270633 - SNM - Stochastic Network Modelling

Coordinating unit: 270 - FIB - Barcelona School of Informatics
Teaching unit: 701 - DAC - Department of Computer Architecture
Academic year: 2019
Degree: MASTER'S DEGREE IN INNOVATION AND RESEARCH IN INFORMATICS (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 6

Teaching languages: English

Prior skills
Probability, random variables and distribution (continuous and discrete) algebra: systems of equations, determinant, eigenvalues and eigenvectors, diagonalization.

Teaching methodology
There will be 4 hours per week, dedicated to theoretical classes to explain the theory and solve problems. The students' activities will consist of reading material and solving practical problems that will be proposed at each theoretical unit. The problems will be collected and corrected during the course. There will be research oriented problems to be solved using numerical tools as MATLAB.

Learning objectives of the subject
2. Being able to model a process that evolves over time with a discrete and continuous time Markov chain
3. Being able to compute the steady state and transient solution of a Markov chain
4. Being able to model processes that engage the formation of queues
5. Being able to resolve the basic queues: M/M/1, M/G/1, M/G/1/K

Study load

<table>
<thead>
<tr>
<th>Total learning time: 150h</th>
<th>Hours large group: 24h</th>
<th>16.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>8.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>8.00%</td>
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<td></td>
<td>Guided activities:</td>
<td>4.00%</td>
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<td>Self study:</td>
<td>64.00%</td>
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Content

**Introduction**

**Degree competences to which the content contributes:**

**Description:**

Concept of probability space, sequence of random variables and stochastic processes.

**Discrete Time Markov Chains (DTMC)**

**Degree competences to which the content contributes:**

**Description:**

Definition of a DTMC, Transient Solution, Classification of States, Steady State, Finite Absorbent Chains

**Continuous Time Markov Chains (CTMC)**

**Degree competences to which the content contributes:**

**Description:**

Definition of a CTMC, Transient Solution, Steady State, Semi-Markov Process and Embedded MC, Finite Absorbent Chains

**Queuing Theory**

**Degree competences to which the content contributes:**

**Description:**

Kendal Notation, Little Theorem, PASTA Theorem, The M/M/1 Queue, M/G/1 Queue, Reversed Chain, Reversible Queues, Networks of Queues, Chains with Matrix Geometric Solutions

Qualification system

The theory mark will be calculated from the problems delivered by the student, assessment marks and a final exam mark. The formula for calculating the mark for the course is:

\[ NF = 0.1 \times NP + 0.30 \times \max\{EF, C\} + 0.60 \times EF \]

where:
- \( NF \) = final mark
- \( EF \) = final theory exam
- \( NP \) = Problems delivered by the students
- \( C = \text{average test mark: } C = 0.5 \times C1 + 0.5 \times C2 \)
Bibliography

Basic:


Complementary: