Study programme

Informatics and Econometrics

Faculty:	Faculty of Applied Informatics and Mathematics
Level of study:	second cycle (post bachelor's degree)
Education profile:	General academic
Form of study:	full-time studies
Academic year:	2025/26

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Basic information

Faculty name:	Faculty of Applied Informatics and Mathematics
Major name:	Informatics and Econometrics
Level of study:	second cycle (post bachelor's degree)
Profile of study:	General academic
Form of study:	full-time studies
Duration of studies (number of semesters):	4
Number of ECTS required to complete the studies:	120
The number of ECTS points a student obtains during classes conducted with the direct participation of academic teachers or other persons conducting classes:	61
Professional title awarded to graduates:	magister
ISCED code:	0688
Language of study:	english

Assigning the major to the fields and disciplines to which the learning outcomes relate

Technical computing and telecommunications	52%
Economics and finance	48%

Major characteristics

Major characteristics

The field of study Computer Science and Econometrics is interdisciplinary - it combines technical, economic and mathematical sciences. It prepares specialists to analyse and model economic phenomena. The study programme is assigned to the general academic profile, which prepares first degree students for scientific work, and second degree students enter this work.

Learning objectives

The goal of education is to prepare staff to analyse economic phenomena, who will have knowledge reflecting the needs of modern economy, deepened by education in computer science and application of modern mathematical methods. According to the Faculty's educational quality policy, the main objective of the educational process is to provide education of the highest quality, so that graduates acquire knowledge, skills and social competences at the highest level and are prepared for the challenges of the contemporary world and the needs and expectations of the labour market.

Education concept

The concept of education in the field of Computer Science and Econometrics and the learning outcomes achieved in the course of the study programme result from the mission and strategy of the Faculty. This strategy includes educating students in order to prepare them for professional work, disseminating and multiplying the achievements of science, especially in the broad field of computer science and econometrics. Education is implemented in accordance with the development of knowledge and the needs of the labour market. It is important to increase internationalisation, including through the education of foreigners.

Description of work placement (if provided for in the study programme)

Graduate profile

Graduates are familiar with mathematical, statistical and econometric methods and tools necessary for advanced analysis of economic phenomena on a micro- and macroeconomic scale, as well as for making rational decisions in all types of economic entities and organisations. They are skilled in designing and implementing advanced information systems and databases in economic organisations, financial and insurance institutions and administrative bodies, as well as formulating strategies for their computerisation. The graduate has the skills necessary to carry out advanced consultancy activities, requiring analytical skills, in which it is necessary to apply mathematical, statistical, econometric and IT tools, as well as to carry out works of a creative nature. Graduates are able to speak a foreign language at the B2+ level of the Council of Europe's Common European Framework of Reference for Languages and have the ability to use specialist language in the fields of computer science, economics, management, finance and applied mathematics. We aim to train graduates who are able to find their way in an international environment, capable of achieving professional success in multicultural teams at home and abroad. The degree prepares for future careers as data analysts and advisors to decision-makers at every level of management. Recipients of such analyses include state and regional administrations as well as companies and financial institutions. Graduates will find employment as economic analysts, consultants on the study of relations occurring in economic phenomena, financial and insurance advisors, managers of lower levels of management, designers, technologists, consultants and users in the field of information solutions using modern information and communication technologies, administrators of e-business applications and users of business (and information) resources of the Internet, in all types of companies, local government units, government agencies, organisations and institutions active in the Internet space - applying information and communication technologies. Graduates should be prepared to conduct research work and undertake third degree (doctoral) studies.

Learning outcomes

Knowledge

Code	Content	PRK
IEj_K2_W01	The graduate knows and understands the nature of economic sciences, their place in the system of sciences, and their relationship to the sciences, technology, and natural sciences, as well as trends, the role of man as a creator of culture, and the economic and legal system.	P7S_WG
IEj_K2_W02	The graduate knows and understands different types of economic structures and institutions and their relevant elements, has an in-depth knowledge of views on information society structures and economic institutions.	P7S_WK
IEj_K2_W03	The graduate knows and understands to anextended degree the relations between economic structures and institutions on a national and international scale, and the processes of change in the information society. Has knowledge of the financial market, its segments, and instruments.	P7S_WK
IEj_K2_W04	The graduate knows and understands to an extended degree the methods and tools, including techniques for obtaining data from observations of socio-economic phenomena, natural phenomena, and surveys, appropriate for the study of computer science and econometrics, allowing one to describe economic structures (including the use of multivariate models, autoregressive models, computer simulation, etc.).	P7S_WG
IEj_K2_W05	The graduate knows and understands selected systems of norms and rules organizing economic structures and institutions, as well as an extended knowledge in the field of copyright, personal data protection law, protection against electronic crime, and protection of intellectual property, and understands the necessity of intellectual property management.	P7S_WK
IEj_K2_W06	The graduate knows and understands to an extended degree the algorithms and their computational complexity, computer systems architecture, operating systems, network technologies, programming languages and paradigms, artificial intelligence, databases, and software engineering.	P7S_WG
IEj_K2_W07	The graduate knows and understands to an extended degree the economic decision optimization methods and (including computer) decision support systems, modern trends in the field, concerning e.g. artificial neural networks and genetic algorithms.	P7S_WG
IEj_K2_W08	The graduate knows and understands to an extended degree the methods, techniques, and tools used in solving computer tasks in the areas of computational complexity of algorithms, computer system design, operating systems, computer networks, programming languages, artificial intelligence, databases, software engineering, and computer information systems.	P7S_WG
IEj_K2_W09	The graduate knows and understands to an extended degree information and knowledge acquisition technologies, database and data warehousing technologies, knowledge base technologies, and ICT technologies (communication technologies, network technologies, Internet technologies).	P7S_WG
IEj_K2_W10	The graduate knows and understands in-depth mathematics (statistics, differential equations, and elements of functional analysis) to the extent necessary to describe dynamic economic processes, create econometric models as well as write algorithms and other activities in the field of computer science.	P7S_WG
IEj_K2_W11	The graduate knows and understands the types, forms, and characteristics of e-business ventures, organization and management of information and knowledge resources for e-business, methods and tools for developing e-business applications, and fundamentals of e-business economics.	P7S_WG
IEj_K2_W12	The graduate knows and understands to an extended degree how to create, operate, and evaluate different classes of information systems (their efficiency, development, and administration), which are applied in financial and public institutions, enterprises, and administration units.	P7S_WG

Code	Content	PRK
IEj_K2_W13	The graduate knows and understands to an extended degree economic phenomena on a micro and macro scale. Is able to identify the relations occurring between economic processes and the links between economic structures and institutions on a national and international scale.	P7S_WK
IEj_K2_W14	The graduate knows and understands how to analyze the dynamics of phenomena and complex economic systems, including the construction of models using adequate research tools. It has the ability to classify research objects and determine forecasts.	P7S_WG
IEj_K2_W15	The graduate knows and understands advanced financial analysis, including valuation and risk analysis of basic financial instruments, credit analysis, and pension plans.	P7S_WG
IEj_K2_W16	The graduate knows and understands the classification, characteristics, tasks, and capabilities of the basic categories of information systems used in the economy.	P7S_WG

