University of Gdańsk

Subject card

Subject name and code	Databases, PG_00207064		
Field of study	Mathematics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	5.0
Learning profile	academic	Assessment form	credit
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. 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	3.0	62.0	125

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
[MATMU2_W03] knows and understands to a deep degree a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections between issues in this field and other areas of mathematics	Student knows relational algebra operators and their properties, theory connected to database normalization.	[SW4] test/exam - oral or written
[MATMU2_U04] is able to apply the scientific method in solving advanced problems in a selected branch of mathematics or its applications, and appropriately selects methods and tools - mathematical or computer - needed to solve such problems	Student 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
[MATMU2_U09] is able to lead a team, cooperate with team members within its work, take the initiative in team management	Student is able to work in a team to design, organize and protect databases against misuse, taking the initiative in organizing team work and dividing tasks during the implementation of group programming projects.	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written

<table>
<tr><td>Subject contents</td><td>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.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>1. Elements of logic
2. Properties of actions (associativity, commutativity, distributivity)
3. Data structures (hash tables, B-trees)</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>short tests</td><td>51.0%</td><td>10.0%</td></tr>
<tr><td>final test in written or oral form</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>project</td><td>51.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>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</td></tr>
<tr><td>Supplementary literature</td><td>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</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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