Course guides
200619 - EA - Actuarial Statistics

Unit in charge: School of Mathematics and Statistics
Teaching unit: 1004 - UB - (ENG)Universitat de Barcelona.
Degree: MASTER'S DEGREE IN STATISTICS AND OPERATIONS RESEARCH (Syllabus 2013). (Optional subject).
Academic year: 2021 ECTS Credits: 5.0 Languages: Spanish

LECTURER
Coordinating lecturer: ANA MARIA PÉREZ MARÍN
Others: Segon quadrimestre:
ANA MARIA PÉREZ MARÍN - A
MIGUEL ANGEL SANTOLINO PRIETO - A

PRIOR SKILLS
Students should have previous knowledge of calculus of probability, random variables, probability distributions and characteristics of probability distributions (means, variances, etc.). It is also recommended to have prior knowledge in algebra of events.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES
Specific:
5. CE-1. Ability to design and manage the collection of information and coding, handling, storing and processing it.
6. CE-2. Ability to master the proper terminology in a field that is necessary to apply statistical or operations research models and methods to solve real problems.
7. CE-3. Ability to formulate, analyze and validate models applicable to practical problems. Ability to select the method and / or statistical or operations research technique more appropriate to apply this model to the situation or problem.
8. CE-5. Ability to formulate and solve real problems of decision-making in different application areas being able to choose the statistical method and the optimization algorithm more suitable in every occasion.
Translate to english
9. CE-6. Ability to use appropriate software to perform the necessary calculations in solving a problem.
10. CE-7. Ability to understand statistical and operations research papers of an advanced level. Know the research procedures for both the production of new knowledge and its transmission.
11. CE-9. Ability to implement statistical and operations research algorithms.
Transversal:
1. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

2. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.

3. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

4. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY
The course is organized in weekly theoretical lessons where the student has to participate once he has studied some materials that have been delivered in advance. Exercises and practical cases will be solved by using the computer.

LEARNING OBJECTIVES OF THE SUBJECT
Regarding knowledge
- To learn how to calculate death probabilities (or survival probabilities) as the core of rating in life insurance. This calculation is carried out for individuals (individual insurance) and groups of individuals (collective insurance).
- To learn how to carry out insurance rating by modelling the number of claims and the total cost of claims, and calculate the ruin probability

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Self study</td>
<td>80,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>15,0</td>
<td>12.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>30,0</td>
<td>24.00</td>
</tr>
</tbody>
</table>

Total learning time: 125 h
### Section 1. Life Insurance Statistics

**Description:**
- Lesson 1. Biometrical model
  - Basic hypothesis
  - Main variables and functions
  - Concepts of population theory
  - Probabilities for a single life
  - Temporal and deferral probabilities
  - Hazard rate
  - Life expectation
  - Measures of the residual life
- Lesson 2. Probabilities for multiple lifes
  - Joint probability
  - Temporal and deferral probabilities
  - Extensions for more than two lifes
- Lesson 3. Survival models and life tables
  - Main survival functions
  - Life tables
  - Survival models for censored data
  - Lee Carter Model
- Lesson 4. Multi-state transition models
  - Disability model (I): practical approach
  - Disability model (II): rational approach

**Full-or-part-time:** 30h  
Theory classes: 30h

### Section 2. Non-life Statistics

**Description:**
- Lesson 1. Modeling the number of claims
  - Main discrete distributions
  - Compound distributions
  - Regression models
  - Estimation
- Lesson 2. Modeling the cost of claims
  - Main continuous distributions
  - Extreme value distributions
  - Model selection and validation
- Lesson 3. Risk models and Ruin theory
  - Collective and individual risk models
  - Estimating the distribution of the total cost
  - Ruin theory
  - Reserves

**Full-or-part-time:** 30h  
Theory classes: 10h  
Practical classes: 5h  
Self study (distance learning): 15h
GRADING SYSTEM

Continuous assessment:
Three practical activities should be resolved by the student. These activities are addressed to assess the student's skill in the application of the concepts developed during the course. Each practical activity has an weight of 33.3% in the final grade.

Final examination system:
A final exam consists of five-six exercises to resolve.

BIBLIOGRAPHY

Basic:

RESOURCES

Hyperlink:
- Software R. Software de lliure distribució.
Disponible a: http://www.r-project.org