Skills

Code	Content	PRK
IEj_K2_U01	The graduate can in an advanced way acquire information from literature, databases, and other appropriately selected sources, also in English, and to interpret and explain economic and social phenomena and their interrelationships correctly.	P7S_UW
IEj_K2_U02	The graduate can use theoretical knowledge to describe and analyze socio-economic processes, extended by the formulation of own opinions and by the critical selection of data and methods of analysis (is able to select appropriate IT and statistical tools to analyze social and economic problems).	P7S_UW
IEj_K2_U03	The graduate can understand the causes and course of socio-economic processes and phenomena extended by formulating own opinions on the subject and making simple research hypotheses and verifying them.	P7S_UW
IEj_K2_U04	The graduate can forecast, predict and model complex social processes of phenomena from different areas of socio-economic life using advanced econometric and IT methods and tools.	P7S_UW
IEj_K2_U05	The graduate can use normative systems, norms, and rules efficiently, to communicate using a variety of techniques in professional and other environments, and has an ability in relation to socio-economic links.	P7S_UK
IEj_K2_U06	The graduate can apply acquired knowledge in different scopes and forms, extended by a critical analysis of the effectiveness and usefulness of applied knowledge in practice.	P7S_UW
IEj_K2_U07	The graduate can independently propose solutions to specific problems extended by the ability to propose innovative or non-standard solutions to emerging problems.	P7S_UW
IEj_K2_U08	The graduate can understand and analyze human behavior, to analyze its motives and economic and social consequences, deepened in relation to the human behavior of the information society.	P7S_UW
IEj_K2_U09	The graduate can prepare, to an extended degree, a variety of written work in Polish and English in the fields of economics, management, finance, applied mathematics, and computer science.	P7S_UK
IEj_K2_U10	The graduate can prepare, to an extended degree, speeches in Polish and English within the scope of economic sciences and selected issues from the areas of science and technology appropriate to the field of study.	P7S_UK
IEj_K2_U11	The graduates can use a foreign language in the field of economics and selected topics in the areas of science and technology appropriate to the field of study, in accordance with the requirements specified for level B2+ of the Common European Framework of Reference for Languages.	P7S_UK
IEj_K2_U12	The graduates can use a range of analytical, simulation, and expert methods to formulate and solve problems of economic practice.	P7S_UW

Code	Content	PRK
IEj_K2_U13	The graduates can use information systems to solve advanced problems in economics, applications of computer science in the life sciences, and others.	P7S_UW
IEj_K2_U14	The graduates can analyze, design and test information systems using methodologies, techniques, and tools to support project management.	P7S_UW
IEj_K2_U15	The graduate can analyse, optimise and model business processes to an extended extent using appropriate information systems.	P7S_UW
IEj_K2_U16	The graduate can interact and work in an interdisciplinary group, taking on a variety of roles and tasks.	P7S_UO
IEj_K2_U17	The graduate can understand the need for lifelong learning and is able to inspire and organize the learning process of others.	P7S_UU

Social competence

Code	Content	PRK
IEj_K2_K01	The graduate is ready to prioritise appropriately to achieve a task defined by him/herself or others.	P7S_KK
IEj_K2_K02	The graduate is ready to independently and critically complement and improve the acquired knowledge and skills, extended by an interdisciplinary dimension.	P7S_KK
IEj_K2_K03	The graduate is ready to participate in the preparation of social projects and is able to anticipate the multidirectional social impact of his/her activities.	P7S_KO
IEj_K2_K04	The graduate is ready to communicate the achievements of information technology and various aspects of the economic analyst profession in a commonly understood manner. Is prepared to actively participate in groups and organizations pursuing social goals and IT projects. Is able to think and act in an entrepreneurial manner.	P7S_KO
IEj_K2_K05	The graduate is ready to correctly identify and resolve dilemmas related to the profession.	P7S_KR

Study plan

Semester 1

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Health and Safety Training	OHS training: 4	0	Pass	Obligatory subjects
Dynamic and financial econometrics	Lecture: 15 Laboratory exercises: 30	4	Exam	Obligatory subjects
Multidimensional Data Analysis	Lecture: 30 Laboratory exercises: 15	4	Pass with grade	Obligatory subjects
Network Services	Lecture: 15 Laboratory exercises: 15	3	Pass with grade	Obligatory subjects
Foundations of Artificial Intelligence	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Second Foreign Language	Language course: 30	2	Pass with grade	Mandatory group
Student wybiera zajęcia z języka obcego				
Polish	Language course: 30	2	Pass with grade	Elective subjects
German	Language course: 30	2	Pass with grade	Elective subjects
Russian	Language course: 30	2	Pass with grade	Elective subjects
Spanish	Language course: 30	2	Pass with grade	Elective subjects
Econometric Modelling	Lecture: 15 Laboratory exercises: 15	2	Pass with grade	Obligatory subjects
Object Oriented Programming	Laboratory exercises: 30	3	Pass with grade	Obligatory subjects
Operational Research - Applications	Lecture: 15 Laboratory exercises: 30	3	Exam	Obligatory subjects
Selected Issues in Sociology and Psychology	Lecture: 30 Auditorium exercises: 15	3	Pass with grade	Obligatory subjects

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Big Data Analytics	Lecture: 15 Laboratory exercises: 30	4	Pass with grade	Elective subjects
Oracle Databases	Lecture: 15 Laboratory exercises: 30	4	Pass with grade	Obligatory subjects
Sum	**379**	**30**		

Semester 2

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Survey Sampling	Lecture: 15 Laboratory exercises: 30	3	Exam	Obligatory subjects
Master Seminar	Auditorium exercises: 30	2	Pass	Obligatory subjects
Big Data Analytics	Lecture: 15 Laboratory exercises: 30	4	Exam/pass with grade	Mandatory group
Processing Massive Datasets	Lecture: 15 Laboratory exercises: 30	4	Exam	Obligatory subjects
Module 1	Lecture: 90	6	Pass with grade	Mandatory group
Student wybiera trzy przedmioty z otwartej listy				
Module 1	Lecture: 90	6	Pass with grade	Elective subjects
Second Foreign Language	Language course: 30	2	Pass with grade	Mandatory group
Student realizuje zajęcia z języka obcego wybranego w semestrze 1				
Polish	Language course: 30	2	Pass with grade	Elective subjects
German	Language course: 30	2	Pass with grade	Elective subjects
Russian	Language course: 30	2	Pass with grade	Elective subjects
Spanish	Language course: 30	2	Pass with grade	Elective subjects

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Mathematical Economics	Lecture: 30 Auditorium exercises: 30	5	Exam	Obligatory subjects
Microeconometrics	Lecture: 15 Laboratory exercises: 30	3	Exam	Obligatory subjects
Software Engineering	Laboratory exercises: 30	3	Pass with grade	Obligatory subjects
Advanced Programming	Laboratory exercises: 30	2	Pass with grade	Obligatory subjects
Sum	**405**	**30**		

Semester 3

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Theory of Forecasting and Simulations	Lecture: 15 Laboratory exercises: 30	4	Exam	Obligatory subjects
Basics of Financial Engineering	Lecture: 15 Laboratory exercises: 30	4	Exam	Obligatory subjects
Big Data Analytics	Lecture: 45 Laboratory exercises: 90	10	Exam	Mandatory group
Advaced Data Exploration Techniques for Big Data	Lecture: 15 Laboratory exercises: 30	4	Exam	Obligatory subjects
Deep Learning Methods	Lecture: 15 Laboratory exercises: 30	4	Exam	Obligatory subjects
Event history analysis	Lecture: 15 Laboratory exercises: 30	2	Pass with grade	Obligatory subjects
Module 2	Lecture: 90	6	Pass with grade	Mandatory group
Student wybiera trzy przedmioty z otwartej listy				
Module 2	Lecture: 90	6	Pass with grade	Elective subjects
Master Seminar	Auditorium exercises: 30	2	Pass	Obligatory subjects

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Network Security	Lecture: 15 Laboratory exercises: 30	4	Pass with grade	Obligatory subjects
Sum	**390**	**30**		

