

TEACHING GUIDE

Course Information	
Full Name	Seminar on Quantitative Methods and Data Science
Code	0000012219
Degree	Master's Degree in Finance
Taught in	Advantere School of Management
Level	Postgraduate Official Master's Degree
Term	3
Credits	2,0 ECTS
Type	Optional
Person in Charge	Jaime Sánchez Fernández
Office hours	Continuous availability via email

Professor Information	
Professor	
Name	Jaime Sánchez Fernández
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SPECIFIC COURSE INFORMATION

Course contextualization

Contribution to the professional profile of the degree

Quantitative Methods have become in recent years the cornerstone on which to make decisions in the vast majority of institutions, companies and financial corporations or related to this area, who want to lead their respective sectors in the next decades. These have been displacing as complementary the decision-making processes through more qualitative methods in force in the last century, which could be more susceptible to courseive biases or less adaptable to the increasingly volatile economic and market conditions.

But for these Quantitative Methods to be successful and produce good results, they need to rely on the increasingly thriving Data Science, based on obtaining and managing a large amount of data and data. information, but, above all, providing these data sets with the highest possible quality to avoid anomalous results or that do not fully reflect the reality of our problem we want to address. The obtaining of these data, their corresponding cleaning and validation, and their subsequent treatment seems key today, allowing the detection of patterns that overlooked the human eye, the prediction of behaviors, the classification of courses and interest groups in a dynamic way, away from the classic thresholds that incorporated a lot of noise in the selection and ran the risk of leaving out anomalous or strange values, and a long etcetera.

In this sense, this Master's Degree in Finance at Advantere School of Management aims to provide students with eminently professional knowledge with this mixed profile, not only economic and financial, but also technical and analytical, so valued by companies currently. Thus, students who wish, may choose in the third quarter to study the Specialty in Quantitative Methods and Data Science that will give them the opportunity to deepen even more, if possible, in these management methods and analysis techniques.

Thus, this Seminar on Quantitative Methods and Data Science, throughout the 2 ECTS credits that compose it, aims to be the space for deepening in all these technical and technological aspects that are already on the agenda and that will be fully current in financial institutions in the coming years. Most of these concepts will have already been presented in previous courses of the Master, but it is intended to see them now with a higher level of depth and visualize some practical examples that help their understanding and glimpse the applications they could have in the future, although they may seem a priori away from the strictly financial world. But it is also intended to present new concepts that will not have been treated in previous months, due to their more disruptive nature and away from the courses studied, given the importance we believe they will have in the financial sector soon.

It is expected, depending on the availability of agendas and existing health situation at all times, to also have the presence of experts in these thematic areas and visit those centers of excellence in each aspect treated, so that students can know first-hand the new tools with which the financial industry will be transformed in the coming years. Likewise, it is also desirable the proactive participation of the student proposing those issues and themes that are of greater interest or generate more questions throughout the sessions, in order to be treated within the seminar. In this way, the student will have the opportunity to finish these studies with an open mind towards the new digital, technical and technological paradigm that is potentially glimpsed inside and outside the financial industry in the coming years.

Competences – Objectives		
Competences		
ESPECIFIC		
CEOPT 2		Know and apply modeling and data analytics techniques to estimate investor and/or market behavior, as well as create investment risk management strategies and models, and how artificial intelligence, process automation and learning automatic, allow these processes to be optimized and made more efficient.
	RA3	Knows how to apply the new methodologies, techniques and technologies that have a direct and indirect impact on data analysis models.

THEMES BLOCKS AND CONTENT

Contents-Themes
Quantum computing
Fundamentals
<p>What is quantum computing.</p> <p>Qubit</p> <p>Classical computing vs. Quantum computing</p> <p>History of quantum computing</p> <p>Managing Expectations: The Hybrid Approach</p>
Possible applications of quantum computing in the financial industry
<p>Portfolio optimization.</p> <p>Optimization of investments or divestments.</p> <p>Optimization in the distribution of regulatory capital.</p> <p>Automatic loan management and credit risk calculation.</p> <p>Alerts against non-payment risks.</p> <p>Valuation of individuals.</p> <p>Fraud detection.</p> <p>Detection of money laundering and tax evasion.</p>
Quantum cryptography

Quantum cybersecurity.
Shor's Algorithm.
The era of post-quantum cryptography.

Low-code/no-code process automation tools

Microsoft Power Platform

Power BI
Power Apps
Power Automate
Power Virtual Agents
Power Pages

Fraud and Cybersecurity

Fraud

Types of fraud.
Historical examples.
Digital Fraud.

Cybersecurity

Examples of security breaches.
Techniques used.

Other examples of digital transformation in the industry

Other examples of digital transformation in the industry

Advanced Machine Learning techniques.
Comparison of Machine Learning algorithms.
Real examples of use of advanced Machine Learning algorithms.
APIs.
Cloud Computing.
Success stories in the industry.
Web scraping.

TEACHING METHODOLOGY

General methodological course aspects

Presential Methodology: Activities

Cooperative work of students who, in pairs or small groups, are given a task, case or assumption that requires sharing information and resources among members in order to achieve the common goal. Based on the case method, studied by each student and discussed by each group before the individual interventions of each general session.

The case method stimulates inductive learning. From the analysis of concrete examples, the different tools of analysis are built and general rules of application to all types of companies and sectors are induced. Therefore, prior study of the cases and active participation in the discussions of the general sessions is essential.

Exhibitions about their skills and abilities to get a job.

The presentations must be evaluated and critiqued by the rest of the classmates or by the professor in order to go deeper into the course.

Lessons of an expository and participative nature.

