

Subject code	ECTS credits
MAT3022	5

Course title in Lithuanian

MATEMATIKOS PROGRAMINĖ ĮRANGA

Course title in English

SOFTWARE FOR MATHEMATICS

Short course annotation in Lithuanian (up to 500 characters)

Šis kursas supažindina studentus su matematikoje ir statistikoje naudojama programine įranga ir jos praktiniais taikymais. Didžiausias dėmesys skiriamas praktiniams darbams naudojant programavimo kalbą R ir LaTeX. Studentai mokomi ne tik naudoti programinę įrangą, bet ir tinkamai interpretuoti rezultatus, įvairiose praktinėse situacijose. Kursas skirtas studentams, besidomintiems matematinių programavimu ir statistinių duomenų apdorojimu bei analizavimu.

Short course annotation in English (up to 500 characters)

This course will introduce the student to the mathematical and statistical software. Among the packages are R for statistical computing and LaTeX for mathematical documents. Hands-on activities with software items will form a major part of the course. The student will be trained not only to use the software items, but also interpret the results meaningfully as related to specific applications situations. The course is designed primarily for students interested in mathematical and statistical computing and analysis.

Prerequisites for entering the course

Programming Fundamentals, Mathematical Statistics.

Course aim

To introduce and teach to use the student to the currently available mathematical and statistical software, particularly programming language R and LaTeX.

Links between course outcomes, criteria of learning achievement evaluation, study methods and methods of learning achievement assessment

No	Course outcomes	Criteria of learning achievement evaluation	Study methods	Methods of learning achievement assessment
1.	To understand how to use R programming language to perform calculations pertaining to optimization, linear algebra and statistical analysis.	Student demonstrates the ability to choose correct packages or methods for the specific computational task. Student is able to write a program in R using various data structures, control structures, built-in math and user defined functions.	Lectures, practical works, individual work, consulting.	Final exam, mid-term exam, assessment of practical works.
2.	To understand how to read, write, import, export data from plain text or binary data files.	Student demonstrates the ability to import/export data using R programming language.	Lectures, practical works, individual work, consulting.	Mid-term exam, assessment of practical works.
3.	To understand how to construct graphical output from the mathematical software.	Student demonstrates the ability to create, save and export graphs in R.	Lectures, practical works, individual work, consulting.	Mid-term exam, assessment of practical works.
4.	To use LaTeX to compose documents, presentations and reports.	Student demonstrates the ability how to typeset and communicate results in LaTeX.	Lectures, practical works, individual work, consulting.	Final exam, mid-term exam, assessment of practical works.

Links between study programme outcomes and course outcomes

Study programme outcomes	Running number of course outcome			
	1	2	3	4
Know and comprehend the needs and importance of information technologies in study process, also be able to apply programming knowledge and skills, data structures and modelling	+			+
Summarize and evaluate critically scientific and professional literature, as well as use various tools for collecting of information for the study process and for solving fixed practical/theoretical problems	+	+	+	+
Identify the problem, collect and analyze real/theoretical data using various mathematical methods, tools and IT technologies	+	+	+	+
Think logically and analytically, evaluate alternative ways of task solving and implement optimal solutions	+			+
Work individually and/or in groups by developing and adopting appropriate mathematical models and tools for use in case analysis	+			+
Clearly and convincingly present problems and solutions, related to economics, energetics, biomedicine and didactics, to experts and non-experts using ground knowledge, reasoning, relevant presentation tools and methods				+

Content

No	Content (topics)
1.	Overview of existing software for the solution of mathematical problems.
2.	Introduction to the R language and functional programming.
3.	Basic data structures: vectors, matrices and arrays, data frames and lists.
4.	Control statements, loops and repeats. Recursion and function composition.
5.	Reading and writing to text files, saving data structures to binary file.
6.	The apply family of functions.
7.	Mathematical and statistical functions.
8.	Programming statistical graphics.
9.	Introduction to Tex and LaTeX.
10.	Specifying document structure.
11.	Mathematical formulas in LaTeX
12.	BibTeX, beamer and other LaTeX packages.

Distribution of workload for students (contact and independent work hours)

Lectures	30
Laboratory work	45
Individual students work	55
Total:	130

Structure of cumulative score and value of its constituent parts

Final examination (50%), written mid-term examination (25%) and assessment of laboratory works (25%).

Recommended reference materials

No	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	Self study rooms	Other libraries
<i>Basic materials</i>						
1.	2008	John M. Chambers, Software for data analysis. Programming with R	Springer			

2.	2010	John Maindonald, W. John Braun, Data Analysis and Graphics Using R – an Example-Based Approach, 3rd edition	Cambridge university press			
3.	2015	Tobias Oetiker, The Not So Short Introduction to LaTeX2 ϵ				http://mirror.datacenter.by/pub/mirrors/CTAN/info/lshort/english/lshort.pdf
4.	2003	Krishnan E, LaTeX Tutorials. A Primer	Indian TeX Users Group, India			http://www.tug.org/twg/mactex/tutorials/ltxprimer-1.0.pdf

Supplementary materials

1.	2005	Emmanuel Paradis, R for Beginners				https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf
2.	2013	Richard Cotton, Learning R.	O'Reilly			
3.	2016	Paul W. Abrahams, TeX for the Impatient				http://git.savannah.gnu.org/cgit/teximpatient.git/plain/teximpatient/book.pdf
4.	2015	Christopher Gandrud, Reproducible Research with R and RStudio, 2nd edition	Chapman and Hall/CRC			

Course programme designed by

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