University of Gdańsk

Subject card

Subject name and code	Advanced Simulation Methods, PG_00178729		
Field of study	Informatics and Econometrics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
Education level	Master'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	part-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	5.0
Learning profile	academic	Assessment form	credit
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	16.0	0.0	16.0	0.0	0.0	32

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	32	2.0	91.0	125

Subject objectives

To acquire in-depth knowledge and advanced skills in the use of computer simulation in solving research and practical problems. Gain practical skills in solving data gaps and assessing imputation quality through computer simulation.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[IiEMU2_W06] Possesses a structured understanding of the processes, methods, and tools necessary for the design, creation, development, and provision of suitable conditions for informatics, econometrics or statistics tools	The student analyses the selection of computer simulation tools, explains the selection of methods for imputation of missing data, creates appropriate computer and statistical tools for imputation and computer simulation.	[SW1] oral statement/ conversation/discussion [SW2] presentation/project/paper/ report [SW5] implementation of a problem task
[IiEMU2_U02] Can use conventional or innovative statistics, econometrics or informatics tools to analyze economic and social phenomena	The student revises and adapts conventional or develops innovative statistical and IT tools and applies them to simulation analysis and analysis of data sets with gaps.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU5] implementation of a problem task [SU6] demonstration of practical skills

<table>
<tr><td>Subject contents</td><td>Concept and types of simulation. Genesis and need for computer simulation. Applicability of simulation methods - advantages and disadvantages of stochastic and deterministic simulation. Building a simulation model. Random number generators from uniform distributions: Assessing the quality of generators through statistical tests and control tasks. Methods for obtaining random numbers from arbitrary probability distributions. Examples of problem solving using computer simulation.

Causes and sources of random and non-random errors in surveys, effects of data gaps on data quality. Analysis of the bias resulting from data gaps. The need to use additional data sources to improve the quality of estimates. Sources of additional data.

Methods of dealing with data gaps - general idea of the imputation approach. Concept and objectives of imputation, basic methods of imputation. Advantages and disadvantages of univariate and multivariate imputation. The problem of variance estimation when imputation is present. Simulation evaluation of imputation quality.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Completed course in statistics, mathematical statistics, representational method, computational programming</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Term paper on imputation and simulation.</td><td>51.0%</td><td>100.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>C.E. Sarndal, S. Lundstrom, Estimation in Surveys with Nonresponse, Wiley.

N. T. Longford, Missing Data and Small-Area Estimation, Springer

Wieczorkowski R. Zieliński R., Computer Generators of Random Numbers, WNT, Warsaw

Gentle J. E., Random Number Generation and Monte Carlo Methods, Springer</td></tr>
<tr><td>Supplementary literature</td><td>M. L. Stein, Interpolation of Spatial Data, Springer

A. Barbu , Song-Chun Zhu, Monte Carlo Methods, Springer

Johnson M. E., Multivariate Statistical Simulation, Wiley</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td></td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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