



Subject card

Subject name and code	Actuarial models, PG_00069472						
Field of study	Modele aktuarialne						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
Education level	second-cycle studies		Subject group		Specialty subject group 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	3		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Institute of Applied Mathematics -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		mgr Piotr Lebieź				
	Teachers		mgr Piotr Lebieź				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	15.0	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	The objective of the course is to familiarize students with the concept of actuarial models, particularly those used for the valuation of property insurance. Throughout the course, students will also learn about market standards and best practices. During the course, students should become acquainted with: • the technical account of an insurance company; • the role of pricing; • data processing methods related to insurance valuation; • GLM/GAM models; • Machine Learning models with techniques for explaining them; • commercialization of models and comparison of various scenarios; • risk modeling, demand modeling, and price optimization. As part of the course assessment, each student will prepare their own project using Python.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W02] has enhanced knowledge of a selected branch of mathematics, theoretical or applied, knows classical definitions and theorems and their proofs and connections with other fields, understands problems being examined	has in-depth knowledge in the field of probability, statistics and mathematical modelling, especially in the field of P&C (non-life) insurance pricing, lists classical definitions, theorems, practices and connections with other fields, understands issues still at the research stage	[SW1] Ocena wiedzy faktograficznej [SW3] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym
	[K7_U07] at an advanced level and covering modern mathematics, applies and presents in speech and in writing the content and methods of a selected branch of mathematics	At an advanced level, including modern mathematics, applies and presents, orally and in writing, the content and methods used in predictive modeling and pricing for P&C (non-life) insurance.	[SU1] Ocena realizacji zadania [SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi
	[K7_U09] constructs mathematical models used in specific advanced applications of mathematics, can use stochastic processes as a tool for modeling phenomena and analyzing their evolution, constructs mathematical models used in specific advanced applications of mathematics, uses stochastic processes as a tool for modeling phenomena and analyzing their evolution, recognizes mathematical structures in physical theories	constructs generalized linear and additive models, understands the operation of tree-based machine learning algorithms	[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu [SU4] Ocena umiejętności korzystania z metod i narzędzi
	[K7_K04] forms opinions on mathematical issues	formulates opinions on issues related to predictive models and pricing process for P&C (non-life) insurance	[SK4] Ocena umiejętności komunikacji, w tym poprawności językowej [SK1] Ocena umiejętności pracy w grupie
Subject contents	Course content – lecture		
	The course consists of:		
	Lectures, covering topics such as: • The technical account of an insurance company • The role of pricing and the actuary • Data preparation • The architecture of actuarial models • Risk and demand models • GLM/GAM • Machine Learning and explainability • Commercialization of models • Price optimization • Scenario analysis • Implementation of ready-made pricing models		
	Course content – laboratory		
Subject contents	Laboratories, where students will use Python to: • Process data • Create visualizations • Build and compare models • Develop and analyze various business scenarios		
	Course content – project		
	Project, where students will independently: • Process data • Create visualizations • Build and compare models • Develop and analyze various business scenarios		

Prerequisites and co-requisites	Basic knowledge of the following courses: 1. Probability Theory 2. Statistics 3. Statistics II 4. Databases 5. Forecasting Theory 6. Mathematical Analysis I 7. Mathematical Analysis II 8. Actuarial Mathematics Basic knowledge of Python programming language.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Project	50.0%	100.0%
Recommended reading	Basic literature	1. "Generalized Linear Models for Insurance Ratemaking", CAS Monograph Series. 2. "Pricing in General Insurance" - Pietro Parodi 3. "Comparative performance analysis between Gradient Boosting models and GLMs for non-life pricing", Viktor Martinez de Lizarduy Kostornichenko, University Carlos III of Madrid, Master in Actuarial Science and Quantitative Finance. 4. "Price Writer", Jeremy Keating.	
	Supplementary literature	Quantee Blog - https://www.quantee.ai/blog - access 15.10.2025.	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. Create well-predicting frequency model; 2. Create well-predicting severity model; 3. Create well-predicting demand model; 4. Compare GLM to GBM built using the same variables; 5. Compare two GLMs with different features and/or transformations; 6. Reverse engineer premium using available variables.		
Practical activities within the subject	Not applicable		

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