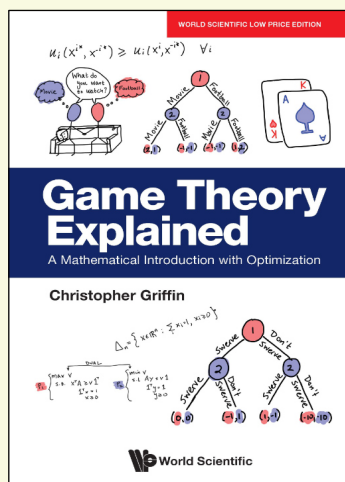


Game Theory Explained

A Mathematical Introduction with Optimization

By **Christopher Griffin**
(The Pennsylvania State University, USA)



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ABOUT THE BOOK

This book provides an introduction to the mathematical theory of games using both classical methods and optimization theory. Employing a theorem-proof-example approach, the book emphasizes not only results in game theory, but also how to prove them.

Part 1 of the book focuses on classical results in games, beginning with an introduction to probability theory by studying casino games and ending with Nash's proof of the existence of mixed strategy equilibria in general sum games. On the way, utility theory, game trees and the minimax theorem are covered with several examples. Part 2 introduces optimization theory and the Karush–Kuhn–Tucker conditions and illustrates how games can be rephrased as optimization problems, thus allowing Nash equilibria to be computed. Part 3 focuses on cooperative games. In this unique presentation, Nash bargaining is recast as a multi-criteria optimization problem and the results from linear programming and duality are revived to prove the classic Bondareva–Shapley theorem. Two appendices covering prerequisite materials are provided, and a "bonus" appendix with an introduction to evolutionary games allows an instructor to swap out some classical material for a modern, self-contained discussion of the replicator dynamics, the author's particular area of study.

READERSHIP

This book is targeted towards advanced undergraduates and beginner graduates in mathematics and graduate students in other STEM disciplines. The book could also be used in an economics class as a secondary text.

CONTENTS

- **Classical Game Theory:**
 - Games Against the House with an Introduction to Probability Theory
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 - An Introduction to N -Player Cooperative Games
- **Appendices:**
 - Introduction to Matrix Arithmetic
 - Essential Concepts from Vector Calculus
 - Introduction to Evolutionary Games Using the Replicator Equation

ABOUT THE AUTHORS

Dr Christopher Griffin is a Research Professor at the Applied Research Laboratory (ARL) at Penn State. He was a Eugene Wigner Fellow in the Computational Science and Engineering Division of the Oak Ridge National Laboratory and has taught in the Mathematics Departments of the United States Naval Academy and the Pennsylvania State University. He holds a courtesy appointment in the Department of Mathematics at Penn State, where he is also a member of the Operations Research Graduate Faculty.

Dr Griffin's research interests are in applied dynamical systems, game theory and optimization. His research has been funded by the National Science Foundation, the Office of Naval Research, the Army Research Office, the Intelligence Advanced Research Projects Agency, the Defense Advanced Research Projects Agency, the Minerva Program and other elements of the US Government. He has published over 100 peer reviewed research papers in game theory, applied optimization and applied dynamical systems.

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