



IB/CS 385 INTRODUCTION TO BUSINESS PROGRAMMING AND ARTIFICIAL INTELLIGENCE

IES Abroad Milan

DESCRIPTION:

This course enables students to acquire basic skills in one of the most fundamental skills of the present period: computer programming. The course introduces students to data analysis programs with the aim of growing their skills in using those programs to predict future outcomes. Students will first learn how to write programming codes from scratch using Python, one of the most intuitive and popular programming languages. The course will then familiarize students with the most important predictive techniques – from linear regressions to machine learning – and ask them to implement what they’ve learned theoretically in applications related to management and marketing.

CREDITS: 3 credits

CONTACT HOURS: 45 hours

LANGUAGE OF INSTRUCTION: English

PREREQUISITES: An introductory knowledge of statistics is required. Students must bring their own laptop in class.

ADDITIONAL COST: None

METHOD OF PRESENTATION:

Theoretical lectures illustrated by examples followed by programming sessions. Students should plan to bring their own laptops (at least 2 GB of RAM) to class on the dates indicated in the schedule. In the first session all relevant concepts in calculus and statistics will be introduced to students.

Since the conceptual material is dense and requires both theoretical and practical modules to be adequately processed and understood by students, the course often pairs theoretical sessions with lab components during which students will get hands-on practice with the week's material by working on assigned lab activities.

REQUIRED WORK AND FORM OF ASSESSMENT:

- Class Engagement - 15%
- Midterm Exam - 30%
- Group Project- 25%
- Final Exam - 30%

Class Engagement

Students are expected to actively participate in class and to demonstrate respect and responsibility in the classroom. A rubric for participation will be available on Moodle and distributed on the first day of class. During practical class sessions, students will be expected to engage actively with self-assessment tests and practical exercises requiring them to code and resolve business problems.

Midterm Exam

Students will be asked to resolve small exercises and to answer multiple-choice questions on the techniques covered in the first half of the class. The exam will last 1 hour.

Group Project

Students will be asked to complete a group project, using coding to answer a series of business questions.

Final Exam

Students will be asked to resolve small exercises and to answer multiple-choice questions on the techniques covered in the first half of the class. The exam will last 1 hour.

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LEARNING OUTCOMES:

By the end of the course, students will be able to:

- Apply the logic of computer programming and Artificial Intelligence
- Write code that collects, manipulates, and visualizes data in Python
- Evaluate a data set and identify analytical techniques that can extract relevant information from it
- Implement the most important predictive techniques in Python and apply them to financial or business concerns

ATTENDANCE POLICY:

As a member of our class community, you are expected to be present and on time every day. Attending class has an impact on your learning and academic success. For this reason, the IES Abroad Milan attendance policy allows for the following number of absences, which are intended to be used for physical and mental health reasons:

- THREE (3) absences in each Italian language course,
- TWO (2) absences in each Area Studies course,
- ONE (1) absence in each seminar course or course meeting 1 day a week,
- ZERO (0) absences in each course of individual music instruction.

Every absence beyond this allowance will automatically result in a penalty of 2 percentage points off the final grade. SEVEN (7) absences will result in a failing grade in Italian language and Area Studies courses. FOUR (4) absences will result in a failing grade in seminar or 1-day-a-week courses. Failure to attend a scheduled exam, test, quiz, or presentation will automatically result in an F grade on that assessment.

ACADEMIC INTEGRITY:

Students are expected to abide by the **IES Abroad Code of Academic Integrity**. All work submitted by a student for academic credit should constitute the student's own original work. Any work submitted for academic credit may be subject to review by a textual similarity detection service for the detection of plagiarism and AI usage.

CONTENT:

Each theoretical session is followed by a practical session in which students are asked to implement the techniques highlighted that week on their own laptops.

Each theoretical session will have support material:

- Lecturer's slides
- Excerptions from books, articles, handbooks, cheatsheets
- Python Notebooks with examples of coding
- Open-source datasets
- A self-assessment test in the form of multiple-choice questions
- Practical exercises require students to code to resolve business problems.

