conflicting interest and where the action of one depends upon the action taken by the other, are known as **competitive games**. The competitors are called **players**. A player may be individual, a group of individuals or an organization.
- If a game involves only two players, then it is called a twoperson game. And if the numbers of players are more than two, the game is called n-person game.
- If in a game the gains of one player are exactly equal to the losses of another player, so that the sum of gains and losses equals zero, then the game is called a **zero sum game**.
- Pure strategy: It is a decision rule which is always used by the player to select the particular course of action. Thus each player knows in advance of all strategies out of which he always selects only one particular strategy irrespective of the strategy others may choose. The objective of the players is to maximize gains and minimize losses.
- Mixed strategy: When both the players are guessing as to which course of action is to be selected on a particular circumstance with some fixed probability, it is a mixed strategic game. The objective of the players is to maximize expected gains or to minimize expected losses.

- **Two person zero sum game:** A game with only two players, say player A and player B is called a two-person zero sum game, if say player A's gain is equal to the loss of player B, so that total sum is zero.
- The payoffs in terms of gains or losses, when players select their particular strategies, can be represented in the form of a matrix, called the **payoff matrix**.

• Pure Strategies: Games with saddle point

When maximin value = minimax value, the corresponding pure strategies are called optimal strategies and game is said to have a saddle point and game is strictly determinable.

In general maximin value \leq value of the game \leq minimax value. If the value of game is zero, the game is said to be **fair**.

Mixed Strategies: Games without saddle point

A game which is not strictly determinable i.e. without saddle point is solved by adopting mixed strategies. The optimal strategy mixture for each player is determined by assigning to each strategy its probabilities of being chosen. The strategies so determined are called mixed strategies because they are probabilistic combination of available choice of strategy.

• Algebraic Method

The optimal strategies for player A is $\begin{bmatrix} A_1 & A_2 \\ p_1 & p_2 \end{bmatrix}$ and optimal strategies for player B is $\begin{bmatrix} B_1 & B_2 \\ q_1 & q_2 \end{bmatrix}$. $p_1 = \frac{a_{22} - a_{21}}{(a_{11} + a_{22}) - (a_{12} + a_{21})}$; $q_1 = \frac{a_{22} - a_{12}}{(a_{11} + a_{22}) - (a_{12} + a_{21})}$ and $p_2 = 1 - p_1; q_2 = 1 - q_1$

Value of game is $v = \frac{a_{11}*a_{22}-a_{12}*a_{21}}{(a_{11}+a_{22})-(a_{12}+a_{21})}$

• Dominance rules

The rules of dominance are used to reduce the size of the payoff matrix. These rules help in deleting certain rows and/or columns of the payoff matrix which is inferior to atleast to one of the remaining rows and/or columns in terms of payoffs to both the players.