COURSE DATA

Data Subject	
Code	36519
Name	Time Series Analysis and Forecasting
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1332 - Degree in Business Intelligence and Analytics	Faculty of Economics	2	Second term

Subject-matter

Degree	Subject-matter	Character
1332 - Degree in Business Intelligence and Analytics	24 - Herramientas y Técnicas de Análisis de Datos	Obligatory

Coordination

Name	Department
ARRIBAS FERNANDEZ, IVAN	10 - Economic Analysis

SUMMARY

Forecasting with Time Data is a basic training subject assigned to the areas of Quantitative Methods for Economics and Business and Foundations of Economic Analysis. It is taught in the second term of the second year of the Degree in INTELLIGENCE AND BUSINESS ANALYSIS with a total of 6 ECTS credits.

The general objective is the training of professionals capable of applying the methods to analyze, describe, evaluate and especially make forecasts on data series that evolve over time, that is, Time Series models.

In particular, the student will have to respond to complex real problems, developing hypotheses, building models, applying statistical analysis techniques and all with the ultimate goal of developing predictions and knowing their quality as an aid to decision making.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The course has no actual prerequisites. However, it is assumed that in order to successfully take this course the student has a basic level of mathematics (the knowledge that corresponds to first and second year of high school in the branch of science or social sciences) and is familiar with the contents of the subjects "Exploratory Data Analysis" and "Chance, Uncertainty and Inference" taken in first year and "Prediction with Transverse Data" taken in the first term of second year. At the same time it is assumed that it has acquired some of the basic competences of those previously programmed on information management, software, use of ICT and specifically handling of the statistical program R.

OUTCOMES

1332 - Degree in Business Intelligence and Analytics

- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Acquire basic training that can be used to learn new methods and technologies and to adapt to new situations in academic and professional areas.
- Be able to solve problems and to communicate and spread knowledge, skills and abilities, taking account of the ethical, egalitarian and professional responsibility of the activity of business intelligence and analytics.
- Know and know how to properly use the appropriate quantitative and qualitative methods to reason analytically, evaluate results and predict economic and financial magnitudes.
- Be able to apply analytical and mathematical methods for the analysis of economic and business problems.

- Demonstrate skills for analysis and synthesis.
- Be able to analyse and search for information from diverse sources.
- Be able to learn autonomously.
- Be able to use ICT, both in academia and in professional practice.
- Be able to define, solve and present complex problems systemically.
- Be able to work in a team demonstrating commitment to quality, ethics, equality and social responsibility.
- Apply methods and techniques of analysis, synthesis and graphical representation by means of software tools.
- Reorganise and restructure variables and databases.
- Manage and distinguish the concepts of universe, population, sample, parameters and estimators in real problems.
- Use software tools to solve problems under uncertainty.
- Distinguish between the explanatory and predictive approaches in data analysis and in business.
- Make predictions using appropriate software tools to manage time series.
- Apply supervised machine learning techniques using software.

LEARNING OUTCOMES

- Knowing how to apply different methods and techniques of temporal data analysis through computer programs.
- Knowing the differences between long and short and medium term prediction methods.
- Knowing and differentiating the components of a time series.
- Learn how to extract unobserved components from time series, how to interpret them and how to make projections of them.
- Know the theoretical basis of ARIMA modelling and its application through computer software. Know how to make predictions of economic time variables.
- Know how to incorporate calendar variations in predictive models.Learn to value the predictive capacity of methods according to the prediction horizon.
- Know the differences between the different types of automatic learning.Know how to use the software for the implementation of automatic learning models.
- Know the potentialities and weaknesses of the different predictive techniques in machine learning, as well as their application to different business problems.
- Know the problems of over-parameterization and the role of training and testing sets.
- Know how to solve business problems using automatic learning methodologies and to know how a recommendation system works.
- Apply machine learning techniques to business problems.

DESCRIPTION OF CONTENTS

1. Introduction

2. Definitions and components

3. Naive prediction methods

4. Moving averages methods

5. Exponential smoothing methods

6. Seasonal Arima models

7. Arima models and extensions

WORKLOAD

ACTIVITY	Hours	% To be attended
Computer classroom practice	45,00	100
Theory classes	15,00	100
TOTAL	**60,00**	

TEACHING METHODOLOGY

The development of the course is structured fundamentally around the differentiated theoretical and practical sessions, being the theoretical ones of 1 hour per week (25%) and the practical ones of 3 hours per week (75%). The methodology, therefore, emphasizes the more practical and computational aspects of the subject.