Semester 4

Subject	Number of hours	ECTS points	Form of verification	Mandatory
Statistical Analysis in Market Research	Laboratory exercises: 30	2	Pass with grade	Obligatory subjects
Business Ethics	Lecture: 15 Auditorium exercises: 15	1	Pass with grade	Obligatory subjects
Master thesis	Diploma thesis: 0	20	-	Mandatory group
Student wybiera tematykę pracy magisterskiej				
Master thesis	Diploma thesis: 0	20	-	Elective subjects
Master Seminar	Auditorium exercises: 30	2	Pass	Obligatory subjects
Project Management	Lecture: 15 Laboratory exercises: 30	4	Exam	Obligatory subjects
Intelectual Property Management	Lecture: 15	1	Pass with grade	Obligatory subjects
Sum	**150**	**30**		

Description of the learning outcomes assigned to the subjects and the curriculum content ensuring the achievement of these outcomes

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Subject name:		Dynamic and financial econometrics	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	methods, tools and techniques used in time series analysis; has knowledge of sources and techniques for collecting time series data.	IEj_K2_W04
	W2	methods to the extent necessary to describe dynamic economic processes and construct econometric models used in time series analysis.	IEj_K2_W10
	W3	predicting complex socio-economic phenomena based on time series; they can apply basic economic laws in the process of analysing socio-economic phenomena represented by time series; they have knowledge of assessing the appropriateness of analytical tools used.	IEj_K2_W14
Skills: (In terms of skills, the graduate can)	U1	extract information in an advanced way from literature, databases and other appropriately selected sources, also in English, and correctly interpret and explain economic and social phenomena represented by time series and mutual relations between them.	IEj_K2_U01
	U2	use a wide range of analytical, simulation and expert methods to formulate and solve problems of economic practice (using time series data).	IEj_K2_U12
	U3	in-depth ability to analyse, optimize and model economic operations (using time series data).	IEj_K2_U15
Course content ensuring the achievement of learning outcomes:		Introduction to dynamic econometrics. Autocorrelation and methods for its detection. Random walk process. Stationary and non-stationary time series. Tests detecting presence of unit roots (ADF, Phillips-Perron, KPSS, Perron tests). Single equation time series models – ARIMA. Volatility analysis in time series: GARCH family models. Methods used to assess the quality of time series models. Multivariate time series models analysis: causality and exogeneity in time series; spurious regression; cointegration of time series; ECM models; VAR models; VECM models; variance decomposition and impulse response function. Efficient Market Hypothesis (EMH): Definition, Critique and Analysis.	
Examination methods:		Test (written or computer based), Project	

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Subject name:		Multidimensional Data Analysis	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	examples of issues in which methods of linear ordering of multi-feature objects are used (including their visualization) and issues related to grouping / classification of such objects, understands the theoretical basis of selected methods of multidimensional analysis Knows and is able to explain the basic concepts of multidimensional analysis and knows and understands what can be the use of individual methods of multidimensional analysis in socio-economic sciences	IEj_K2_W04, IEj_K2_W16
Skills: (In terms of skills, the graduate can)	U1	identify the right tool for the analysis of a specific practical problem, is able to acquire data in the right way and is able to interpret and verify the results obtained in the field of ordering, classification (discrimination) of economic objects and present the results in the form of visualization) Has the ability to use the basic functions of the Excel spreadsheet related to multidimensional analysis and the selected specialist package available at the faculty, is able to apply appropriate machine learning methods to selected problems from business practice and using simulation techniques to assess the quality of these methods	IEj_K2_U02, IEj_K2_U06, IEj_K2_U07, IEj_K2_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	cooperate and work within the group by undertaking different roles	IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Two cultures of Data Analysis. Multivariate analytical techniques. Linear Multidimensional Models. Non-Linear Multidimensional Models. Principal Components - dimensionality reduction. Factor Analysis – interpretation of dimension. Cluster Analysis. Multidimensional Discrimination Methods. Additional topics in multidimensional data. Python, SAS – tools for multidimensional analysis. Multivariate Regression and its extentions. Dimensional reduction and their interpretation . Segmentation and grouping. Discrimination and classification. Additional topics in multidimensional data.	
Examination methods:		Project, Assessment of work in the laboratory	

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Subject name:		Network Services	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the methods, techniques and tools used in solving simple IT tasks in the field of network services.	IEj_K2_W08, IEj_K2_W09
	W2	algorithms and their computational complexity, computer systems architecture, operating systems, network technologies, programming languages and paradigms, artificial intelligence, databases, software engineering.	IEj_K2_W06, IEj_K2_W16
Skills: (In terms of skills, the graduate can)	U1	use the acquired knowledge in various scopes and forms, extended by a critical analysis of the effectiveness and usefulness of the applied knowledge in practice.	IEj_K2_U06
	U2	analyse and test IT systems using methods, techniques and tools supporting project management.	IEj_K2_U14, IEj_K2_U15
Social competences: (Within the scope of competence, the graduate is ready to)	K1	correctly identify and resolve dilemmas related to the practice of the profession.	IEj_K2_K01, IEj_K2_K02, IEj_K2_K05
Course content ensuring the achievement of learning outcomes:		Introduction to Network Services: Overview and Basic Concepts. DNS (Domain Name System): Principles, Configuration, and Troubleshooting. DHCP (Dynamic Host Configuration Protocol): IP Address Allocation and Management. Web Services: HTTP/HTTPS, Web Servers, and Hosting. Email Services: SMTP, IMAP, POP3, and Email Security. File Sharing Protocols: FTP, SFTP, and SMB/CIFS. Remote Access Services: SSH, Telnet, and Remote Desktop Protocols. VPN (Virtual Private Network) Services: Tunneling, Encryption, and Remote Access Network Directory Services: LDAP, Active Directory, and Authentication. Network Management and Monitoring: SNMP, NetFlow, and Monitoring Tools. Voice over IP (VoIP) and Unified Communications: Protocols and Services. Streaming Services: RTSP, RTP, and Content Delivery Networks (CDNs). Load Balancing and High Availability: Techniques and Protocols. Network Security Services: Firewalls, IDS/IPS, and Access Control. Cloud-based Network Services: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).	
Examination methods:		Written credit, Assessment of work in the laboratory	

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Subject name:		Foundations of Artificial Intelligence	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	algorithms and their complexities and on programming paradigm as well as on A.I.	IEj_K2_W06, IEj_K2_W10
	W2	implementation of programming languages and A.I.	IEj_K2_W08, IEj_K2_W09
Skills: (In terms of skills, the graduate can)	U1	exploit variety of analytic, simulation and expert-like methods to formulate and solve practical problems in industry and economy.	IEj_K2_U12, IEj_K2_U14
Social competences: (Within the scope of competence, the graduate is ready to)	K1	cooperate and work within the group by undertaking different roles	IEj_K2_K02, IEj_K2_K05
Course content ensuring the achievement of learning outcomes:		Propositional logic and predicate logic. Inference rules i deduction. Models logical consequences and satisfiability. Refutation, Horn Clauses and SLD resolution. PROLOG programming: declarative paradigm. Searching cyclic and acyclic graphs in PROLOG. Applications of PROLOG in A.I. Herbrand models and interperetations. The Least Herbrand Model.	
Examination methods:		Assessment of work in the laboratory, Project	

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Subject name:		Polish	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Skills: (In terms of skills, the graduate can)	U1	communicate on the elementary level in spoken and written forms.	IEj_K2_U09, IEj_K2_U10
	U2	describe everyday phenomena, processes and procedures.	IEj_K2_U09, IEj_K2_U10
	U3	give explanations, express opinions, give reasons or make plans.	IEj_K2_U09, IEj_K2_U10
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work in a team.	IEj_K2_K01, IEj_K2_K03, IEj_K2_K04
	K2	prepare and deliver presentations.	IEj_K2_K02, IEj_K2_K04
	K3	communicate in different situations of everyday life and professional life.	IEj_K2_K02, IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Vocabulary connected with family, everyday life, housing, transport, work, education, nutrition, services, health, sport and natural environment. Grammar structures: correst use of word forms and sentence structures, word formation. Language functions: practising communication, pronunciation and spelling.	
Examination methods:		Written credit, Presentation, Assessment of activity during classes	

