Stochastic Process
Preface

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Preface

1. Probability in the real world

2. Discrete stochastic processes

3. Processes to be studied

4. Suggestion

1. Probability in the real world

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The objective here is to provide the necessary knowledge and insight about probabilistic models so that the reader can later combine this with a deep understanding of particular real application areas. This will result in a useful interactive use of models, analysis, and experimentation.

The way one selects probability models of real-world experiments in practice is to use scientific knowledge and experience, plus simple experiments, to choose a reasonable model. The results from the model (such as the laws of large numbers) are then used both to hypothesize results about the real-world experiment and to provisionally reject the model when further experiments show it to be highly questionable.

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1. Try oversimplified models first.
2. Use the mathematics of those simple models to help understand the real problem.
3. Then in multiple stages, add to and modify the models to understand the original problem better.

2. Discrete stochastic processes

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It is not important to define which stochastic processes are discrete precisely.

3. Processes to be studied

- Counting processes: Each sample point is a sequence of 'arrival' times. Special cases are Poisson processes (chap.2) and Renewal processes(chap.5).
- Gaussian processes: Every finite collection of those random variables has a multivariate Gaussian distribution (chap.3).
- Markov processes: The future state depends on the past only through the present. Special cases are Finite Markov chains(chap.4), countable Markov chains(chap.6) and Markov processes with countable state spaces(chap.7).
- Random Walks and martingales(chap.9)
- Detection(chap.8) and estimation(chap.10)

4. Suggestion

- My conviction is that if a student acquires a deep understanding of any, say, 20% of the material, then that student will be able to read and understand the rest with relative ease at a later time. Better still, a full appreciation of that 20% will make most students eager to learn more. In other words, instructors have a good deal of freedom, subject to a prerequisite structure, to choose topics of interest to them and their students to cover in a one term course.

Textbook

Stochastic Processes: Theory for Applications by Robert G. Gallager.
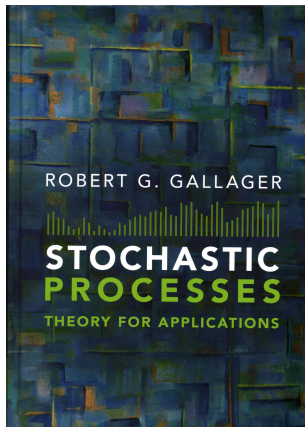
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Thank you for your attention!