

PROGRAMING FOR ECONOMISTS II

IE University

Professor: **JUAN JOSE MANJARIN COLON**

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Academic year: 19-20

Degree course: FIRST

Semester: 2º

Category: COMPULSORY

Number of credits: 3.0

Language: English

PREREQUISITES

Knowledge of “programming thinking” will be a help, but not a must. The “*Introduction for Economists I*” course will help to understand many of the ideas.

SUBJECT DESCRIPTION

Python is a general-purpose language that is becoming more and more important for companies and researchers around the world. In this course we will explore the main properties of the language from its base library and then see how use external modules that are important to expand its capabilities to deal with new data structures and methods needed in the analysis of data.

OBJECTIVES AND SKILLS

In this course you will learn the basic tools of one the most relevant programming languages of today, used in many different business areas. This includes

- Understanding the base Python programming
- Understanding Functional Programming and how its versatility can be used to build your own applications
- How to control your codes by tracing errors
- Learning to make graphical representations at different levels with different data
- Understand the basic Python modules used in Data Science

METHODOLOGY

Since the only way to learn to code is coding, all the sessions will be a mixture of explanations and direct applications of the concepts in problems that will allow the student to gain confidence with the tools and methods of Python. The first units deal with the basic Python and then we will see how to load and use external modules. Each new problem we face will incorporate previous knowledge and we will go building over the previous units and so the problems will also face new situations.

Once the Anaconda environment is installed and set up, the student will be responsible of maintaining it clean and usable. All needed libraries will be installed and used during the applications and examples made during the lectures so that any new concept can be immediately coded and studied.

Readings of the recommended books in advance will allow you to get the most out of each lecture. When reading the textbook portions prior to each lecture, you must look at the examples, but you do not need to solve them. Those readings may also raise doubts that can be solved during the lectures.

Participation and involvement are important. This includes the solution of the different exercises that will be proposed along the lectures.

Teaching methodology	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	20.0 %	15 hours
Discussions	20.0 %	15 hours
Exercises	20.0 %	15 hours
Group work	26.67 %	20 hours
Other individual studying	13.33 %	10 hours
TOTAL	100.0 %	75 hours

PROGRAM

UNIT I: INTRODUCTION

SESSION 1

- About the course
- Syllabus objectives
- Setting up the environment: Jupyter and Spyder in Anaconda; Google's Colab

UNIT II: TYPES OF DATA

SESSION 2

- Assigning Values;
- Numbers;
- Strings;
- Lists

SESSION 3

- Multiple Assignments;
- Tuples;
- Dictionaries

SESSION 4

- Dates and Time

UNIT III: FUNCTIONS AND FUNCTIONAL PROGRAMMING

SESSION 5

- Control Sequences: If, If-else, if-elif-else;
- Conditional Expressions

SESSION 6

- Loop sequences: for, while, break & continue
- Cases and Dictionaries

SESSION 7

- Functions in Python;
- Custom Functions;
- Organizing functions in a program: the main function;
- Global and Local Variables;

SESSION 8

- Arguments;
- Anonymous functions

UNIT IV: INTRODUCTION TO NUMPY

SESSION 9

- Modules in Python;
- Arrays and Vectors;
- Data Types for ndarrays;
- Indexing for ndarrays

UNIT V: INTRODUCTION TO PANDAS

SESSION 10

- Series, Data Frames and Index Objects

SESSION 11

- Data Loading;
- Data Wrangling: join, combine and reshape

SESSION 12

- Indexing,
- Selection and Sorting

SESSION 13

- apply, applymap and pipe functions

UNIT VI: INTRODUCTION TO MATPLOTLIB

SESSION 14

- pyplot module;
- Direct access to the objects in the library

UNIT VII: FINAL EXAM

SESSION 15

Final Exam

BIBLIOGRAPHY

Of special importance are the manuals written by the R Core Team, among them we can find:

