GAME THEORY

Solution of a game

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1. **What is a Strategy?**
   Ans : The strategy of a player is the predetermined rule by which he or she decides his course of action from the list of all possible actions available with him or her during the game. In other words a player's **strategy** is any of the options which he or she chooses in a setting where the outcome depends *not only* on their own actions *but* on the actions of others.
2. **What are the different types of strategies?**

Ans: In a game involving two players i.e. Two person Game there are four types of different strategies. They are discussed below.

a) Pure Strategy: A Pure strategy is a decision, in advance of all plays, always to choose a particular course of action. In other words a pure strategy is one in which a player of a game takes a specific action to maximize his payoff or makes specific strategy to increase their payoff.

b) Mixed Strategy: A Mixed strategy is a decision, in advance of all plays, to choose a particular course of action for each play in accordance with some particular probability distribution. It is one in which a player makes random choice between two or more possible actions that can be taken but those actions taken are based on a set of chosen probabilities. The basic difference between pure strategy and mixed strategy is that in pure strategy people makes specific actions but in mixed strategy actions are taken randomly or actions are based on probabilities.

c) Dominant Strategy: Dominant strategy is a strategy which is optimal regardless of what other players do. It means the player performs an action without caring about his competitor`s action or he simply doesn`t care about what other players do , he is only concerned with maximizing his own payoff.

d) Nash Equilibrium: Nash equilibrium is a set of actions or strategies. Actions taken by each player, who is doing the best he can, given the actions of their opponents. In other words one of the player's doesn't have any strategy of his own. He just follows whatever his opponent, the dominant player chooses.

In conclusion we can say that in a game all the players have only one strategy , that is maximize his profit and minimize his loss. Thus all the strategies mentioned above are special cases of Mixed Strategy.

3. **What are the Maximin and Minimax criteria of Optimality ?**

   Ans: The Maximin and Minimax criteria of optimality is based on the principle – " If a player lists his worst possible outcomes of all his potential strategies then he will choose that strategy which corresponds to the best of these worst outcomes.

   Maximin Criterion of Optimality:

   The maximin criterion involves selecting the alternative that maximises the minimum pay-off achievable. The player would look at the worst possible outcome at each strategy or course of action, and then selects the highest among of these. The player therefore chooses the maximum value from all his minimum profits. Thus Maximin stands For Maximise your minimum profit. This strategy is adopted by the winning player in a two person game. **In a pay off matrix of a two person game Maximin is the Maximum of the row minima.**

   Minimax Criterion of Optimality:

   The minimax criterion involves selecting the alternative that minimises the maximum pay-off achievable. The player would look at the best possible outcome at each strategy or course of action, and then selects the lowest among of these. The player therefore chooses the minimum value from all his maximum losses. Thus minimax stands For minimise your maximum loss. This strategy is adopted by the losing player in a two person game. **In a pay off matrix of a two person game Minimax is the Minimum of the column Maxima.**

4. **What is a saddle point?**

   Ans: The Saddle point in a payoff Matrix is that position which is simultaneously a row minimum and a column maximum. In other words at the saddle point maximum of the row minima coincide with the minimum of the column maxima . At a saddle point the Maximin coincides with the Minimax.

5. **What is the Value of a game ? What if a fair game?**

   Ans : The cell entry or Pay –off at the saddle point is called the value of the game. It gives the amount of win or profit of the winning player and the quantum of loss of the losing player.

   The fair game is one whose value is 0 (zero). In a fair game neither player wins.

6. **Explain how a game with a saddle point is solved using Pure strategy.**

   Ans: A two person game with a saddle point is solved using the pure strategy. The point where Maxinmin coincides with Minimax is the saddle point of the game. The game is solved when the saddle point is found out and the value of the game is expressed. Following steps are followed to find the Saddle point of a game-

   a) Select the minimum element or lowest value in each row and encircle them .i.e. enclose the lowest value in each row within a circle ◯ .
   b) Select the maximum element or highest value in each column and enclose them within a small square.i.e. Enclose the highest value in each column within a small square ▭.

c) The point which is enclosed by both a circle and a square is the saddle point. 

d) The Cell entry at the saddle point is the value of the game.