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Subject name:		German	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Skills: (In terms of skills, the graduate can)	U1	describe phenomena, processes, procedures.	IEj_K2_U01, IEj_K2_U11
	U2	conduct correspondence and take notes.	IEj_K2_U11
	U3	give explanations, give reasons, express opinions or make plans.	IEj_K2_U01, IEj_K2_U11
Social competences: (Within the scope of competence, the graduate is ready to)	K1	prepare and deliver presentations.	IEj_K2_K01, IEj_K2_K03, IEj_K2_K04
	K2	work in a team and conduct a discussion.	IEj_K2_K02, IEj_K2_K04
	K3	communicate correctly in most situations of professional life using specialised linguistic resources	IEj_K2_K02, IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Specialised vocabulary related to the field of study. Linguistic means necessary to master the assumed skills. Language functions: describing phenomena and processes, taking notes, preparing and delivering presentations.	
Examination methods:		Presentation, Assessment of activity during classes	

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Subject name:		Russian	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Skills: (In terms of skills, the graduate can)	U1	describe phenomena, processes, procedures.	IEj_K2_U01, IEj_K2_U11
	U2	conduct correspondence and take notes.	IEj_K2_U01, IEj_K2_U11
	U3	give explanations, give reasons, express opinions or make plans.	IEj_K2_U01, IEj_K2_U11
Social competences: (Within the scope of competence, the graduate is ready to)	K1	prepare and deliver presentations.	IEj_K2_K01, IEj_K2_K03, IEj_K2_K04
	K2	work in a team and conduct a discussion.	IEj_K2_K02, IEj_K2_K04
	K3	communicate correctly in most situations of professional life using specialised linguistic resources	IEj_K2_K02, IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Specialised vocabulary related to the field of study. Linguistic means necessary to master the assumed skills. Language functions: describing phenomena and processes, taking notes, preparing and delivering presentations.	
Examination methods:		Presentation, Assessment of activity during classes	

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Subject name:		Spanish	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Skills: (In terms of skills, the graduate can)	U1	describe phenomena, processes, procedures.	IEj_K2_U01, IEj_K2_U11
	U2	conduct correspondence and take notes.	IEj_K2_U01, IEj_K2_U11
	U3	give explanations, give reasons, express opinions or make plans.	IEj_K2_U01, IEj_K2_U11
Social competences: (Within the scope of competence, the graduate is ready to)	K1	prepare and deliver presentations.	IEj_K2_K01, IEj_K2_K03, IEj_K2_K04
	K2	work in a team and conduct a discussion.	IEj_K2_K02, IEj_K2_K04
	K3	communicate correctly in most situations of professional life using specialised linguistic resources	IEj_K2_K02, IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Specialised vocabulary related to the field of study. Linguistic means necessary to master the assumed skills. Language functions: describing phenomena and processes, taking notes, preparing and delivering presentations.	
Examination methods:		Presentation, Assessment of activity during classes	

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Subject name:		Econometric Modelling	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	methods of classical inference statistical	IEj_K2_W10
	W2	examples of valid statistical tests	IEj_K2_W04, IEj_K2_W10
	W3	how to construct qualitative econometric models	IEj_K2_W04, IEj_K2_W14
	W4	selected methods of estimating parameters of quantitative models and statistical methods verification of quantitative econometric models	IEj_K2_W04, IEj_K2_W14
	W5	the areas of application of quanitative econometric models in economic, financial and social research	IEj_K2_W01
Skills: (In terms of skills, the graduate can)	U1	select estimators appropriate to the conditions of the statistical analysis to be carried out	IEj_K2_U02, IEj_K2_U06, IEj_K2_U09
	U2	Knows how to select and carry out a statistical test	IEj_K2_U02, IEj_K2_U03, IEj_K2_U06
	U3	Can select explanatory variables for an econometric model, interpret parameters of causal models	IEj_K2_U01, IEj_K2_U02, IEj_K2_U04
	U4	estimate parameters of a single-equation model; can carry out basic substantive and statistical verification of the model,	IEj_K2_U02, IEj_K2_U04, IEj_K2_U10, IEj_K2_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate with the environment to exchange and disseminate knowledge from econometrics	IEj_K2_K01, IEj_K2_K02
Course content ensuring the achievement of learning outcomes:		Selected issues in estimation theory Verification of statistical hypotheses. One- and two-parametric tests. Selected non-parametric tests. Econometric model, classification and examples of econometric models. Single equation descriptive econometric models. Ordinary Least Squares (OLS) method, principles of its application. Selected modelling problems - autocorrelation and heteroskedasticity. Weighted least squares (WLS) method	
Examination methods:		Test (written or computer based), Written credit	

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Subject name:		Object Oriented Programming	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	Student knows object-oriented programming (OOP) and an environment that supports it. Student understands the methods of object-oriented analysis of domains and designing objects.	IEj_K2_W06, IEj_K2_W08
	W2	Student knows the fundamental features and constructs of OOP and their use in complex information systems.	IEj_K2_W06, IEj_K2_W08
Skills: (In terms of skills, the graduate can)	U1	Student can use the knowledge on OOP in creating complex software.	IEj_K2_U13, IEj_K2_U15
	U2	Student can formulate analytic and information science problems in terms of the OOP paradigm.	IEj_K2_U13, IEj_K2_U15
Social competences: (Within the scope of competence, the graduate is ready to)	K1	Student is prepared to work in groups of programmers and to use the results of work performed by others, for example in the form of using libraries.	IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Introduction to object-oriented programming. Notion of a class and an object. Components of a class – fields and methods. Data protection, hermetization, specification of access to fields and methods, keyword "this". Static components. Creation, initialization and destroying of an object. Overloading of constructors. Designing classes. Object-oriented modelling of a domain. Inheritance. Inheritance versus inclusion. Class hierarchy, constructors and inheritance. Virtual functions and polymorphism. Abstract classes and interfaces. Application of interfaces. Overloading of operators. Streams, work with files, serialization. Name spaces. Information on the Visual Studio environment of C# language. Remarks of the Java language and NetBeans environment. Creating classes. Hermetization. Examples of classes from libraries and their applications. Programming with the use of inheritance, virtual functions and polymorphism. Programming with the use of interfaces. Programming with the use of collections. Programming with the use of general types. Design and implementation of own object-oriented libraries.	
Examination methods:		Project, Test (written or computer based)	

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Subject name:		Operational Research - Applications	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the areas of applications of OR in management.	IEj_K2_W01
	W2	methods and algorithms used in decision making problems.	IEj_K2_W06
	W3	optimization methods and methods of supporting decision making process.	IEj_K2_W07
	W4	mathematical methods and algorithms used in Operations Research	IEj_K2_W10
Skills: (In terms of skills, the graduate can)	U1	identify decision making problems and assign them to relevant class of problems, build mathematical models of decision problems in management, interpret obtained results and based on them make optimal decisions	IEj_K2_U06
	U2	use computer software in decision making process	IEj_K2_U13
Course content ensuring the achievement of learning outcomes:		Linear programming: basic notions and methods, sensitivity analysis, dual problem. Transportation problem, Optimal routing, Allocation problem, Assignment problem. Project planning: project network, Critical Path Method, PERT, crashing a project. Decision Making Under Risk and Uncertainty. Multicriteria Decision Making. Linear programming- graphical method. Examples of application: optimal diet, a product mix problem, paper roll trimming, production planning, sensitivity analysis. Dual problem as a method of solving primal problem. Transportation problem: Optimal routing, Allocation problem, Assignment problem. Project planning: project network, Critical Path Method, PERT, crashing a project. Decision Making under risk and uncertainty. Maximum expected profit. Payoff matrix.	
Examination methods:		Written exam, Written credit, Test (written or computer based)	

