HEC DOCTORAT

* First Year Core Course: 2006-2007 *

STOCHASTIC PROCESSES, Part 2

Prof. Laoucine KERBACHE

Course Syllabus

2006-2007
STOCHASTIC PROCESSES, Part 2

The course Stochastic Processes (Part 2) aims at showing the importance of stochastic models in which time plays a major role. The emphasis is on Markov decision processes. The models arise in many phenomena and have wide applications in operations, finance, marketing, economics, etc.

Understanding the dynamic relationships and mastering the structured models through formulation and analysis of models in many contexts are the main objectives of this course.

To achieve these aims, the students must have had a thorough introduction to the fundamental concepts of probability (Part 1 of this course offered in the Fall 2006).

2. TEACHING METHODS

In this course, lectures as well as exercises and in-class paper presentations are as the primary tools for learning. The students are requested to prepare all the topics and the assignments.

3. EVALUATION

Each student's grade will be based on homework (exercises, paper discussions and presentations) as well as class participation and a final exam, as listed below.

- Exercises, papers and presentations: 50%
- Class Participation: 10%
- Final exam: 40%

Research papers

Each student must be prepared, to discuss in class (as a class presentation) a selected research paper using relevant stochastic processes seen in this course. There are many application papers in Marketing journals (Marketing Science, Journal of marketing research, International Journal of Research in Marketing), in Operations Management (Management science, OR, IIE Transactions, etc), Finance, etc.

The details of these assignments will be discussed with you at the introductory session of this course. The in-class presentation using IT capabilities (powerpoint, etc) must not exceed 25 minutes followed by a short discussion period.

Main References


Additional recommended Readings

# PROVISIONAL COURSE OUTLINE

*(may be subject to slight changes)*

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<tr>
<th>N°</th>
<th>Date</th>
<th>Sequence</th>
<th>Readings and preparations</th>
<th>Presentations</th>
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| Part 1 | Review of some probability concepts  
Jointly distributed R.V., Moment generating functions, Limit theorems, chi-square, etc. | | | |
| Part 2 | Poisson Process  
Exponential distribution and its properties  
Poisson Process (counting process, properties of Poisson process), generalizations of Poisson process. | | | Paper 1 |
| Part 3 | Discrete-Time Markov Chains  
Markov property, Markov chain, Transition diagram, Chapman-Kolmogorov Equations; classification of states, limiting probabilities, Time reversible markov chains. | | | Paper 2 |
| Part 4 | Continuous-Time Discrete Markov Chains  
Birth and death Processes, Transition probability function, limiting probabilities, Time reversibility, transition probabilities. | | | Paper 3 |
| Part 5 | Queueing Theory: Applications  
Exponential models, Network of queues, systems (M/G/1, Loss system,etc). | | | Paper 4 |
| Part 6 | Brownian Motion and stationary processes | | | |
| | Final Examination | | | |