- Brian Heinhold (2019), "***A Practical Introduction to Python Programming***", distributed under Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License, available in <https://www.brianheinold.net/books.html>
- Wes Mckinney (2017), "***Python for Data Analysis***", O'Reilly Media, ISBN: 978-1-491-95766-0

EVALUATION CRITERIA

GENERAL OBSERVATIONS

Each student has four attempts over two consecutive academic years to pass this course. Dates and location of the final exam will be posted in advance and will not be changed. Students must attend at least 70% of the sessions. Students who do not comply with the 70% attendance rule will receive a 0.0 on their first and second attempts and go directly to the third one (they will need to enroll in this course again the following academic year). Students who are in the third or fourth attempt should contact the professor during the first two weeks of the course.

ATTENDANCE

Attendance is mandatory at IE University, as it is an essential factor of IE's learning methodology. While we do closely monitor attendance in each course, we also consider our students responsible for their own agenda and commitments, as adult university students. With that in mind, each student may miss up to 30% of the sessions within a given course and still maintain the possibility of passing that given course. This 30% "buffer" is to be used for any absences, such as: illnesses, personal emergencies, commitments, official/governmental matters, business and/or medical appointments, family situations, etc. Students should manage their various needs, and situations that may arise, within that 30% buffer. If a student is absent to more than the allowed 30% of the sessions (regardless of the reason), s/he will obtain a 0.0 grade for that course in both the ordinary and extraordinary calls of the current academic year, and s/he will have to retake the course during the following academic year. Having established the rule, we strongly discourage to use this buffer as granted, we highly recommend to attend 100% of the classes as it will improve your learning outcomes, it will increase the class performance and it might improve your participation grade.

Extreme cases involving emergencies such as: extended hospitalizations, accidents, serious illnesses and other contexts involving force majeure, are to be consulted with the Program Management team for assessment of the situation and corresponding documentation, so that Program Management can support and guide each student optimally.

RETAKE POLICY

Any student whose weighted final grade is below 5 will be required to sit for the retake exam to pass the course (except those not complying with the attendance rules, whom are banned from this possibility).

Grading for retakes will be subject to the following rules:

- The retakes will consist of a comprehensive exam. The grade will depend only on the performance on this exam; continuous evaluation over the semester will not be taken into account.
- The exam will be designed bearing in mind that the passing grade is 5 and the maximum grade that can be attained is 8 out of 10.
- Dates and location of the retakes will be posted in advance and will not be changed.

PLAGIARISM / ACADEMIC HONESTY

Plagiarism is the dishonest act of presenting another person's ideas, texts or words as your own. This includes in order of seriousness of the offense:

- providing faulty sources;
- copy-pasting material from your own past assignments (self-plagiarism) without the instructor's permission;
- copy-pasting material from external sources even while citing them;
- using verbatim translations from sources in other languages without citing them;
- copy-pasting material from external sources without citing them;
- and buying or commissioning essays from other parties.

IEU students must contact the professor if they don't know whether the use of a document constitutes plagiarism. The professor will advise the student on how to present said material. All written assignments have to be submitted through Turnitin, which produces a similarity report and detects cases of plagiarism. Professors are required to check each student's academic work in order to guarantee its originality. If the originality of the academic work is not clear, the professor will contact the student in order to clarify any doubts. In the event that the meeting with the student fails to clarify the originality of the academic work, the professor will inform the Director of the Bachelor Program about the case, who will then decide whether to bring the case forward to the Academic Ethics Committee. Very high similarity scores will be automatically flagged and forwarded to the Academic Ethics Committee. Plagiarism constitutes a very serious offense and may carry penalties ranging from getting a zero for the assignment to expulsion from the university depending on the severity of the case and the number of times the student has committed plagiarism in the past.

EVALUATION

Criteria	Percentage	Comments
Class Participation	10 %	
Assignments	50 %	Individual or Group
Final Exam	40 %	

ASSIGNMENTS

Along the course you will be given 5 different assignments that will count for the 50% of the final grade. To complete each of them you will be given 3 days and then you will have to upload them in the corresponding campus online assignment.

