Operations Research-II Game Theory Games with saddle point

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Game Theory

Important Concepts:

- Game: A Competitive Environment
- Player: A Competitor in a game
- Two-Person Zero-Sum Game:

A Game involving only two persons and

gain of one player=loss of other player

- Strategy: Any action of a competitor
- Optimum Strategy: which maximizes the gain or minimizes the loss of a player
- Pure Strategy: A strategy that always (certainly) opted by a player to optimize his gain/loss
- Mixed Strategy: A strategy that a player opts uncertainly (with some probability) to optimize his gain/loss

Determistic Games: Games with Pure Strategies

i.e., Games in which the two players attempt the game always with specific strategies

Probabilistic Games: Games with Mixed Strategies

i.e., Games in which the two players attempt the game probably with different strategies

- Payoff: An outcome of a game
- Payoff Matrix: A matrix formed by the payoffs of all combinations of strategies of the two players.

Ex:	Strategy of A/B	B1	B2	B3
	A1	4	6	-2
	A2	3	0	3
	A3	-2	6	9

The payoffs in the above matrix are the gains of the player A (losses of B)

Gain of A for (A1,B1) = 4 = loss of B

- ** Payoff Matrix is simplest toll to solve the games.
- Value of the game: It is the result of the game

Games with Saddle Point and solution:

If the games are determistic, then there exists a saddle point for the players.

The saddle point describes the solution of the game.

The saddle point may not be unique.

The saddle point can be obtained by a principle which is called

Maximin-Minimax principle.

Maximin-Minimax Principle:

If the payoffs in payoff matrix are the gains of Player A, then

Maximin principle says that the player A always tries to maximize his minimum gains corresponding to the opponent strategies.

Minimax principle says that the player B always tries to minimize his maximum losses corresponding to the opponent strategies.

Finding Saddle Point:

- Find row minimums -> find maximum of these minimums. It is maximin value
- Find column maximums -> find minimum of these maximums. It is minimax value
- Identify the pair of strategies for which maximin=minimax.
- The point corresponding to the pair is the saddle point.
- > The pair of strategies are the pure strategies
- Value = maximin/minimax value
- Note: If maximin ‡ minimax, the game an not be determined strictly by this way. Where we will discuss games without saddle points later



Strategy of A/B	B1	B2	B3
A1	4	6	2
A2	5	0	-3
A3	-2	6	1

Strategy of A/B	B1	B2	B3	Row Min
A1	4	6	2	2 -> Max (maxmin)
A2	5	0	-3	-3
A3	-2	6	1	1
Column max	5	6	2 -> Min (minimax)	

So, maximin = minimax = 2= value

and optimum pure strategies are A2 and B3.