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Subject name:		Selected Issues in Sociology and Psychology	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the basic concepts used in sociology and psychology and the most important sociological and psychological theories.	IEj_K2_W01
	W2	a general knowledge of a human being as an entity located in the structure of social relations, of which he/she is a co-creator, and within which he/she takes actions.	IEj_K2_W02
Skills: (In terms of skills, the graduate can)	U1	take part in the social debate - presenting and evaluating various opinions and positions and discussing them.	IEj_K2_U01
	U2	use basic theoretical concepts to analyze the causes and implications of specific phenomena and social processes.	IEj_K2_U03, IEj_K2_U08
Social competences: (Within the scope of competence, the graduate is ready to)	K1	critically evaluate his knowledge and relating its elements to selected problems of social life.	IEj_K2_K03
	K2	recognize the importance of knowledge in solving social problems and to consult experts in case of emerging difficulties.	IEj_K2_K02
Course content ensuring the achievement of learning outcomes:		Social and psychological theories. Social behavior and its determinants. Motivation and intelligence. Personality types. Language and memory. Attitudes, stereotypes, and prejudices. Communication between people in institutions and rules of cooperation. The nation-state, capitalism, democracy, and globalization.	
Examination methods:		Test (written or computer based), Assessment of speeches during classes	

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Subject name:		Oracle Databases	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	methods and tools, including techniques for obtaining quantitative and qualitative data, derived from the observation of socio-economic and natural phenomena and surveys, appropriate for studying computer science and econometrics, allowing to describe and study economic structures and institutions as well as processes in them and between them using advanced techniques.	IEj_K2_W04
	W2	algorithms and their computational complexity, computer system architecture, operating systems, network technologies, programming languages and paradigms, artificial intelligence, databases, software engineering.	IEj_K2_W06
	W3	methods, techniques and tools used in solving simple IT tasks in the field of analysis of computational complexity of algorithms, construction of computer systems, operating systems, computer networks and network technologies, implementation of programming languages, artificial intelligence, databases, software and computer engineering information systems.	IEj_K2_W08
	W4	information and knowledge acquisition technology, database and data warehouse technology, knowledge base technology, ICT technologies (communication technologies, network technologies, Internet technologies).	IEj_K2_W09
Skills: (In terms of skills, the graduate can)	U1	acquire information in an advanced way from literature, databases and other properly selected sources, also in English, and can correctly interpret and explain economic and social phenomena and the mutual relations between them.	IEj_K2_U01
	U2	analyze, design and test IT systems using methodologies, techniques and tools supporting project management.	IEj_K2_U14
Course content ensuring the achievement of learning outcomes:		Introduction. Data filtering and sorting. Scalar and conversion functions. Data grouping. Work with multiple tables. Subqueries. Data modification. Tables. Database objects. Advanced techniques.	
Examination methods:		Written credit, Assessment of work in the laboratory	

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Subject name:		Survey Sampling	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	statistics of finite populations.	IEj_K2_W04
	W2	problems with collecting a representative sample.	IEj_K2_W04
	W3	typical issues of optimal sample allocation.	IEj_K2_W10
Skills: (In terms of skills, the graduate can)	U1	construct a sampling design	IEj_K2_U12
	U2	determine point and interval estimators	IEj_K2_U02, IEj_K2_U06, IEj_K2_U12
	U3	determine the optimal sampling design	IEj_K2_U06, IEj_K2_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	collect information about the parameters of the population	IEj_K2_K03
Course content ensuring the achievement of learning outcomes:		Introduction to survey sampling: basic terms. Simple, stratified and two-step random sampling. Optimal allocation.	
Examination methods:		Written exam, Written credit	

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Subject name:		Master Seminar	ECTS: 6
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the procedures concerning the selection a potential supervisor, as well as knows the master's exam rules and understands what components have an impact on the diploma's final grade.	IEj_K2_W04, IEj_K2_W09
	W2	how to format, structure and write a master's thesis.	IEj_K2_W04, IEj_K2_W09
	W3	how to avoid plagiarism in the master's thesis writing.	IEj_K2_W04, IEj_K2_W09
	W4	how to cite and refer in a master's thesis and how to paraphrase.	IEj_K2_W04, IEj_K2_W09
	W5	the glossary and phrases used in an academic writing, in particular in the master's thesis writing.	IEj_K2_W04, IEj_K2_W09
Skills: (In terms of skills, the graduate can)	U1	write a decent, substantive and well-structured master's thesis in English.	IEj_K2_U01, IEj_K2_U04, IEj_K2_U09, IEj_K2_U10
	U2	follow antiplagiarism rules.	IEj_K2_U01, IEj_K2_U04
Social competences: (Within the scope of competence, the graduate is ready to)	K1	share the acquired experience and skills in creating a master's thesis.	IEj_K2_K02, IEj_K2_K04, IEj_K2_K05
Course content ensuring the achievement of learning outcomes:		Providing students with principles concerning the selection of a potential supervisor, as well as with procedures and questions regarding a master's exam and the components influencing the final grade on a degree certificate. Familiarizing students with a master's thesis template and the examples of the earlier master's theses. Introducing MS Word and LaTeX as the useful tools in the master's thesis writing. Teaching students about inserting and numbering charts, tables and adding captions to them in MS Word. Familiarizing students with interesting tips and tricks regarding formatting a master's thesis in MS Word (division into sections, an automatic creation of a table of contents, etc.). Providing students with practical information on how to avoid plagiarism in the master's thesis writing. Conveying a comprehensive knowledge about the styles and forms of citation and referencing in a master's thesis and about an art of paraphrasing. Familiarizing students with interesting files, slides and films on structuring and writing a master's thesis. Providing students with a reliable knowledge about organizing an order and the time of master's thesis writing. Giving the practical information on the glossary and phrases, used in an academic writing, in particular in the master's thesis writing. Passing on the knowledge about preparation of the literature review in a master's thesis. Discussing students' reports and presentations (mainly those regarding the process of the master's thesis preparation and the questions for a master's exam). Monitoring of students' progress in their research related to the process of the master's thesis writing.	
Examination methods:		Project, Presentation	

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Subject name:		Processing Massive Datasets	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	selected systems of norms and rules that organize economic structures and institutions, as well as extended knowledge of basic concepts and principles in the field of copyright, the Personal Data Protection Act, protection against electronic crime and protection of intellectual property, understands the need to manage intellectual property resources.	IEj_K2_W05, IEj_K2_W13
	W2	mathematics (including: statistics, differential equations, elements of functional analysis) to the extent necessary to describe dynamic economic processes, create econometric models, as well as record algorithms and other typical activities in the field of computer science.	IEj_K2_W10
Skills: (In terms of skills, the graduate can)	U1	use the acquired knowledge in various scopes and forms, extended by a critical analysis of the effectiveness and usefulness of the applied knowledge in practice.	IEj_K2_U06
	U2	analyze, design and test IT systems using methodologies, techniques and tools supporting project management.	IEj_K2_U14
	U3	use a number of analytical, simulation and expert methods to formulate and solve business practice problems.	IEj_K2_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	lifelong learning, is able to inspire and organize the learning process of other people.	IEj_K2_K01
Course content ensuring the achievement of learning outcomes:		R environment and Rstudio program. Basic and complex data types in R. Basic operators. Indexing of vectors. Data filtering. Overview of built-in functions. Creating lists. List indexing. Creating function objects. Parameters and arguments. Object attributes. Conditional expressions if and if . . . else. Loops. Performance considerations. Factors. Matrices and arrays. Data Frames. Run-time measurement and estimation. Integration of R with C++. R basic atomic types in Rcpp. Rcpp handling non-basic types. Theoretical background of parallel processing. Approaches to parallelization. Load balancing. Large memory and out-of-memory data. Efficient Computing from RAM. Computing from Efficient File Structrures.	
Examination methods:		Written exam	

