200619 - EA - Actuarial Statistics

Coordinating unit: 200 - FME - School of Mathematics and Statistics
Teaching unit: 1004 - UB - (ENG)Universitat de Barcelona
Academic year: 2018
Degree: MASTER'S DEGREE IN STATISTICS AND OPERATIONS RESEARCH (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: Spanish

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.
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.

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.

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>Total learning time: 125h</th>
<th>Hours large group: 30h</th>
<th>24.00%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group: 15h</td>
<td>12.00%</td>
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<td>Guided activities: 0h</td>
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<td>Self study: 80h</td>
<td>64.00%</td>
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### 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

**Learning 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

**Learning time:** 30h
- Theory classes: 10h
- Practical classes: 5h
- Self study (distance learning): 15h
Continuous assessment:
In each section a set of exercises and practical activities should be resolved by the student. These exercises are addressed to assess the student's skill in the application of developed concepts. These exercises and practical activities have an overall weighting in the final grade equal to 75%. The remaining 25% of the final grade corresponds to an exam.

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

Bibliography

Basic:

Others resources:

Hyperlink

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