© 2018 IJSRST | Volume 4 | Issue 10 | Print ISSN : 2395-6011 | Online ISSN : 2395-602X
Themed Section: Science and Technology

3×3 Game Problem Using Linear Programming Problem

[1]Mohanraj N, [2]Srividhya B
[1]Department of Mathematics, Dr. SNS Rajalakshmi College of Arts and Science, Coimbatore, Tamil Nadu, India
[2]Assistant Professor, Department of Mathematics, Dr. SNS Rajalakshmi College of Arts and Science, Coimbatore, Tamil Nadu, India

ABSTRACT

In this paper, a discussion has been done about the 3×3 game problems by using LPP, which does not satisfy the saddle point conditions and calculated the optimal strategy and value of the game.Considering the far wide applications of game theory it becomes essential to establish the most effective method of optimization of games.
Keywords : Game Problem, Optimal Strategies, Linear Programming Problem, Value of the Game.

I. INTRODUCTION

The branch of mathematics concerned with the study of mathematical moels of strategic interaction between rational decision makers.In Linear programming problem ,the objective is either maximization or minimization of the objective function. Each player is trying to maximize his profit and minimize his lost

BASIC CONCEPTS:

Linear programming problem:
It is a method to achieve the best outcome (such as Maximum profit or lowest cost in a mathematical model), whose requirements are represented by a linear relationships.

Optimal Strategies:
Strategies for all players which fully specifies all actions in a game.A strategy profile must include one an only one strategy for every player.

Value of the game:
The saddle point payoff is called the value of the game.

Mixed strategy:
In case when the game is unstable and no saddle point is reached, there is no pure strategy for player.

PROBLEM:

Consider a 3×3 game problem which does not have a saddle point.

	PLAYER B		
PLAYER A	3	-4	2
	1	-3	-7
	-2	4	7

Solution:
Value of the game lies between -2 and 3.Hence it does not satisfy the saddle point. So we are taking C=3 and adding the value in game problem.

	Player B		
Player A	6	-1	5
	4	0	-4
	1	7	10

Converting a game problem into a LPP standard form and it can be written as,

Max Z = Y_1+Y_2 + Y_3 + $0S_1$ + $0S_2$ + $0S_3$

$6Y_1$-Y_2+$5Y_3$+S_1=1

$4Y_1$+Y_2-$4Y_3$+S_2=1

Y_1+Y_2+$10Y_3$+S_3=1

$Y_1 \geq 0$ $Y_2 \geq 0$ $Y_3 \geq 0$

INITAL ITERATION:

C_B	Y_B	X_B	Y_1	Y_2	Y_3	S_1	S_2	S_3
0	S_1	1	6	-1	5	1	0	0
0	S_2	1	4	0	-4	0	1	0
0	S_3	1	1	7	10	0	0	1
		Zj-Cj	-1	-1	-1	0	0	0

FIRST ITERATION:

C_B	Y_B	X_B	Y_1	Y_2	Y_3	S_1	S_2	S_3
0	S_1	8/7	43/7	0	45/7	1	0	1/7
0	S_2	1	4	0	-4	0	1	0
1	Y_2	1/7	1/7	1	10/7	0	0	1/7
	Zj-Cj		-6/7	0	3/7	0	0	1/7

S_1 →leaves ,Y_1→enter

FINAL ITERATION:

C_B	Y_B	X_B	Y_1	Y_2	Y_3	S_1	S_2	S_3
1	Y_1	8/43	1	0	45/43	7/43	0	1/43
0	S_2	11/43	0	0	-352/43	-28/43	1	-4/43
1	Y_2	5/43	0	1	1/43	-1/43	0	6/43

Y_1+Y_2 + Y_3= $\frac{8}{43}$ + $\frac{5}{43}$+ 0 = $\frac{13}{43}$ =$\frac{1}{V}$

V=$\frac{43}{13}$

Considering Player A as p_1, p_2, p_3 and Player B as q_1, q_2, q_3.

Prob of strategy q_1=Y_1×V=$\frac{8}{43}$×$\frac{43}{13}$= $\frac{8}{13}$

q_2=Y_2×V = $\frac{5}{43}$×$\frac{43}{13}$=$\frac{5}{13}$

q_3=Y_3×V = 0×V=0

Real value of the game

V'=V-3= $\frac{43}{13}$-3= $\frac{4}{13}$

Dual variables with respect to player is X_1 , X_2, X_3

$X_1 = \frac{6}{43}$, $X_2 = 0$, $X_3 = \frac{7}{43}$

$p_1 = X_1 \times V = \frac{6}{43} \times \frac{43}{13} = \frac{6}{13}$

$p_2 = X_2 \times V = 0 \times V = 0$

$p_3 = X_3 \times V = \frac{7}{43} \times \frac{43}{13} = \frac{7}{13}$

$X_1 + X_2 + X_3 = \frac{6}{43} + 0 + \frac{7}{43} = \frac{13}{43}$

$V = \frac{43}{13}$

Value of game= $\frac{43}{13} - 3 = \frac{4}{13}$

II. CONCLUSION

In this paper a 3×3 Game problem in the game theory can be solved by Linear programming problem method. It has been observed that the optimal strategies and value of the game for the players are calculated and same when comparing the solution.

For Player A and Player B:

optimal strategies => $p_1 + p_2 + p_3 = 1$ and $q_1 + q_2 + q_3 = 1$

Value of the game => $\frac{4}{13}$

III. REFERENCES

[1]. Richard Bronson, "Theory and problems of operation research", Mc-Graw Hill publications Singapore,1983.

[2]. M.V.Subba Rao-Dept of mathematics, ANITS, Visakhapatnam, India

[3]. M.N.R.Chowdary-Dept of physical education, GITAM University, Hyderbad, India and J. Vijayasekhar -Dept of mathematics, GITAM University, Hyderabad, India-Two person zero sum game problem solution:Integer Simplex Method(2017).

[4]. S. Kalavathy, Operations research. second edition, Vikas publishing House, India,(2004)