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Subject name:		Mathematical Economics	ECTS: 5
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	basic optimization problems in microeconomics, basic functions and microeconomic laws	IEj_K2_W01
	W2	basic optimization methods in microeconomics	IEj_K2_W07
	W3	mathematical methods and tools that can be applied in problems of mathematical economics	IEj_K2_W10
	W4	basic problems in microeconomics as well as in equilibrium theory	IEj_K2_W13
Skills: (In terms of skills, the graduate can)	U1	apply relevant mathematical tools (differential calculus, difference equations, matrix calculus) to solve optimization problems of microeconomics and analyze basic mathematical models of economics.	IEj_K2_U02
	U2	apply differential calculus in marginal analysis and interpret the results.	IEj_K2_U02
	U3	apply relevant mathematical tools to describe and analyze problems of Microeconomics	IEj_K2_U12
Course content ensuring the achievement of learning outcomes:		History of mathematical economics. Derivative and its application. Elasticity. Theory of the consumer. Theory of the firm. Market equilibrium. Edgeworth box, Arrow-Hurwicz model. Cobweb model. Difference equations. Linear models of economy. Derivative and its application. Consumer's preferences. Utility functions. Optimal bundle in the budget set. Demand function and indirect utility, compensated demand and expenditure function. Theory of the firm and optimization problems, the cost function, the supply and demand function of a firm. Pure exchange. Equilibrium prices and allocation. Cobweb model.Leontieff model.	
Examination methods:		Test (written or computer based), Written credit	

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Subject name:		Microeconometrics	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the areas of application of qualitative econometric models in economic, financial and social research	IEj_K2_W01
	W2	selected methods of estimating parameters of qualitative models and statistical methods verification of qualitative econometric models	IEj_K2_W04
	W3	how to identify decision-making situations and assign them to a specific class of problems	IEj_K2_W07
	W4	how to construct qualitative econometric models to analyse micro-data	IEj_K2_W10
	W5	the student has knowledge of microeconomic phenomena	IEj_K2_W13
Skills: (In terms of skills, the graduate can)	U1	to interpret the obtained results and on their basis make optimal decisions, can analyse solutions to analyse solutions to decision-making problems and predict the economic consequences of decisions taken	IEj_K2_U03
Social competences: (Within the scope of competence, the graduate is ready to)	K1	communicate with the environment in order to exchange and to disseminate knowledge from microeconometrics	IEj_K2_K01, IEj_K2_K02
Course content ensuring the achievement of learning outcomes:		Selected issues in estimation theory. Multivariate regression model. Assessing the quality of econometric model estimation results. Microeconomic data structures. Multinomial models (ordered and unordered). Censored and truncated models. Count data regression (Poisson regression, negative binominal model). Sample selection models (Heckman two-step estimator).	
Examination methods:		Written exam, Written credit	

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Subject name:		Software Engineering	ECTS: 3
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	algorithms, data bases, software engineering.	IEj_K2_W06
	W2	CASE tools, data bases, software engineering.	IEj_K2_W08
	W3	creating of different types of the software products.	IEj_K2_W12
Skills: (In terms of skills, the graduate can)	U1	create and analyse the software using CASE tools. Student is able to analyse and to model different processes with the usage of IT tools; Student is able to make software tests with the usage of the CASE tools.	IEj_K2_U14
	U2	analyse and model different processes with usage of proper IT systems. Student is able to work on the IT project in cooperation with the non IT specialists.	IEj_K2_U16
Social competences: (Within the scope of competence, the graduate is ready to)	K1	work in group.	IEj_K2_K01, IEj_K2_K02
Course content ensuring the achievement of learning outcomes:		Lectures cover the presentation of software engineering concepts and dedicated tools. The lectures include methods of IT project management, issues of quality and security, methods and tools supporting software development (CASE), UML diagrams and issues related to software testing and program debugging methodology. Using the knowledge from the lectures to write and test the application, including the negotiation stage. During the laboratory students will learn how to use software engineering tools.	
Examination methods:		Assessment of activity during classes	

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Subject name:		Advanced Programming	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	advanced programming techniques based on object-oriented, component and functional programming paradigms, as well as design patterns and unit testing.	IEj_K2_W06, IEj_K2_W08, IEj_K2_W12
	W2	the principles of design and implementation of information systems of higher-than-basic level of complexity.	IEj_K2_W06, IEj_K2_W08, IEj_K2_W12
	W3	good programming practices related to version control and proper documentation of the code.	IEj_K2_W06, IEj_K2_W08, IEj_K2_W12
Skills: (In terms of skills, the graduate can)	U1	design and implement complex applications and information systems based on selected programming paradigms: structured, object-oriented, functional, component and multithreaded; use abstract data structures and specialized modules related to the development of applications with a graphical user interface and advanced data analysis.	IEj_K2_U13, IEj_K2_U14
	U2	apply good programming practices related to the implementation of the principles of selected programming paradigms, as well as version control and code documentation.	IEj_K2_U13
	U3	guide one's own development and acquisition of further skills in programming and administration of information systems.	IEj_K2_U14, IEj_K2_U17
Social competences: (Within the scope of competence, the graduate is ready to)	K1	to work in programming teams.	IEj_K2_K03, IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Advanced data structures in Python: sets, dictionaries, and tuples. Object-oriented programming (OOP) concepts in Python. Efficient and optimized code writing in Python. Debugging, profiling, and packaging techniques in Python. Working with databases using Python libraries such as SQLAlchemy and SQLite. Web frameworks such as Flask and Django to build web applications using Python. Machine learning and artificial intelligence applications using Python.	
Examination methods:		Project, Presentation, Test (written or computer based)	

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Subject name:		Theory of Forecasting and Simulations	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	methods of optimising economic decisions and systems (including computer systems) of decision support, modern trends in this field, concerning e.g. artificial neural networks and genetic algorithms.	IEj_K2_W07, IEj_K2_W10
	W2	economic phenomena on a micro and macro scale. The student can determine relations between economic processes and links between economic structures and institutions on a national and international scale.	IEj_K2_W13
	W3	how to analyse the dynamics of phenomena and complex economic systems, including the construction of appropriate models with the use of adequate research tools. The student can classify research objects and to determine forecasts for any time horizon.	IEj_K2_W14
Skills: (In terms of skills, the graduate can)	U1	understand the causes and course of socio-economic processes and phenomena, expanded by formulating their own opinions on the subject and by formulating simple research hypotheses and verifying them.	IEj_K2_U03
	U2	forecast and predict and model complex social processes of phenomena from various areas of social and economic life using advanced econometric and IT methods and tools.	IEj_K2_U04
	U3	apply a range of analytical, simulation and expert methods to formulate and solve problems of economic practice.	IEj_K2_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	independently and critically supplement and improve the acquired knowledge and skills, extended by an interdisciplinary dimension.	IEj_K2_K02
	K2	provide information about the achievements of computer science and various aspects of the profession of an economic analyst	IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Theoretical bases of forecasting socio-economic phenomena. Non-quantitative forecasting methods: analogue methods and heuristic methods. Using adaptive models in forecasting (Winters and Holt exponential smoothing models). Econometric prediction. Forecasting economic and social phenomena using univariate time series models. Selected simulation methods for forecasting models. Application of ANOVA in the forecasting process. Multi-equation models in the process of forecasting and simulation of economic and social phenomena. Application of artificial neural networks to the forecasting of socio-economic phenomena.	
Examination methods:		Test (written or computer based), Project	

