University of Gdańsk

Subject card

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|---|---|---|---|
| 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<br>Optional subject group<br>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 has knowledge on computer simulation tools, explains the selection of methods for imputation of missing data, creates appropriate computer and statistical tools for imputation and computer simulation. | [SW2] presentation/project/paper/ report |
| [IiEMU2_U02] Can use conventional or innovative statistics, econometrics or informatics tools to analyze economic and social phenomena | The student is able to revise and adapt conventional or develop innovative statistical and IT tools and apply them to simulation analysis and analysis of data sets with gaps. | [SU2] presentation/project/paper/ report |

<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.<br><br>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.<br><br>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.<br><br>N. T. Longford, Missing Data and Small-Area Estimation, Springer<br><br>Wieczorkowski R. Zieliński R., Computer Generators of Random Numbers, WNT, Warsaw<br><br>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<br><br>A. Barbu , Song-Chun Zhu, Monte Carlo Methods, Springer<br><br>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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