

<b>Course:</b> Quantitative Methods					<b>Status:</b> optional			
Semester	No. of weeks	No. of hours (weekly)			No. of hours (total)			ECTS
		Lect.	Class	Lab.	Lect.	Class	Lab.	
autumn		2		2	15		15	4
<b>Lecturer:</b> Grzegorz Bulczak, PhD								

**Contents of study:**

1. Data-Driven Decision Making: Emphasize the crucial role of quantitative methods in making informed decisions across various fields, moving beyond intuition to evidence-based insights.
2. Quantitative Foundations: Revisit core statistical concepts (e.g., probability, distributions, hypothesis testing) with a strong focus on their practical application and interpretation in real-world data.
3. Introduction to Programming for Data: Integrate an accessible introduction to a relevant programming language (e.g., Gretl, Stata or R) for data manipulation, analysis, and visualization, treating it as a fundamental tool.
4. Regression Analysis (Beyond Linearity): Cover linear regression thoroughly, but then extend to more advanced topics like multiple regression, logistic regression, and an introduction to non-linear models.
5. Time Series Analysis & Forecasting: Introduce techniques for analyzing time-dependent data, including ARIMA models, exponential smoothing, and machine learning approaches for forecasting.
6. Optimization & Simulation: Explore concepts of mathematical optimization (e.g., linear programming) and simulation (e.g., Monte Carlo) to model complex systems and find optimal solutions.
7. Machine Learning Fundamentals, AI (Applied): Dedicate a segment to the basics of supervised and unsupervised machine learning algorithms (e.g., k-NN, decision trees, clustering) and their application in quantitative analysis.
8. Data Visualization & Storytelling: Stress the importance of effectively communicating quantitative findings through compelling and accurate data visualizations, teaching principles of good design.
9. Big Data, Data Management & Cloud Computing.
10. Ethical Considerations & Responsible AI: Integrate discussions on the ethical implications of using quantitative methods, including data privacy, bias in algorithms, and the responsible deployment of AI-driven solutions.

**Criteria for assessment:** Project developed during the practical (lab.) part of the course (10 points). Voluntary presentation (2 points) The course is passed after receiving 6 points.

**References:**

1. Gelman, A., Hill, J., & Vehtari, A. (2020). *Regression and Other Stories*. Cambridge University Press.
2. Hyndman, R. J., & Athanasopoulos, G. (2021). *Forecasting: Principles and Practice* (3rd ed.). OTexts.
3. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2023). *An Introduction to Statistical Learning: With Applications in R* (2nd ed.). Springer. OR James, G., Witten, D., Hastie, T., Tibshirani, R., & Taylor, J. (2023). *An Introduction to Statistical Learning: With Applications in Python*. Springer. [Choose the appropriate version based on the course's language focus.]
4. McKinney, W. (2017). *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd ed.). O'Reilly Media.
5. Provost, F., & Fawcett, T. (2013). *Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking*. O'Reilly Media.