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Subject name:		Basics of Financial Engineering	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the structure of financial market, its segments and istruments as well as the relationships between the commodity, financial and derivatives markets.	IEj_K2_W03
	W2	financial engineering methods for pricing basic derivatives and assessing the risk faced by their purchasers and writers.	IEj_K2_W15
	W3	statistical and econometric methods applied to estimate the volatility of financial instruments.	IEj_K2_W14
Skills: (In terms of skills, the graduate can)	U1	prepare parameters necessary for pricing futures and options, select proper methods and tools for derivatives pricing and draw the pay-off profiles.	IEj_K2_U02
	U2	predict financial results of derivatives applications in different market conditions.	IEj_K2_U04
	U3	construct hedging strategies and rationallly assess their efficiency in specific market conditions.	IEj_K2_U06
Course content ensuring the achievement of learning outcomes:		The concept of financial engineering, its origin and subject. Financial and commodity markets as the environment for financial engineering. Standard forward and futures contracts (forward price, futures price). Standard options and methods for their pricing (the Black-Scholes model, the Cox-Ross-Rubinstein model). Options sensitivity (Greeks). Historical and implied volatilities. Option hedging strategies (spreads and combinations). Selected non-standard options (path-dependent, time-dependent, binary and two-asset options).	
Examination methods:		Written exam	

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Subject name:		Advaced Data Exploration Techniques for Big Data	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	the process of collecting, processing, extracting data from database systems and data warehouses.	IEj_K2_W06
	W2	basic algorithms of data mining (decision trees, neural networks, algorithms) and advanced algorithms (teams of classifiers) used to support decisions in business practice (in IT, industry, marketing)	IEj_K2_W05, IEj_K2_W07
	W3	mass data specifics and extracting it from source systems using IT technology and efficiently prepare it depending on the problem and the requirements.	IEj_K2_W10
Skills: (In terms of skills, the graduate can)	U1	use literature to gain required skills on analytical methods (data mining techniques)and to formulate and solve tasks at the interface between IT and business applications (in IT, industry, medicine, marketing).	IEj_K2_U01, IEj_K2_U06
	U2	implement selected analytical techniques in information systems (including generating scoring lists, generating decision rules) using the right methods and IT tools.	IEj_K2_U13
	U3	analyse of market phenomena and business processes, including the specificity of collecting, processing, extracting data from database systems and data warehouses.	IEj_K2_U12, IEj_K2_U14, IEj_K2_U15
Social competences: (Within the scope of competence, the graduate is ready to)	K1	learn throughout life, to inspire and organize the learning process of others.	IEj_K2_K01
Course content ensuring the achievement of learning outcomes:		Introduction, basic concepts (3V, 4V), problems of analysis of large data volumes. Data processing, discovery of inconsistencies, peculiarities and dependencies in large data repositories, methods of dimension reduction. Big data technology and specifics of programing in SAS 4GL, SAS SQL, SAS MACRO. Introduction to problems of classification, regression and forecasting in business practice. Data mining techniques: classification trees - basic algorithms, C4.5, C5.0, ID.3, CART, learning classification trees, tree division criteria, comparison of model validity; neural networks - history, neuron construction, construction of artificial neural networks of the RBF and MLP types, selected algorithms of learning artificial neural networks, optimization of neural network architecture, assessment of network performance. Advanced machine learning techniques – ensemble classifiers. Application of data mining methods in computer science and telecommunications, finance, industry, medicine, marketing. Big data technology and the solutions supporting the processing of large data volumes. Data processing in SAS 4GL and SAS SQL language. Automation of data extraction processes in SAS Macro language. Data mining techniques and their implementation: decision trees and neural networks for classification and regression. Advanced techniques of machine learning: groups of classifiers and predictors. Case study on large data volumes (in terms of the number of observations and variables).	
Examination methods:		Test (written or computer based), Project	

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Subject name:		Deep Learning Methods	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	artificial intelligence algorithms and issues related to their implementation ; optimization methods and decision support systems, modern trends in this field; methods, techniques and tools used to solve simple IT tasks in the field of problems related to computational complexity and artificial intelligence; information acquisition and knowledge discovery technology; mathematics (including: statistics, differential and difference equations, elements of functional analysis) in the field of creating models of neural networks and other typical activities in the field of computer science.	IEj_K2_W06, IEj_K2_W07, IEj_K2_W08, IEj_K2_W09, IEj_K2_W10
Skills: (In terms of skills, the graduate can)	U1	describe the proposed model, extended by the formulation of own opinions and a critical selection of data and methods of analysis (is able to select the appropriate IT and statistical tools to analyze social and economic problems).	IEj_K2_U02
Social competences: (Within the scope of competence, the graduate is ready to)	K1	providing information on the importance of artificial intelligence methods in the current state of technology.	IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Fully Connected Neural Networks. Convolution Neural Networks. Siamese Networks; Autoencoders. Recurrent Neural Network. Generative Adversarial Networks. Reinforcement learning. Examples of implementations of deep model models.	
Examination methods:		Oral exam, Project, Case	

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Subject name:		Event history analysis	ECTS: 2
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	knowledge of how to obtain empirical data on durations and of advanced techniques to model them.	IEj_K2_W04
	W2	how to properly identify the nature of the process under investigation and how to properly collect data from the available databases.	IEj_K2_W05, IEj_K2_W09
	W3	the statistical methods used to study the occurrence and distribution of events over time.	IEj_K2_W14
Skills: (In terms of skills, the graduate can)	U1	obtain data in an appropriate manner and correctly interpret the results of the analyses carried out.	IEj_K2_U01
	U2	apply adequate methods to problems of event history analysis, using model estimation tools.	IEj_K2_U02
	U3	model complex social processes using advanced econometric methods.	IEj_K2_U04
Course content ensuring the achievement of learning outcomes:		Introduction to event history analysis. Data types and databases used in the construction of survival models: Cohort and cross-sectional data, Censored data. Tools used in the construction of survival models: R, PS IMAGO, gretl, SAS, Stata. Discrete-time models - logit and probit models (theory, estimation and verification). Probabilistic continuous-time survival model:Survival model as a probability distribution. Density, distribution and survival functions. Hazard (intensity) function, its relationships with other functions. Duration distribution parameters as characteristics of the survival process. Non-parametric models.Traditional method of constructing life tables. Construction of life tables using Kaplan-Meier and Nelson-Aalen methods. Estimation and verification of non-parametric models. Parametric models. PH proportional hazards models: exponential, Weibull, Gompertz, Makeham (the latter two as parametric models of the human survival process). Accelerated failure models AFT: exponential, Weibull, log-logistic, log-normal, generalised gamma-□ Estimation and verification of parametric models. Hazard models with unobservable heterogeneity. Semiparametric models. Cox proportional hazards model. Verification of the proportional hazards assumption. Estimation and verification of semiparametric models. Semiparametric model with time-dependent variables. Multivariate duration models. Competing risks model.	
Examination methods:		Test (written or computer based), Project	

