MGT-484

Applied probability & stochastic processes

Cristi Andrés

Cursus	Sem.	Type
Life Sciences Engineering	MA1, MA3	Opt.
Management of technology		Opt.
Management, Technology and Entrepreneurship minor	H	Opt.
Managmt, tech et entr.	MA1, MA3	Obl.
Neuro-X minor	H	Opt.
Neuro-X	MA1, MA3	Opt.
Physics of living systems minor	H	Opt.
Systems Engineering minor	H	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course focuses on dynamic models of random phenomena, and in particular, the most popular classes of such models: Markov chains and Markov decision processes. We will also study applications in queuing theory, finance, project management, etc.

Content

Keywords

Markov chains, Markov decision processes, dynamic programming, optimal control

Learning Outcomes

By the end of the course, the student must be able to:

- Formulate Markov chain models for dynamic uncertain phenomena.
- Formulate Markov decision process models for dynamic decision problems under uncertainty.
- Use these models to structure real decision-making situations.
- Compute relevant performance measures for Markov models.
- Develop an awareness of the manifold uses of probability theory in management science.
- Reason about the concept of a discrete-time Markov chain and understand how Markov chains are used to model random phenomena
- Compute several properties of a given Markov chain, such as hitting probabilities, expected hitting times, invariant distributions and the long-run proportion of time spent in a given state
- Formalize decision problems under uncertainty as optimal control models
- Solve optimal control models via dynamic programming
- Analyze the technical literature in applied probability and to undertake independent self-study (or research) in the future

Transversal skills

- Communicate effectively, being understood, including across different languages and cultures.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Use a work methodology appropriate to the task.
- Demonstrate the capacity for critical thinking

Teaching methods

Classical formal teaching interlaced with practical exercices.

Expected student activities

Active participation in exercise sessions is essential.

Assessment methods

- 30% midterm exam
- 70% final exam

Resources

Bibliography

Introduction to Probability Models, 10th edition, Sheldon M. Ross, Academic Press, 2009.
Dynamic Programming and Optimal Control, 3rd edition, Dimitri P. Bertsekas, Athena Scientific, 2005.
Introduction to Probability, Dimitri P. Bertsekas and John N. Tsitsiklis, Athena Scientific, 2002.

Ressources en bibliothèque

- Introduction to Probability Models, 10th edition, Sheldon M. Ross
- Dynamic Programming and Optimal Control, 3rd edition, Dimitri P. Bertsekas
- Introduction to Probability, Dimitri P. Bertsekas and John N. Tsitsiklis

Moodle Link

- https://go.epfl.ch/MGT-484

Prerequisite for

Advanced MTE courses