Course title:	Computer simulations and numerical calculations by Monte Carlo
Course title in Polish:	Symulacje komputerowe i obliczenia numeryczne metodą Monte Carlo
Course for discipline:	Technical Informatics and Telecommunications

Semester:	5	**Status of course:**	faculty	**Language:**	english
Academic year:	2027/28	**Catalog number:**	127/2025/26		

Coordinator of course:	dr hab. Konrad Furmańczyk, prof. SGGW
Lecturer od course:	dr hab. Konrad Furmańczyk, prof. SGGW
Executing unit:	Institute of Information Technology
Ordering unit:	Doctoral School SGGW
Assumptions, goals and description of the course:	The course will provide an introduction to methods for simulating random phenomena. The main tools for such simulations are Monte Carlo methods. Basic computer simulation techniques will be discussed, including the generation of pseudorandom numbers, simulation of stochastic processes such as ARIMA–GARCH models, numerical integration using the Monte Carlo method, the Gibbs sampler, and the Metropolis–Hastings algorithm. Applications of these methods in Bayesian statistics will also be presented.
Didactic form, number of hours:	15 hours
Teaching methods:	Case-based learning and problem solving
Limit of people in the group:	

Learning outcomes

KNOWLEDGE - the graduate knows and understands:	**SKILLS - the graduate is able to:**	**COMPETENCES - the graduate is ready to:**
To the extent enabling to revise the existing pradigms in the field/discipline - the world achievments, gathering theoretical background as well as general and selected detailed issues	Carry out critical assessment of the scientific research findings and expert activities and their contribution to the knowledge development in the field/discipline	Critically evaluate the achievments in the field/discipline represented
Major general development trends in the field/discipline		Recognise knowledge in solving cognitive and practical problems characteristic for the area of research (field/discipline) and in an interdisciplinary aspect
		Support the ethos of scientific circles and conduct independent research

The method of verification of learning outcomes:	Evaluation of the work
Form of documentation of achieved learning outcomes:	Submitted assignment
Elements and weights of the final grade:	Final assessment: project (written report) – 80%, discussion and class participation – 20%.
Place of the course:	Computer laboratory

Basic and supplementary literature

Basic:
W. Niemiro. Symulacje stochastyczne i metody Monte Carlo, Uniwersytet Warszawski 2013
http://mst.mimuw.edu.pl/wyklady/sst/wyklad.pdf
Supplementary:
C.J. Geyer (1992): Practical Markov Chain Monte Carlo. Statistical Science 7 (4), 473–511.
B.D. Ripley: Stochastic Simulation, Wiley & Sons, 1987.
R. Zieliński, R. Wieczorkowski: Komputerowe generatory liczb losowych, WNT, Warszawa, 1997.

Comments:	

Estimated number of hours of work of the doctoral student necessary to achieve the assumed learning outcomes:	20

Leraning outcomes reference to the second degree characteristics of the National Qualification Framework (level 8) covering doctoral competences:

Symbol:	**Learning outcomes:**	**8 level NQF**
SD1_KW01	To the extent enabling to revise the existing pradigms in the field/discipline - the world achievments, gathering theoretical background as well as general and selected detailed issues	P8S_WG
SD1_KW02	Major general development trends in the field/discipline	P8S_WG
SD1_KU05	Carry out critical assessment of the scientific research findings and expert activities and their contribution to the knowledge development in the field/discipline	P8S_UW
SD1_KK01	Critically evaluate the achievments in the field/discipline represented	P8S_KK
SD1_KK03	Recognise knowledge in solving cognitive and practical problems characteristic for the area of research (field/discipline) and in an interdisciplinary aspect	P8S_KK
SD1_KK08	Support the ethos of scientific circles and conduct independent research	P8S_KR