Support material and exercises are reported into the Assignment column, session by session.

Session	Content	Assignments
Week 1 <i>Session 1</i>	Course Introduction • Python initial assessment (not graded)	Professor's Slide Initial Assessment

Week 1 <i>Session 2</i>	Introduction to statistical learning and model accuracy. - Brief history of AI - Defining data science, machine learning, deep learning, artificial intelligence, large language models - Why AI is at a tipping point (cloud, open source, data explosion, models improvements)	Readings Introduction to Machine Learning: https://towardsdatascience.com/introduction-to-machine-learning-for-beginners-eed6024fdb08 Cheatsheets
Week 2 <i>Session 3</i>	Statistical learning and model metrics. - Classification of Analytics: descriptive, diagnostic, predictive analytics - Data Science Process (CRISP Model) - Model performances: overfitting, underfitting - Introduction to Google Colab	Readings - Types of Analytics: https://business.adobe.com/blog/basics/descriptive-predictive-prescriptive-analytics-explained - CRISP DM Model: https://www.datascience-pm.com/crisp-dm-2/ Cheatsheets
Week 2 <i>Session 4</i>	Lab session: introduction to Python (bring your own laptop) Introduction to Python: basic commands, data structures, if-then-else, for, while cycles, functions	Notebooks Python notebooks in Intro Folder Cheatsheets
Week 3 <i>Session 5</i>	- Data Exploration and Visualization: univariate and multivariate statistics - Problem / Objective: visualization (barplot, histogram, scatterplot, time series, boxplot, correlation matrices, etc.) - Main statistics: mean, median, mode, variance, standard deviation, count, correlation, etc.	Notebooks Python notebooks in Intro Folder Cheatsheets Readings - EVALUATION METRICS https://www.analyticsvidhya.com/blog/2019/08/11-important-model-evaluation-error-metrics/ - UNDERFITTING VS OVERFITTING: https://towardsdatascience.com/overfitting-and-underfitting-principles-ea8964d9c45c

Week 3 <i>Session 6</i>	Data Exploration and Visualization: univariate and multivariate statistics II - Problem / Objective: visualization (barplot, histogram, scatterplot, time series, boxplot, correlation matrices, etc.) - Main statistics: mean, median, mode, variance, standard deviation, count, correlation, etc.	Notebooks Python notebooks in EDA Folder Cheatsheets Readings - EDA (Exploratory Data Analysis) https://towardsdatascience.com/exploratory-data-analysis-8fc1cb20fd15 - CLEANING DATA (with PANDAS and NUMPY): https://realpython.com/python-data-cleaning-numpy-pandas/
Week 4 <i>Session 7</i>	Linear regression part 1	Readings Linear Regression Introduction: A Beginner's Guide to Linear Regression in Python with Scikit-Learn - KDnuggets Cheatsheets
Week 4 <i>Session 8</i>	Lab session: linear regression	Notebooks Python notebooks in Linear Regression Folder
Week 5 <i>Session 9</i>	Linear regression part 2	Readings Linear Regression using Python: https://towardsdatascience.com/simple-linear-regression-model-using-python-machine-learning-eab7924d18b4
Week 5 <i>Session 10</i>	Lab session linear regression part 2	Notebooks Python notebooks in Linear Regression Folder
Week 6 <i>Session 11</i>	Classification introduction - Main Classification Use Cases - Confusion Matrix - Performance Metrics	Readings Classification introduction: https://www.datacamp.com/blog/classification-machine-learning Cheatsheets
Week 6 <i>Session 12</i>	MIDTERM EXAM	Midterm Exam
Week 7 <i>Session 13</i>	Classification Models Logistic Regression	Notebooks Python notebooks in Classification Folder Cheatsheets Readings Logistic Regression Intro: https://www.analyticsvidhya.com/blog/2021/08/conceptual-understanding-of-logistic-regression-for-data-science-beginners/