Each of them will have a weight of a 10% and any delay in the submission will reduce the maximum grade in 2 points per day of delay.

The format of the submission is pdf or html, no other format is allowed (this means that you will have to do a markdown notebook), and it must contain the explanations, pieces of code and graphs required for the questions.

FINAL EXAM

The Final Exam, which accounts for the 40% of the grade, will be completed alone. Each student will receive a data base and be asked to perform some analysis of the data covering the four previous units. The exam must be submitted to the campus online within the session time in pdf or html format after compiling your own markdown document.

In this report the student will have to write both, the codes designed to perform the analysis and the explanation of the results. The report will account for the 40% of the Final Grade. The evaluation of this report is divided in two: 30% the explanations and 70% the codes, all considering the following criteria

About the report

The aspects that will be considered when grading the report are the following

Criteria	Weights
Formatting (30%)	- 30% if the report is well-formatted and thought out - 15% if the report is partly well-formatted - 5% if the report is poorly formatted
Content (40%)	- 40% if the content is clearly presented - 25% if there are some mathematical or spelling typos, wrong tables, grammatically incorrect sentences... - 12% if there are too many mathematical or spelling typos, wrong tables grammatically incorrect sentences... - 0% if the content is incomprehensible
Reasonings (30%)	- 30% if the problem and the solutions are rightly explained - 15% if some of the explanations are not right - 5% if nor the problem nor the solutions are rightly explained

About the programs

The aspects that will be considered when grading both, the assignments and the final exam programs, are the following

Criteria	Weights
Program Design (25%)	- 25% if the solution well thought out - 15% if the solution is partially planned out - 5% if the program is “designed at the keyboard”
Program Execution (20%)	- 20% if the program runs correctly - 10% if the program produces correct output some of the times - 5% if the program runs but mostly incorrectly - 0% if the program does not run at all
Specification Satisfaction (25%)	- 25% if the program satisfies the specifications completely and correctly - 12% if parts of the specifications are not implemented - 5% if the program does not satisfy the specifications
Coding Style (20%)	- 20% for well-formatted, understandable code - 12% for code hard to follow in one reading - 5% for incomprehensible code
Comments (10%)	- 10% for concise, meaningful, well-formatted comments - 5% for partial, poorly written or poorly formatted comments - 2% for wordy, unnecessary, incorrect, or badly formatted comments - 0% if no comments at all
Extra Credit (10%)	- 4% for programs that usefully extend the requirements - 3% for programs that use a particularly good algorithm - 3% for programs that are written or use the capabilities of the language particularly well

PROFESSOR BIO

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Short Bio

Prof. Juanjo Manjarín received the highest grade for his Ph.D. in Theoretical Physics in String Theory and M-Theory from the Universidad Autónoma de Madrid (UAM), after earning an Advanced Studies Diploma (DEA) in Theoretical Physics from the Universidad Autónoma de Madrid (UAM).

His teaching experience includes different international universities where he lectured on Complex Variable Analysis, Theoretical Mechanics or Classical Electrodynamics. In the IE University he has been teaching Mathematics, Statistics, Econometrics and Introduction to R Programming, receiving two awards for Excellence in Teaching in Mathematics II and Statistics. He is also professor of Math and Stats in R and Python at the Bootcamp for Data Science in the IE Exponential Learning. He has published a number of papers on international journals on mathematics and theoretical physics and was reviewer for Mathematical Reviews from 2003 to 2005 and during 2016 he also worked in El Pais in the realization of some divulgative science materials.

He has also corporate experience on different TV and cinema production companies: Gestmusic Endemol, 7 y Acción S.L., Hill Valley S.L., 100 Balas S.L. or Zebra Producciones in TV shows such as “El Hormiguero” or “Esto es vida!”, receiving prize Ondas and Rose d’Or in 2008 and 2009. He has worked as director, producer and post-producer of different short films and now as director of E8 Producciones is recording a documentary film on gender equalit

OTHER INFORMATION