GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Probabilistic Methods for Informatics, PG_00047664		
Field of study	Informatics		
Date of commencement of studies	October 2021	Academic year of realisation of subject	2022/2023
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	4	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Computer Communications -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jerzy Konorski	
	Teachers	dr hab. inż. Jacek Rak dr hab. inż. Jerzy Konorski dr inż. Maciej Sac dr inż. Bartosz Czaplewski mgr inż. Jakub Grochowski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	15.0	0.0	0.0	60
	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	60	5.0	35.0	100

Subject objectives	Building the knowledge and skills necessary for application of probability and mathematical statistics to selected problems arising in informatics.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U43] can analyse date and formulate, apply and assess appropriate formal models and algorithms for solving problems in the field of information systems and applications	Student can evaluate the usefulness of selected probabilistic models of IT systems	[SU4] Assessment of ability to use methods and tools
[K6_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study and perform tasks, in an innovative way, in not entirely predictable conditions, by:n- appropriate selection of sources and information obtained from them, assessment, critical analysis and synthesis of this information,n- selection and application of appropriate methods and toolsn	Student can apply probabilistic methods to moderately complex problem sof modeling and analysis of IT systems	[SU4] Assessment of ability to use methods and tools
[K6_W01] Knows and understands, to an advanced extent, mathematics necessary to formulate and solve simple issues related to the field of study	Student understands probabilities of random events and distributions of random variables, understands the importance of randomness in the models of contemporary IT systems, as well as suitable analytical methods	[SW1] Assessment of factual knowledge

Subject contents	1. Introduction, probabilistic paradoxes; probabilistic methods as an instrument of cognitive processes; review of basic notions and results of probability theory 2. Probabilistic modeling of content replication in networked structures, coding systems, multiple access, Bloom filters, data fusion, distributed algorithms: applications of event calculus, conditional and total probability, maximum likelihood, Bayes' rule. 3. Probabilistic modeling of social networks, concurrent processes, sorting mechanisms, system lifetimes, defense mechanisms against network attacks: applications of random variables, popular probability distributions, moments and quantiles. 4. Probabilistic analysis of complex decision mechanisms in IT systems: termination policy, software testing, risk analysis, reputation systems. 5. Applications of transformed random variables: pseudorandom number generation with arbitrary probability distributions, elements of data analysis. 6. Practice of sums of iid random variables, convolution of distributions, application of characteristic and generating functions, random sums: access arbitration in multicore architectures, load balancing, population dynamics analysis applied to stack queueing. 7. Weak law of large numbers and central limit theorem, application to prediction of web server workload, anomaly detection, fitting probability distribution to empirical data. 8. Analysis of distribution tails, elements of large deviations theory: assessment of noisy signal deviation, reliability of networked elements, risk of violation of real-time constraints. 9. Application of Markov chains to modeling of text sources, error bursts, queue state evolution, PageRank workings, speech recognition. 10. Random vectors, correlation and regression models: applications to variance reduction in Monte Carlo simulation, lossy image compression, optimal linear prediction. 11. Elements of statistical data analysis and validation of experimental data, estimators, construction of confidence and tolerance intervals. 12. Selected problems of statistical inference, properties and examples of significance tests, evaluation of non-functional requirements in computer systems.
Prerequisites and co-requisites	none
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Lab exercixes	50.0%	30.0%
Final test covering lecture material	50.0%	40.0%
Midterm colloquia	50.0%	30.0%

Recommended reading	Basic literature	W. Sobczak, J. Konorski, J. Kozłowska: Probabilistyka stosowana, Wyd. PG 2004 W. Krysicki i in.: Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, PWN Warszawa 1997
	Supplementary literature	W. Feller: Wstęp do rachunku prawdopodobieństwa, t. I, tłum. pol. PWN Warszawa 1980
	eResources addresses	Adresy na platformie eNauczanie: Metody probabilistyczne w informatyce - 2023 - Moodle ID: 27174 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27174
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	