Non-presential Methodology: Activities

Individual study.

Individual reading of different types of texts (cases, books, magazines, articles, press, Internet publications, reports on practical experiences, etc.) related to the study courses.

Cooperative work of students who, in pairs or small groups, undertake a project that requires the sharing of information and resources among members in order to achieve a common goal.

SUMMARY OF STUDENT WORK HOURS

PRESENTIAL HOURS					
Professor Exposition	Student exhibition. Debates and group dynamics	Exercises and problem solving. Elaboration of applied work	Analysis and documentation	Tutorial sessions	Development of real projects for organizations
5	6	8	0	0,5	0,5
NON-PRESENTIAL HOURS					
Professor Exposition	Student exhibition. Debates and group dynamics	Exercises and problem solving. Elaboration of applied work	Analysis and documentation	Tutorial sessions	Development of real projects for organizations
0	0	23,5	15	1	0,5
ECTS CREDITS: 2,0 (40,00 hours)					

EVALUATION AND GRADING CRITERIA

Graded Activities	Evaluation Criteria	% of Total Grade
<p>Assessment of individual or group work carried out by students, some of them presented in class</p>	<ul style="list-style-type: none"> • Work adequacy to the objectives set • On-time delivery • Goal adequacy and focus • Results achieved • Compliance with deadlines • The participation of ALL members of each team in the presentations and elaborations is required 	<p>50</p>
<p>Performance of oral and written examinations, public defenses and multiple-choice tests, concept tests and resolution of practical cases as exams</p>	<ul style="list-style-type: none"> • Throughout the program, exams or written tests will be given to test the solidity of the concepts acquired. • In order to pass the course, the final exams and tests of each section of the course must be passed. If there are several exams in the same section or block of a course, the weighted average of them must be higher than 5.0 as a necessary condition to pass the course. 	<p>30</p>
<p>Participation and utilization of the classes</p>	<ul style="list-style-type: none"> • When we talk about participation, it is clear that both the positive and negative ones are counted and that the quality of participation is as important as the quantity. The students' participation in class, the quality and timeliness of their interventions, the quality in the preparation and presentation of their work, predisposition and commitment, initiative, attendance. 	<p>20</p>

Grades

The evaluation criteria for the subject are governed by the following rules:

- 1-All students must comply with 100% attendance on the days established for this course. Any absence must be justified.
- 2-The final grade corresponds to the sum of the graded activities, the evaluation criteria and the % of the total grade described in the Evaluation and Grading Criteria section.
- 3-Individual and group work must be submitted on time and in the form specified by the subject's teacher.
- 4-A final grade lower than 5 implies the need to take an extraordinary exam. The final grade for this exam may not exceed the median of the passing grades at the time of the schedule exams.

The evaluation criteria for enrolling in a second year:

The student enrolled in the second-year course must fulfill the individual and group tasks established by the course professor. The same evaluation criteria described in the Evaluation and Grading Criteria section will be maintained.

In circumstances not covered by this Teaching Guide, the Advantere School of Management Regulation and the General Regulation of Comillas will apply.

Health alert criteria:

The student must be permanently identified, in class with an identification poster and remotely with their full name. Students should not change the spaces they occupy in the classroom, until indicated by a professor or the direction of the program.

Failure to comply with any of the health recommendations during the teaching sessions may lead to failure in the course.

BIBLIOGRAPHIES AND RESOURCES

Additional Recommended Bibliographies and Web Resources

FATF (2021); *"Opportunities and Challenges of New Technologies for AML/CFT"*, FATF, Paris, France.

Ripjar Report; *"The Future Of Financial Crime Investigations"*

FATF (2021); *"Stocktake on Data Pooling, Collaborative Analytics and Data Protection"*, FATF, Paris, France.

FATF (2021); *"Suggested Action to Support the Use of New Technologies for AML/CFT"*, FATF, Paris, France.

IBM Corporation (2020); *"Getting your financial institution ready for the quantum computing revolution"*.

IBM Corporation (2018); *"Taking the quantum leap: Why now?"*.

Boston Consulting Group (2020); *"It's Time for Financial Institutions to Place Their Quantum Bets"*.

Brian Thomas Lenahan (2021); *"Quantum Boost: Using Quantum Computing to Supercharge Your Business"*.

The Economist (2020); *"Wall Street's latest shiny new thing: quantum computing"*.

McKinsey & Company (2020); *"How quantum computing could change financial services"*.

GitHub (2018); *"Qiskit: User guides & tutorials"*.

<https://qiskit.org/textbook/preface.html>

<https://qiskit.org/learn/>

IBM Quantum (2021); <https://quantum-computing.ibm.com/>

Nikitas Stamatopoulos, Daniel J. Egger, Yue Sun, Christa Zoufal, Raban Iten, Ning Shen, Stefan Woerner (2019); *"Option Pricing using Quantum Computers"*

Javier Gonzalez-Conde, Ángel Rodríguez-Rozas, Enrique Solano, Mikel Sanz (2021); *"Simulating option price dynamics with exponential quantum speedup"*

Enterprise Skills Initiative (ESI), Microsoft: <https://esi.microsoft.com/>

<https://docs.microsoft.com/es-es/power-platform/>

In compliance with current regulations regarding the **protection of personal data**, we inform you and remind you that you can consult the aspects related to privacy and data protection that you have accepted in your registration by entering this website and pressing "download".

[https://servicios.upcomillas.es/sedelectronica/inicio.aspx?csv=02E4557CAA6F4A81663AD10CED66792](https://servicios.upcomillas.es/sedeelectronica/inicio.aspx?csv=02E4557CAA6F4A81663AD10CED66792)