Week 7 <i>Session 14</i>	Classification Models Decision Tree	Notebooks Python notebooks in Classification Folder Cheatsheets Readings Decision Tree: https://www.kdnuggets.com/2020/01/decision-tree-algorithm-explained.html
Week 8 <i>Session 15</i>	Classification Models Random Forest	Notebooks Python notebooks in Classification Folder Cheatsheets Readings Random Forest: https://www.analyticsvidhya.com/blog/2021/06/understanding-random-forest/
Week 8 <i>Session 16</i>	Unsupervised learning Principal Component Analysis 1	Cheatsheets Principal Component Analysis: https://www.sartorius.com/en/knowledge/science-snippets/what-is-principal-component-analysis-pca-and-how-it-is-used-507186
Week 9 <i>Session 17</i>	Unsupervised learning: Principal Component Analysis 2	Notebooks Python notebooks in PCA and Clustering Folder
Week 9 <i>Session 18</i>	Unsupervised learning Clustering 1	Cheatsheets Clustering: https://blog.dataiku.com/clustering-how-it-works-in-plain-english
Week 10 <i>Session 19</i>	Unsupervised learning Clustering 2	Notebooks Python notebooks in PCA and Clustering Folder
Week 10 <i>Session 20</i>	Data Modeling Lab	Notebooks Exercises in class
Week 11 <i>Session 21</i>	Data Modeling Lab	Notebooks Exercises in class DEADLINE: GROUP PROJECT SUBMISSION
Week 11 <i>Session 22</i>	Final review of the course / Exam simulation	Multiple-choice and open-ended questions

REQUIRED READINGS:

- Introduction to Machine Learning: <https://towardsdatascience.com/introduction-to-machine-learning-for-beginners-eed6024fdb08>

- Types of Analytics: <https://business.adobe.com/blog/basics/descriptive-predictive-prescriptive-analytics-explained>
- CRISP DM Model: <https://www.datascience-pm.com/crisp-dm-2/>
- EVALUATION METRICS <https://www.analyticsvidhya.com/blog/2019/08/11-important-model-evaluation-error-metrics/>
- UNDERFITTING VS OVERFITTING: <https://towardsdatascience.com/overfitting-and-underfitting-principles-ea8964d9c45c>
- EDA (Exploratory Data Analysis) <https://towardsdatascience.com/exploratory-data-analysis-8fc1cb20fd15>
- CLEANING DATA (with PANDAS and NUMPY): <https://realpython.com/python-data-cleaning-numpy-pandas/>
- Linear Regression Introduction: A Beginner's Guide to Linear Regression in Python with Scikit-Learn - KDnuggets
- Linear Regression using Python: <https://towardsdatascience.com/simple-linear-regression-model-using-python-machine-learning-eab7924d18b4>
- Classification introduction: <https://www.datacamp.com/blog/classification-machine-learning>
- Logistic Regression Intro: <https://www.analyticsvidhya.com/blog/2021/08/conceptual-understanding-of-logistic-regression-for-data-science-beginners/>
- Decision Tree: <https://www.kdnuggets.com/2020/01/decision-tree-algorithm-explained.html>
- Random Forest: <https://www.analyticsvidhya.com/blog/2021/06/understanding-random-forest/>
- Principal Component Analysis: <https://www.sartorius.com/en/knowledge/science-snippets/what-is-principal-component-analysis-pca-and-how-it-is-used-507186>
- Clustering: <https://blog.dataiku.com/clustering-how-it-works-in-plain-english>

RECOMMENDED READINGS:

- **Short history of AI 1:** <https://www.freecodecamp.org/news/the-history-of-ai/>
- **Short history of AI 2:** <https://www.tableau.com/data-insights/ai/history>
- **What is Generative AI?:** <https://www.gartner.com/en/insights/generative-ai-for-business>

SUGGESTED HANDBOOK:

- Jake Vanderplas, Python Data Science Handbook: Essential Tools for Working With Data, O'Reilly, 2022: <https://www.oreilly.com/library/view/python-data-science/9781098121211/>