- Theory lessons: the core concepts of each subject will be presented in a precise and rigorous way, in natural, graphic and formal language.
- Practice lessons: from the R code and the data files, the theoretical concepts seen will be practiced and the handling of R for the analysis of time series will be learned.

It is advisable that you bring your computer to work in both theory and practice classes.

EVALUATION

Continuous assessment will account for 60% of the subject's grade a

- After each of the thematic units, a test will be carried. The test will contain multiple choice questions, numerical, true/false, etc.
- This part of the continuous assessment **is recoverable**.

On the agreed schedule, an **exam** will be taken which will represent the remaining **40%** of the subject's grade.

- The exam will have both theory sections and practical questions.
- It will be an essential condition for passing the course to pass the written exam.

REFERENCES

Basic

- Dos libros interesantes:
  * Forecasting: Principles and Practice de Rob J. Hyndman y George Athanasopoulos: https://otexts.com/fpp2/
  * An Introduction to Statistical Learning with Applications in R de Gareth, Witten, Hastie y Tibshirani. Springer New York 2013

  Otros libros de interés:
  * Hyndman, R. J., Koehler, A., B., Ord, J. K. y Snyder, R. D. (2008) Forecasting with Exponential Smoothing: the State Space Approach. Ed. Springer.
  * Machine Learning Using R With Time Series and Industry-Based. Use Cases in R. Ramasubramanian y Singh. Apress, 2019

  Libros de R y Series Temporales:
  * Cowpertwait, P. S. P. y Metcalfe, A. V. (2009) Introductory Time Series with R. Springer (Collection Use R!)
  * Pfaff, B. (2008) Analysis of Integrated and Cointegrated Time Series with R. Springer (Collection Use R!)
  * Cryer, J. D., Chan, Kung-Sik. (2008) Time Series Analysis. With Applications in R. Springer

  Dos clásicos:
  * Makridakis, S. y Hibon, M. (2000). The M3-Competition: results, conclusions and implications. International Journal of Forecasting, 16(4), pp. 451476. doi:10.1016/S0169-2070(00)00057-1
  * Box, G. E.P. y Jenkins, G. (1976). Time Series Analysis: Forecasting and Control Editado por Holden-Day, San Francisco, CA

Additional

- Artículos seminales (los orígenes)
  Brown, R. G. (1959). Statistical forecasting for inventory control. Ed. McGraw/Hill.

  Gardner, Jr, E. S. y McKenzie, E. (1985) Forecasting trends in time series, Management Science, 31(10), pp. 12371246. doi:10.1287/mnsc.31.10.1237

  Holt, C. E. (1957). Forecasting seasonals and trends by exponentially weighted averages O.N.R. Memorandum No. 52. Carnegie Institute of Technology, Pittsburgh USA. doi:10.1016/j.ijforecast.2003.09.015

  Winters, P. R. (1960). Forecasting sales by exponentially weighted moving averages. Management Science, 6, pp. 324342. doi:10.1287/mnsc.6.3.324

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1. Subject contents

No changes are made to the teaching guide.

2. Workload and time planning of teaching

No changes are made to the teaching guide.

3. Teaching methodology

The modality of classes for students will depend on the social and health conditions and the restrictions established by the competent authorities.

In the case of **online teaching**, classes will be given by videoconference, preferably synchronous, using Blackboard Collaborate, Teams, Skype or the tool that the lecturer considers appropriate to optimize the student's teaching-learning process during the scheduled program sessions, **which remain the same days and times.**

In the case of **blended teaching**, the students will have to access the classroom in alternate weeks according to the initial of their last name (A-M or L-Z). The classes will be broadcast so that the students will have face-to-face teaching one week, and the next week they will follow the classes in streaming.

In the case of **face-to-face teaching**, students shall attend classes during the established timetable, in classrooms where attendance does not exceed 50% of their capacity.

4. Evaluation

No changes are made to the teaching guide.

5. References

No changes are made to the teaching guide.