University of Gdańsk

Subject card

Subject name and code	Databases, PG_00155281						
Field of study	Mathematical Modeling and Data Analysis						
Date of commencement of studies	October 2024		Academic year of realisation of subject	2025/2026			
Education level	Bachelor's studies		Subject group	Obligatory subject group 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	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Rafał Lutowski				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	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	• To familiarize students with the theory of databases, mainly the relational model, but also the object-oriented approach and the physical organization of data. • Preparing students to use selected tools for creating and maintaining databases, as well as modifying and extracting data. • Preparing students to work in teams on more complex database projects.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MMiADL3_W09] knows and understands the basics of computational and programming techniques supporting mathematician's work and understands their limitations	knows the theoretical foundations of the relational database model knows the basics of computational and programming techniques supporting the work of a mathematician and understands their limitations	[SW4] test/exam - oral or written
[MMiADL3_U10] is able to recognise problems, including practical issues, that can be solved algorithmically; can make a specification of such a problem	designs databases using an entity relationship diagram, applies standardization procedures to database designs implements a database using the structured query language SQL, as well as wizards available in the database management system analyzes database designs in terms of the task to be fulfilled	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written
[MMiADL3_U09] is able to use the learned software package or the learned programming language to solve selected problems from the known fields, in particular from mathematical analysis, linear algebra and statistics	designs databases using an entity relationship diagram, applies standardization procedures to database designs	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written
[MMiADL3_U13] knows how to use computer programmes in the field of data analysis	searches for data using SQL, constructing queries appropriate to the given problems	[SU8] observation of student's independent or team work
[MMiADL3_K03] is ready to work in a team; understands the need for systematic work on all projects that have a long-term character	can work in a team; understands the need to systematically work on all long-term projects	[SK2] presentation/project/paper/ report
[MMiADL3_U11] knows how to arrange and analyse an algorithm in accordance with the specification and save it in the selected programming language	implements a database using the structured query language SQL, as well as wizards available in the database management system analyzes database designs in terms of the task to be fulfilled	[SU2] presentation/project/paper/ report

Subject contents

1. Introduction to database systems. Database concept. Entity relationship model. Relationships between entities. Entity relationship diagrams. Database management system.
2. Relational databases. Relational algebra. Relational query languages.
3. Theory of relational database design. Functional dependencies. Decomposition of relations. Invertible joins. Testing the invertibility of decompositions. Dependency-preserving decompositions. Normal forms of relationship diagrams. Justification for introducing normal forms. Query optimization.
4. SQL language. Introduction to SQL. Advanced SQL features.
5. Concurrent database operations. Locks. Transactions.
6. Protecting the database against misuse. Data protection and security. Data integrity. Protection against failures.
7. NoSQL databases. Data models, database examples. CAP principle. BASE properties.
8. Physical organization of databases. Sequential access files. Direct access files. Files with index-sequential access. B-trees. Files with variable length records.

Prerequisites and co-requisites

1. Logic
2. Properties of actions (associativity, commutativity, distributivity)
3. Data structures (hash tables, B-trees)

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
short tests	0.0%	10.0%
final test in written or oral form	51.0%	50.0%
project	51.0%	40.0%

Recommended reading

Basic literature

1. C.J. Date, Wprowadzenie do systemów baz danych, Wydawnictwa Naukowo-Techniczne, Warszawa 2000
2. K. Douglas, S. Douglas, PostgreSQL, Second Edition, Sams Publishing 2006
3. D. Mendrala, M. Szeliga, Access 2010 PL Ćwiczenia praktyczne, Helion, Gliwice 2010
4. A. Dybowska-Dyk, M. Bartnik, Ćwiczenia z języka SQL, Mikom, Warszawa 1999
5. J. Jędrzejowicz, Bazy danych, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2004

Supplementary literature

1. J. Celko, Joe Celkos Complete Guide to NoSQL : What Every SQL Professional Needs to Know About Non-Relational Databases, Morgan Kaufmann 2013
2. H. Garcia-Molina, J.D. Ullman, J. Windom, Implementacja systemów baz danych, Wydawnictwa Naukowo-Techniczne, Warszawa 2003
3. G. Lausen, G. Vossen, Obiektowe bazy danych. Modele danych i języki, Wydawnictwa Naukowo-Techniczne, Warszawa 2000
4. D. Mendrala, M. Szeliga, Access 2010 PL, Helion, Gliwice 2010
5. G. Vaish, Getting Started with NoSQL, Packt Publishing 2013

	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Working with small databases without a computer (for example making joins). 2. Discovering types of relationships between entities. 3. Formulating simple SQL formulas without a computer. 4. Explaining SQL queries. 5. Formulating and proving theorems of Heath and Fagin. 6. Finding candidate keys when a functional dependencies are given.	
Work placement	Not applicable	

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