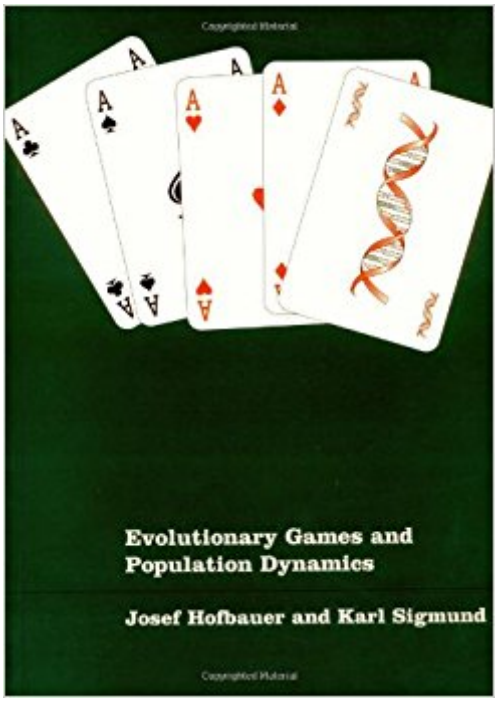
Evolutionary Games And Population Dynamics



Synopsis

Every form of behavior is shaped by trial and error. Such stepwise adaptation can occur through individual learning or through natural selection, the basis of evolution. Since the work of Maynard Smith and others, it has been realized how game theory can model this process. Evolutionary game theory replaces the static solutions of classical game theory by a dynamical approach centered not on the concept of rational players but on the population dynamics of behavioral programs. In this book the authors investigate the nonlinear dynamics of the self-regulation of social and economic behavior, and of the closely related interactions among species in ecological communities. Replicator equations describe how successful strategies spread and thereby create new conditions that can alter the basis of their success, i.e., to enable us to understand the strategic and genetic foundations of the endless chronicle of invasions and extinctions that punctuate evolution. In short, evolutionary game theory describes when to escalate a conflict, how to elicit cooperation, why to expect a balance of the sexes, and how to understand natural selection in mathematical terms.

Book Information

Paperback: 352 pages

Publisher: Cambridge University Press; 1 edition (June 13, 1998)

Language: English

ISBN-10: 052162570X

ISBN-13: 978-0521625708

Product Dimensions: 6 x 0.8 x 9 inches

Shipping Weight: 1.7 pounds (View shipping rates and policies)

Average Customer Review: 4.1 out of 5 stars 4 customer reviews

Best Sellers Rank: #294,650 in Books (See Top 100 in Books) #10 inÂ Books > Science & Math > Mathematics > Applied > Biomathematics #77 inÂ Books > Science & Math > Evolution > Game Theory #93 inÂ Books > Science & Math > Evolution > Organic

Customer Reviews

"...something for anyone interested in game models in organismal biology." Nature"The book under review is a very nice further development of its ten-year-old predecessor...by the authors. Not only has the title been modified, but also the contents have been thoroughly reworked and thus adapted to today’s topics of interest in the field of biomathematics. The book is totally restructured and contains much new material, mainly in game theory, especially in its evolutionary and dynamical aspects...the book is written in the well-known authors’ usual clear, elegant and motivating style."

Mathematical Reviews"For the biologist who is mathematically inclined or the mathematician interested in biology...this volume is rich in results and likely to provoke stimulating thought." The Quarterly Review of Biology

Since the work of Maynard Smith and others, it has been realised how game theory can model natural selection. Evolutionary game theory replaces the concept of rational players with the population dynamics of behavioural programs and can be used to understand the strategic and genetic foundations of the endless chronicle of invasions and extinctions which punctuate evolution. In short, it describes when to escalate a conflict, how to elicit cooperation, why to expect a balance of the sexes, and how to understand natural selection in mathematical terms.

When I was writing the chapter on evolutionary dynamics for my book Game Theory Evolving (Princeton, 2000), I looked at all the books available and found nothing. Then Hofbauer and Sigmund’s new book (a totally revised version of their earlier Theory of Evolution and Dynamical Systems) came out, and I knew I had a masterpiece in hand.The book does not assume the reader knows basic differential equation theory--it presents all the theory necessary. Indeed, it is a wonderful way to learn differential equation theory, since one immediately is faced with meaningful problems to solve. It does assume the reader is familiar with multivariate calculus. The book should be accessible to biologists and game theorists with a minimum understanding of each other’s disciplines.There are four parts. First, HS deal with Lotka-Volterra equations of the type prevalent in predator-prey models, which they extend to ecological models and several populations. Like the rest of the book, there are lots of problems and the presentation is elegant and succinct.The second part deals with game theory dynamics and replicator equations, including sections on evolutionary games and asymmetric games. This too is extremely nicely presented, and the links to the Lotka-Volterra models are made clear.Part three is on dynamical systems especially of relevance to biochemistry--catalytic hypercycles--as well as higher dimensional phase space dynamics of ecological models.Part four deal with population genetic models using a differential equation approach. This section is also excellent, though for serious readers it should be complemented by Karlin and Taylor’s Second Course in Stochastic Processes (which is much more mathematically demanding).The physical production of the book is also first rate--a pleasure to read and use.

This book is a classic and still one of the best places to read about evolutionary games.

It arrived on time and in great condition. This book is for my class in mathematical biology which open for the first time this semester.

This book covers alot of ground and the table of contents had me really excited. However, one chapter into the book and the authors are using, without explanation, terms and symbols that will be foreign to most biologists. Moreover, they present practice problems for solution that have no analogue in the text. This book is probably great if you already know all the math. But, I respectfully disagree with the previous reviewer that it’s a good source from which to learn about dynamical systems for the first time...

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