

Subject card

Subject name and code	Analytical Software and Data Visualization - Statistical Profile, PG_00203602						
Field of study	Informatics and Econometrics						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2027/2028		
Education level	Bachelor's studies		Subject group		Obligatory subject group in the field of study Optional subject group Subject group related to scientific research in the field of study		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		Polish		
Semester of study	3		ECTS credits		7.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Department of Statistics -> Faculty of Management -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		dr Tomasz Jurkiewicz				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	15.0	0.0	0.0	75
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	75		4.0		96.0	175
Subject objectives	To gain knowledge of software tools used for statistical analysis and data presentation. To develop the ability to independently prepare and apply software for data analysis, data visualization, and computer-based simulations.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[liEL3_W05] Knows and understands the methods, techniques and informatics or statistics tools used to acquire, collect, process and present data in decision-making processes	Student knows software tools used for data extraction from databases (SQL), data processing and analysis using Python and R programming languages, as well as for presenting results using Power BI.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report
	[liEL3_U02] Can select or construct econometrics, informatics or statistics tools and apply them to describe and solve economic and social problems	Student is able to select and apply appropriate tools (SQL, Python, R, and Power BI) to solve analytical problems, as well as to design reports, dashboards, and decision-support models.	[SU2] presentation/project/paper/report [SU4] test/exam - oral or written
	[liEL3_W06] Knows and understands, to an advanced degree, the processes and methods of creating, developing, and providing appropriate conditions for using informatics or statistics tools, particularly those that improve human and organizational functioning	Student knows and understands the capabilities and limitations of SQL, Python, R, and Power BI tools in the acquisition, processing, analysis, and visualization of data supporting decision-making processes.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/report
	[liEL3_U03] Can obtain data from appropriately selected sources, use these data to solve economic and social problems, and process and interpret them using econometrics, informatics or statistics tools	Student is able to extract data from relational databases using SQL, prepare data for analysis, perform analyses in Python and R, and interpret obtained results.	[SU2] presentation/project/paper/report [SU4] test/exam - oral or written

Subject contents	R • Project website, download and installation; literature and documentation; R environment and RStudio; philosophy of the R language (including basic operations, vectors and matrices: creation, modification, and operations on them) • Data frames (importing data from .txt, .csv, .xlsx files; data inspection; selecting subsets (rows and columns); adding and removing variables/records; variable types; variable names; factor labels for categorical variables; checking missing values (NA)) • Data structure analysis: computation of descriptive statistics, data grouping, frequency distributions and contingency tables, multivariate calculations across multiple columns. Data transformations and structural manipulation. Conditional analysis (grouped statistics). Saving results (.RData, .xlsx, .csv) • Data transformation using the dplyr package (grouping, filtering, variable transformation, summarising variables, grouped statistics; joining data frames) • Loops and conditional statements. User-defined functions. Examples based on computer simulations • Computer simulations • Data visualisation using the graphics package and related packages • Data visualisation using ggplot2 and related packages • Report generation and R Markdown workflow Python • Anaconda: download and installation. Environments: Jupyter Notebook, Spyder, PyCharm, Google Colab. Philosophy of Python (including basic operations, data types, and object operations) • Control structures and loops (including operations on different data types, for and while loops) • User-defined functions • Operations on vectors and matrices • Use of software in computer simulations • Data frames (data import, basic operations: adding, merging, grouping observations and variables) • Data frames (basic descriptive statistics, relationships between quantitative and qualitative variables) • Data visualisation in Python • Interactive data visualisation in Python • Practical data preparation and data frame analysis • Use of generative artificial intelligence as a programming aid (including code generation and debugging) • Opportunities and risks of using artificial intelligence in statistical computing and data visualisation SQL • Microsoft SQL Server: download and installation • Philosophy of SQL (including basic database concepts) • Data retrieval and sorting (SELECT, ORDER BY) • Data filtering (WHERE, BETWEEN, AND, OR, IN, NOT, LIKE) • Aggregate functions (AVG, COUNT, MAX, MIN, SUM) • Grouping and joining tables (GROUP BY, JOIN, UNION) • Data insertion, updating and deletion (INSERT, UPDATE, DELETE) Power BI • Power BI: download and installation • Data transformation using Power Query Editor (including data extraction, cleaning, and transformation) • Data modelling (including table relationships and defining relationships between tables) • Calculations using DAX (including aggregate, filtering, time-intelligence, relational, and statistical functions) • Interactive data visualisations and reports • Dashboard development (including data storytelling)											
Prerequisites and co-requisites	Descriptive statistics, mathematical statistics. Basic computer skills and ability to use the Internet.											
Assessment methods and criteria	<table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>written project</td><td>51.0%</td><td>50.0%</td></tr><tr><td>oral exam</td><td>51.0%</td><td>50.0%</td></tr></table>			Subject passing criteria	Passing threshold	Percentage of the final grade	written project	51.0%	50.0%	oral exam	51.0%	50.0%
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written project	51.0%	50.0%										
oral exam	51.0%	50.0%										
Recommended reading	Basic literature	1. R Core Team (2021). <i>An Introduction to R</i>. The R Foundation for Statistical Computing. https://cran.r-project.org/doc/manuals/r-release/R-intro.html 2. H. Wickham, G. Grolemund (2017). <i>R for Data Science: Import, Tidy, Transform, Visualize, and Model Data</i>. O'Reilly Media, Sebastopol, CA. https://r4ds.had.co.nz/ 3. W. McKinney (2018). <i>Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython</i>. 2nd ed. Helion, Gliwice. 4. D. Knight, E. Ostrowsky, M. Pearson (2023). <i>Microsoft Power BI Quick Start Guide: The Ultimate Beginners Guide to Data Modeling, Visualization, and Dashboards</i>. Helion. 5. I. Ben-Gan (2023). <i>T-SQL Fundamentals</i>. Pearson.										

	Supplementary literature	1. E. Matthes (2019). <i>Python Crash Course: A Hands-On, Project-Based Introduction to Programming</i>. 2nd ed. Hellon, Gliwice 2. Lutz, M. (2013). <i>Learning Python</i>. O'Reilly Media. 3. Martin, R. C. (2008). <i>Clean Code: A Handbook of Agile Software Craftsmanship</i>. Prentice Hall. 4. Wickham, H., Grolemund, G. (2017). <i>R for Data Science</i>. O'Reilly Media.
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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