Stochastic Processes in Demography and Applications

This is a book on the fundamentals and applications of stochastic processes in demography. It discusses the use of stochastic models in understanding demographic phenomena, such as population growth, migration, and mortality. The book covers both theoretical foundations and practical applications, with a focus on real-world examples such as the dynamics of population systems and the impact of stochastic processes on epidemiology. It is written for students and researchers interested in the intersection of probability, statistics, and demography.

Stochastic Processes in Demography and Application

The book begins by introducing the basic concepts of stochastic processes and their applications in demography. It then delves into more advanced topics, such as the use of stochastic models to understand population dynamics and the implications of these models for public policy. Throughout the book, real-world examples and case studies are used to illustrate key points.

A significant part of the book is devoted to the use of stochastic processes in epidemiology. It discusses the role of stochastic models in understanding the spread of infectious diseases and the effectiveness of different prevention strategies. The book also covers recent developments in the field, such as the use of stochastic models to predict the impact of interventions on disease transmission.

The book concludes with a discussion of future research directions and the challenges that remain in the field of stochastic processes in demography. It is an essential resource for anyone interested in the use of probability and statistics in the study of demography and epidemiology.

Overall, this book provides a comprehensive and up-to-date treatment of stochastic processes in demography. It is an excellent resource for students, researchers, and policymakers who are interested in the intersection of probability, statistics, and demography.
formulations of age-classified, stage-classified, and multitype population models. Methods are presented for linearization, decomposition, and transient and time-outgoing cases. Readers will discover the problems of the given parameters, time revelation, and the net reproductive rate. For the Markov process, the book provides the application of these concepts to population growth rates, stable population structures, reproductive value under immigration and nonlinearity, and population cycles. Individual stochasticity is a theme through this, with a focus that goes beyond expected value calculations. Asymptotic statistical properties of stochastic-processes-in-demography and applications to population processes are implemented in matrix-oriented programming languages such as MATLAB or R. Sensitivity analysis will help readers determine the effect of future changes, to evaluate policy effects, and to identify possible evolutionary responses to the environment. Complete with many examples of the applications, the book will be of interest to researchers and graduate students in demography and population biology. The material will also appeal to those in mathematical biology and applied mathematics.

An Introduction to Stochastic Processes with Applications to Biology
Lindsay J. S. Allen 2010-12-02 An Introduction to Stochastic Processes with Applications to Biology. Second Edition presents the basic theory of stochastic processes necessary in understanding and applying stochastic methods to biological problems in areas such as population growth and extinction, drug kinetics, two-species competition and predation, the spread of epidemics, evolutionary genetics, and more. Each chapter begins with a focus on the biological background. The resulting empirical and theoretical approximations are often illuminating even when exact solutions are available. However, our empirical and theoretical approximations are often illuminating even when exact solutions are available. However, our empirical and theoretical approximations are often illuminating even when exact solutions are available. However, our empirical and theoretical approximations are often illuminating even when exact solutions are available. However, our empirical and theoretical approximations are often illuminating even when exact solutions are available. However, our empirical and theoretical approximations are often illuminating even when exact solutions are available. However, our empirical and theoretical approximations are often illuminating even when exact solutions are available. However, our empirical and theoretical approximations are often illuminating even when exact solutions are available.
Advances In Mathematical Population Dynamics -- Molecules, Cells And Man - Proceedings Of The 4th International Conference On Mathematical Population Dynamics-Arino O 1997-12-04 This book presents a new approach to the subject of cosmology. It fully exploits Einstein's theory of general relativity. It is found that the most general formal expression of the theory replaces the (10-component) tensor formalism with a (16-component) quaternion formalism. This leads to a unified field theory, where one field incorporates gravitation and electromagnetism. The theory predicts an oscillating universe cosmology with a spiral configuration. Dark matter is explained in terms of a sea of particle-antiparticle pairs, each in a particular (derived) ground state. This leads to an explanation for the separation between matter and antimatter in the universe. There is a brief discussion of black holes and pulsars. The final chapter delves into philosophical considerations such as the different types of 'truth', positivism versus realism and a discussion of the role of the Mach principle in physics and cosmology.

Mathematical Biology - James D. Murray 2013-03-09 Mathematical biology - the use of mathematical ideas and models in the biosciences - is a fast growing, very exciting and increasingly important interdisciplinary field. This textbook is an account of some of the major techniques and models used and of some genuine practical applications drawn from current areas of research interest in, for example, population ecology, developmental biology, physiology, epidemiology and evolution. It provides the reader with a thorough background, sufficient to start genuine interdisciplinary collaborative research with biomedical scientists.

The Health State Function of a Population - Christos H. Skiadas 2013-03-04 The Health State Function of a Population This book will inspire colleagues in applying, developing and expanding the theoretical and practical issues related to the health state of the population and to improve forecasts related to the life expectancy and the healthy life span. The Second Edition of the book includes four more chapters presenting very important theoretical and applied work. The book deals with the theory related to the health state of a population and the introduced health state function. The book presents and applies the stochastic modeling techniques and the first exit time theory in demography along with the healthy life expectancy estimates and a derivation and classification of the human development stages. The data fitting techniques and the related programs are also presented. Many new and old terms are explored and quantitatively estimated especially the health state or the "vitality" of a population, the Determination and the related function and the Healthy Life Expectancy. A method for estimating the total loss of healthy life years with applications and comparisons for the healthy life expectancy in UK, Scotland, Sweden, and in the US States is added. A new Quantitative Method for Estimating the Human Development Stages based on the Health State Function Theory and the Resulting Determination Process is also included. The book is addressed to demographers, actuaries, statisticians, applied mathematicians, sociologists, psychologists, economists, health scientists, biologists, policy makers and scientists and practitioners of very many fields. Attention was given to prepare the material for readers from multidisciplinary fields thus including the appropriate formulas and mathematical types along with many applications from computer programs in Excel. Read this book and share with us a fascinating exploration on life table data and the underlying information on human health state.

Stochastic Processes in Science, Engineering and Finance - Frank Beichelt 2006-02-22 This book presents a self-contained introduction to stochastic processes with emphasis on their applications in science, engineering, finance, computer science, and operations research. It provides theoretical foundations for modeling time-dependent random phenomena in these areas and illustrates their application by analyzing numerous practical examples. The treatment assumes few prerequisites, requiring only the standard mathematical maturity acquired by undergraduate applied science students. It includes an introductory chapter that summarizes the basic probability theory needed as background. Numerous exercises reinforce the concepts and techniques discussed and allow readers to assess their grasp of the subject. Solutions to most of the exercises are provided in an appendix. While focused primarily on practical aspects, the presentation includes some important proofs along with more challenging examples and exercises for those more theoretically inclined. Mastering the contents of this book prepares readers to apply stochastic modeling in their own fields and enables them to work more creatively with software designed for dealing with the data analysis aspects of stochastic processes.