Non-cooperative game theory as a decision-making tool in conflict situations and asymmetric information / Osman Abdel Ghani Mohamed.

NON-COOPERATIVE GAME THEORY AS A DECISION-MAKING TOOL IN CONFLICT SITUATIONS AND ASYMMETRIC INFORMATION

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NON-COOPERATIVE GAME THEORY AS A DECISION-MAKING TOOL IN CONFLICT SITUATIONS AND ASYMMETRIC INFORMATION

By

OSMAN ABDEL GHANI MOHAMED

Thesis Submitted in Fulfilment of the Requirements for the Degree of Master of Science in the Faculty of Science and Professional Arts
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December 1998

DEDICATION

This work is dedicated
to my parents

ACKNOWLEDGEMENTS

In the Name of God, Most Gracious, Most Merciful.

Praise be to Allah, the Lord of the Worlds, and Peace be upon the Master of the Apostles, his Family and Companions.

I would like to express my sincere gratitude to the chairman of my supervisory committee Assoc. Prof. Dr. Hj. Ismail bin Mohd, whose excellent supervision, invaluable guidance, continuous encouragement, and numerous discussion were instrumental for the completion of this work. I also would like to extend my gratitude to the other members, Prof. Dr. Hj. Mohd. Sahar Sawiran and En. Abd. Fatah Wahab for their kind interest and constructive comments to this work are greatly appreciated.

Acknowledgement is due to Universiti Putra Malaysia for offering to me Graduate Assistantship, which is helpful to pursue my master. Special gratitude to Upper Nile University and Sudan Government for granting permission and encouraging are highly appreciated.

I thanks my colleagues and all Post Graduate Student in UPMT for cooperation socially and academically during my study, I also would like to extend my thanks to all my friends and any one who has helped me directly or indirectly.

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SYMBOLS AND ABBREVIATION

$\mathbf{P}_i$	Player i
RHS	Right-hand side
LHS	Left-hand side
E(x)	Expected value of x
A, **B**	Matices
♦	End of definitions, theorems, etc.
φ_i	Payoff function of $\mathbf{P}_i$.
ϕ	Joint payoff function
N	Number of player
u_i	Action (Decision variable) of $\mathbf{P}_i$, $u_i \in U_i$.
γ_i	Strategy (decision law) of $\mathbf{P}_i$, $\gamma_i \in \Gamma_i$.
η_i	Information available to $\mathbf{P}_i$.
t	Time
$\mathbb{R}$	Real line
∂	Subdifferential

Abstract of the thesis submitted to the senate of Universiti Putra Malaysia in fulfillment of the requirements for the degree of Master of Sciences.

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By

Osman Abdel Ghani Mohamed

December, 1998

Chairman: **Assoc. Prof. Ismail Bin Mohd, Ph.D.**

Faculty: **Faculty of Science and Professional Arts**

The main purpose of this research is to study non-cooperative game theory as strategic decision making tool in conflict situations, with describing how to find solution to these models and to analyze asymmetric information.

The objective of dealing with the problem of decision making in conflict situations is to find optimal strategy among alternative strategies. Two approaches will be put into consideration; The mathematical modeling of the situation and computational solutions for these models.

Non-cooperative game theory renown for being encounter at once more common place, more interesting, and more difficult to analyze.

Therefore, a more detailed introduction to non-cooperative game theory and some of its theoretical ideas were introduced. The basic solution concepts and the

underlying theory were explained through some examples of basic kinds of some games.

Through the idea of reaction function together with relaxation algorithm and violated constraints method we proposed a method for computing non-cooperative equilibria in general synchronous games. To implement this idea a computer code was developed, and has been used successfully to solve some unconstrained and constrained game under open-loop information pattern. This code is referred to as Numerical Method Approach.

Relaxation methodology and violated constraints technique seem to be a useful method to increase the ability of game theory for solving more complex game theoretical problems.

The study continues with the way of modeling suggested by Rasmusen and a heavy use of principal-agent model to analyze asymmetric information. The structure and optimality of the contracts have been derived from the basic attributes such as taste, technologies, endowments and informational structure.