

BEST OF SUBJECT CATEGORY AWARD MATHEMATICS – DELHI NATIONAL FAIR

Arbitrating Disputes Using Mathematical Modeling

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Aim of Project: The Management and Labour often negotiate with each other on various aspects such as wage, bonus etc. Each side has considerations it wishes to get from the other. Labour asks for increase in wages, annual incentives, bonus, and overtime payment while the Management is concerned that unless productivity is increased and Labour produces quality products it will not be able to sustain the business. The Management may also wish to automate some parts of the production process that will result in loss of jobs. Very often in such situations, negotiations are long drawn and tedious.

The aim of this project is to study if mathematical modeling can be used to resolve disputes between two such negotiating parties.

Procedure used: The pre-requisite knowledge of mathematics required is calculus, co-ordinate geometry, linear programming and elementary utility theory. Mathematica will be used for numerical computations wherever required.

In our problem each party is presented with several options and they are asked to indicate their preferences. We attach utilities to the preferences given by both parties and establish a relationship between them that leads us to defining a utility function. Based on these utility functions we propose lotteries (compromises between the various options). We then draw the payoff polygon representing the various utilities and use Nash's arbitration scheme to arrive at the fairest solution to the problem.

Conclusion: The result show that it is possible to find a solution to an arbitration problem, which is fair to both parties using utility theory. Nash's scheme proposes that the 'north-east extreme corner' of the payoff polygon is the fairest solution. We verify this method and use calculus to maximize the 'value' attained by both parties.