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Subject name:		Network Security	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	methods, techniques and tools used in solving simple IT tasks in the field of securing computer systems, operating systems, computer networks and network technologies on the AWS platform	IEj_K2_W08
	W2	technologies of obtaining information and knowledge related to network security, computer systems, etc. to an extended extent.	IEj_K2_W09
Skills: (In terms of skills, the graduate can)	U1	analyse and test IT systems in terms of network security	IEj_K2_U14, IEj_K2_U17
	U2	use the acquired knowledge in various scopes and forms, extended by a critical analysis of the effectiveness and usefulness of the applied knowledge in practice.	IEj_K2_U06
Social competences: (Within the scope of competence, the graduate is ready to)	K1	set priorities appropriately for the implementation of a task defined by himself or others.	IEj_K2_K01, IEj_K2_K04
Course content ensuring the achievement of learning outcomes:		Introduction to AWS Cloud Security: Understanding the AWS shared responsibility model and cloud security best practices. AWS Identity and Access Management (IAM): Setting up and managing user access, roles, and policies. AWS Key Management Service (KMS): Understanding and implementing encryption and key management in AWS. AWS CloudTrail: Monitoring, logging, and retaining API usage across AWS accounts. AWS Security Hub: Comprehensive view of the high-priority security alerts and compliance status. AWS GuardDuty: Learning to enable intelligent threat detection and continuous monitoring. AWS Shield: DDoS protection and how to implement it. Amazon Macie: Understanding data privacy and protection, detection of sensitive data exposure. AWS WAF (Web Application Firewall): Protecting against web exploits. AWS Network Security: VPC security best practices, security groups, NACLs, and VPC flow logs. AWS Data Protection: Best practices for S3 bucket policies, EBS encryption, and RDS security. Security for Serverless and Container-based services: Understanding security best practices for AWS Lambda, ECS, and EKS. Compliance and Governance on AWS: Understanding AWS's approach to IT controls and risk management. Incident Response on AWS: Understanding how to manage and respond to security incidents within the AWS environment. Integrating Third-Party Security Solutions: Exploring the AWS Marketplace and learning how to integrate external security tools and services to enhance the overall security posture of your AWS environment.	
Examination methods:		Written credit	

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Subject name:		Statistical Analysis in Market Research		ECTS: 2
Effects:		The content of the effect assigned to the subject:		Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	qualitative and quantitative methods used in market analysis and marketing research		IEj_K2_W04
	W2	how to support economic decision-making with quantitative methods		IEj_K2_W07
	W3	methods of analysing the dynamics of phenomena and methods of grouping objects		IEj_K2_W14
Skills: (In terms of skills, the graduate can)	U1	obtain data from various databases and correctly interpret observed economic phenomena		IEj_K2_U01, IEj_K2_U02, IEj_K2_U04
	U2	apply relevant methods to specific problems in market analysis		IEj_K2_U02
	U3	use unidimensional and multidimensional methods of analysis in market research		IEj_K2_U04
Social competences: (Within the scope of competence, the graduate is ready to)	K1	conduct market analyses. taking into account the social problems associated with them		IEj_K2_K05
Course content ensuring the achievement of learning outcomes:		The informational base of market analysis (purposes of information collection, sources of information, data processing and presentation of results). Data in marketing (measuring scales and preliminary analysis of data), Portfolio analysis (BCG method). Estimation of sale functions. Analysis of consumers' behaviour on a market (measuring of consumer's attitude – one- and multidimensional scales, analysis of consumer's loyalty, analysis of consumers' preferences, the impact of qualitative characteristics on the decision of purchasing). Analysis of market trends – a quantitative approach. Trading area analysis (measures of location and spatial gravitation; identifying the trading areas - Reilly's law of retail gravitation and Huff's law; market concentration measures: Gini coefficient Herfindahl- Hirschman index, entropy measure). Multidimensional methods of market data analysis (dependence analysis: regression analysis, conjoint analysis, classification trees; coincidence analysis: factor analysis, classification methods, multidimensional scaling; linear ordering). Spatial analysis of market (taxonomic methods). Brand positioning. Analysis of distribution. The efficiency of marketing activities.		
Examination methods:		Written credit		

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Subject name:		Business Ethics	ECTS: 1
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	to an in-depth degree the relations between economic structures and institutions on a national and international scale in terms of their ethical significance.	IEj_K2_W03, IEj_K2_W16
Skills: (In terms of skills, the graduate can)	U1	make an ethical assessment of selected phenomena in the field of economic life.	IEj_K2_U03, IEj_K2_U12
Social competences: (Within the scope of competence, the graduate is ready to)	K1	correctly identify and resolve ethical dilemmas related to the business practice.	IEj_K2_K05
Course content ensuring the achievement of learning outcomes:		General ethics. What is ethics? Main Concepts in Ethics. Sub-disciplines of ethical reflection. Ethical paradigms. Utilitarianism. Ethics of Duty. Virtue ethics. The Ethics of Care. Business ethics. What is business ethics? Three approaches to business ethics. Business Social Responsibility model and its critics. Particular issues in business ethics (exact topics will be anounced in tutorials). Green business dilemmas. Ethics in the era of global business. Socio-economic inequalities. Ethics in HR.	
Examination methods:		Test (written or computer based), Presentation	

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Subject name:		Project Management	ECTS: 4
Effects:		The content of the effect assigned to the subject:	Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	basic processes in accordance with a specific methodology.	IEj_K2_W02
	W2	selected concepts and methods of project management, including IT (software engineering)	IEj_K2_W06, IEj_K2_W11, IEj_K2_W16
Skills: (In terms of skills, the graduate can)	U1	define the importance of project management functions	IEj_K2_U05
	U2	distinguish individual stages of planning and task management	IEj_K2_U14, IEj_K2_U16
Social competences: (Within the scope of competence, the graduate is ready to)	K1	show an active attitude in learning about new management concepts	IEj_K2_K01
Course content ensuring the achievement of learning outcomes:		Introduction to project management - project definition, project features, project life cycle, project creation, selected management methodologies projects. Traditional management methods eg Prince 2, PMBOK. Agile management methods: Agile, Scrum. Project evaluation methods. Selection of the project team. Managing the design team - styles steering. Planning the course of the project - Gantt chart, network methods.	
Examination methods:		Written exam, Project, Assessment of speeches during classes	

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Subject name:		Intelectual Property Management		ECTS: 1
Effects:		The content of the effect assigned to the subject:		Directional effect reference:
Knowledge: (In terms of knowledge, the graduate knows and understands)	W1	issues in the field of intellectual property protection, which includes understanding the legal aspects of using the products of human intelligence (copyright and related rights, industrial property law)		IEj_K2_W05
Skills: (In terms of skills, the graduate can)	U1	find the necessary information in collections of legal acts (laws and regulations, court decisions) and practically use the knowledge in the field of intellectual property protection, skillfully communicating in the language of the subject		IEj_K2_U01, IEj_K2_U05
Social competences: (Within the scope of competence, the graduate is ready to)	K1	practically use the acquired knowledge in the field of intellectual property protection and to seek cooperation with experts in case of difficulties with solving the problem on their own		IEj_K2_K02
Course content ensuring the achievement of learning outcomes:		On the basis of the literature on the subject (data from the Patent Office, court rulings), students prepare and deliver presentations covering the issues of industrial property protection as well as copyright and related rights. The presentations are a starting point for discussion and discussing the most important issues in the field of intellectual property protection.		
Examination methods:		Presentation		

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Programme indicators

Name	Value
Potwierdzenie – na podstawie planu studiów, że student realizuje zajęcia z dziedziny nauk humanistycznych i/lub społecznych, którym przypisano nie mniej niż 5 punktów ECTS	5
Potwierdzenie – na podstawie planu studiów, że student ma możliwość wyboru zajęć, którym łącznie przypisano liczbę punktów ECTS nie niższą niż 30% ECTS określonych dla programu tych studiów	54/120 (45%)
Potwierdzenie, że program studiów o profilu ogólnoakademickim obejmuje zajęcia związane z prowadzoną w uczelni działalnością naukową, w wymiarze większym niż 50% liczby punktów ECTS, określonej dla programu tych studiów	77/120 (64.17%)
Potwierdzenie, że liczba punktów ECTS uzyskanych w programie studiów poprzez realizację zajęć z wykorzystaniem metod i technik kształcenia na odległość jest nie wyższa niż 75% ogólnej liczby punktów ECTS w programie studiów o profilu ogólnoakademickim	0/120 (0%)
Liczba godzin w programie	1324