

Subject card

Subject name and code	Data Analysis and Visualisation in R, PG_00210490						
Field of study	Spatial Management						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2026/2027		
Education level	Master's studies		Subject group		Obligatory subject group in the field of study Optional subject group		
Mode of study	full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		English		
Semester of study	3		ECTS credits		2.0		
Learning profile	academic		Assessment form		credit		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Michał Marosz				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		0.0		20.0	50
Subject objectives	The aim of the course is to develop practical skills in importing, processing, analysing, interpreting and visualising data using the R programming language and selected packages from the tidyverse ecosystem. Students will learn the basic principles of working with data, preparing datasets for analysis, creating effective visualisations, and presenting analytical results in a clear, reproducible and methodologically sound way.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
			Is able to create and interpret visualisations and simple analytical reports in R, using the ggplot2 package, code, results, graphs and interpretative commentary to draw valid conclusions.		[SK2] presentation/project/paper/report [SK4] test/exam - oral or written		
			Can import, clean, transform and analyse data in R, including identifying missing data, checking variable types, performing aggregations, joining tables and carrying out basic exploratory data analysis.		[SK2] presentation/project/paper/report [SK4] test/exam - oral or written		
			Knows the basic components of the R working environment and understand the principles of organising a simple analytical project, comprising scripts, objects, data frames and a repeatable workflow.		[SK2] presentation/project/paper/report [SK4] test/exam - oral or written		

Subject contents	## Course content 1. **Introduction to R and RStudio** * basic elements of the working environment, * scripts, console and R projects, * installing and loading packages, * basic types of objects in R. 2. **Basics of working with data in R** * data frames and tibbles, * structure of datasets, * types of variables, * basic operations on objects and variables. 3. **Importing data from different sources** * importing CSV and TXT files, * importing spreadsheets, * using sample datasets available in R packages, * checking the correctness of imported data. 4. **Data cleaning and preparation for analysis** * identifying missing values, * checking and changing variable types, * detecting basic errors in data, * cleaning column names and variable values. 5. **Data transformation using tidyverse packages** * filtering observations, * selecting and renaming variables, * creating new variables, * grouping and aggregating data, * sorting data, * joining tables. 6. **Reshaping data** * data in wide and long formats, * reshaping data using <code>`pivot_longer()`</code> and <code>`pivot_wider()`</code>, * preparing data for analysis and visualisation. 7. **Basic exploratory data analysis** * describing variable distributions, * basic measures of descriptive statistics, * analysing relationships between variables, * comparing groups, * identifying outliers. 8. **Introduction to data visualisation in R** * the role of visualisation in data analysis, * selecting the appropriate type of chart for the data, * basic principles of clear and accurate visualisation. 9. **Creating charts using ggplot2** * structure of a chart in <code>`ggplot2`</code>, * scatter plots, line charts, bar charts and histograms, * boxplots and density plots, * mapping aesthetics, * grouping data in charts. 10. **Customising chart appearance** * axis scales, * colours and colour palettes, * labels, titles and legends, * graphical themes, * improving chart readability. 11. **Presenting variability and uncertainty in data** * confidence intervals, * error bars, * presenting dispersion and variability in data, * interpreting uncertainty in charts. 12. **Interpreting analytical and visual results** * formulating conclusions based on results, * identifying key relationships and patterns,
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	* avoiding interpretation errors. 13. **Reproducibility of analyses** * organising an analytical project, * good practices in writing code, * documenting the stages of analysis, * basics of working with an analytical report. 14. **Preparing a simple analytical report** * combining code, results, charts and commentary, * structure of an analytical report, * presenting results in a clear and reproducible way. 15. **Independent work with documentation and problem solving** * using help in R, * interpreting error messages, * searching for solutions in documentation and R community resources, * good practices for further development of analytical skills.											
Prerequisites and co-requisites	Ability to use a PC at a basic level. Knowledge of the basics of descriptive statistics.											
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>Test - practical use of R in data analysis and visualisation</td><td>51.0%</td><td>70.0%</td></tr><tr><td>Project - real data analysis (group work + presentation)</td><td>51.0%</td><td>30.0%</td></tr></table>	Subject passing criteria	Passing threshold	Percentage of the final grade	Test - practical use of R in data analysis and visualisation	51.0%	70.0%	Project - real data analysis (group work + presentation)	51.0%	30.0%		
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Sample practical test tasks

Task 1. Data import and initial data checking

Import the file `students\_results.csv`, which contains data on students' results from several tutorial groups.

The file contains the following variables:

- * `student\_id` – student identifier,
- * `group` – tutorial group,
- * `test\_1` – result of the first test,
- * `test\_2` – result of the second test,
- * `project` – project result,
- * `attendance` – number of attended classes.

Complete the following steps:

1. Import the data into R.
2. Check the structure of the data.
3. Check the number of observations and variables.
4. Check whether there are any missing values in the dataset.
5. Calculate basic descriptive statistics for numerical variables.

Task 2. Data cleaning and preparation

In the `students\_results.csv` dataset, some group names are recorded inconsistently, for example: `A`, `group A`, `Grupa A`, `B`, `group B`.

Complete the following steps:

1. Standardise the group names so that they have the form `A`, `B`, `C`.
2. Replace any missing values in the `attendance` variable with `0`.
3. Create a new variable `final\_score`, calculated as a weighted average of the results:

- * `test\_1` – 30%,
- * `test\_2` – 30%,
- * `project` – 40%.

4. Create a new variable `passed`, which takes the value:

- * `"yes"` if `final\_score >= 50`,
- * `"no"` if `final\_score < 50`.

5. Display the first 10 rows of the cleaned dataset.

Task 3. Grouping, aggregation and interpretation of results

Using the prepared dataset, calculate a summary of results for each tutorial group.

For each group, calculate:

1. the number of students,
2. the mean final score,
3. the median final score,
4. the minimum and maximum final score,
5. the percentage of students who passed the course.

Then:

6. arrange the groups in descending order according to the mean final score,
7. indicate the group with the highest mean final score,
8. write a short interpretative comment consisting of 2–3 sentences.

Task 4. Data visualisation using ggplot2

Using the `students\_results.csv` dataset, prepare three charts:

1. a histogram of the `final\_score` variable,
2. a boxplot showing the variation in `final\_score` across groups,
3. a bar chart showing the percentage of students who passed the course in each group.

Each chart should include:

- * a title,
- * labelled axes,
- * a clear legend, if needed,
- * a readable graphical theme, for example `theme\_minimal()`.

	Finally, choose one of the charts and write a short interpretation of the results shown. --- ## Task 5. Simple analytical report Prepare a short analytical report in a <code>.qmd</code> or <code>.Rmd</code> file using the <code>students_results.csv</code> dataset. The report should include: 1. a report title, 2. a short description of the analysed dataset, 3. code for importing the data, 4. a basic summary of the data, 5. a table with results aggregated by group, 6. at least two charts created with <code>ggplot2</code>, 7. a short interpretative comment on the results, 8. final conclusions in 3–5 sentences. The report should be possible to render as an HTML or PDF document.
Work placement	Not applicable

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