COURSE DESCRIPTION CARD - SYLLABUS

Course name
Management of SQL and NoSQL databases

Course

Field of study
Computing

Year/Semester
3/5

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
16	18	
Tutorials	Projects/seminars	

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

A student beginning this course should have a basic knowledge of programming fundamentals, computer system architecture, operating systems, and database systems.

A student should have the ability to obtain information from the indicated sources.

A student should also understand the need to expand his competencies and have a willingness to cooperate as part of a team. In addition, in terms of social competence, the student must present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. To provide students with the basic knowledge of database systems technology necessary for the proper design, use and implementation of database systems.

2. To develop students' ability to solve problems that arise in the management of database systems.

Course-related learning outcomes

Knowledge

- student has a structured, theoretically based general knowledge of conventional databases and NoSQL databases (K1st_W4),
- student has detailed knowledge about the management of database systems, including transactionality, mechanism of database disaster recovery (K1st_W5),
- student has basic knowledge about the life cycle of SQL and NoSQL database systems (K1st_W6),
- student knows basic methods, techniques and tools used in solving simple computer tasks in the field of database management, (K1st_W7).

Skills

- student is able to acquire knowledge from various sources, including literature and databases, as well as interpret it properly, draw conclusions and justify opinions (K1st_U1),
- student is able, solving the problem of data processing in databases, to apply appropriate methods and algorithms (K1st_U4),
- student is able to make a critical analysis of the functioning of the database system and prepare functional and efficiency tests of the operation of the information system using the database system (K1st_U9),
- student is able, according to a given specification, to develop and implement a model of a fragment of reality, formulate a functional specification of an information system and implement an information system using a database system with the use of one of the popular DBMS (K1st_U10),
- student is able to formulate data processing algorithms and implement them using at least one of the popular tools (K1st_U11),
- student is able to plan and carry out the process of self-education and knows the possibilities of further education (K1st_U19).

Social competences

- student understands that in computer science, within the framework of database issues, knowledge and skills become obsolete very quickly (K1st_K1),
- student is aware of the importance of database knowledge in solving engineering problems, and knows examples and understands the causes of malfunctioning information systems (K1st_K2),
- student is able to think and act in an entrepreneurial manner (K1st_K3).

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Verification of the established learning outcomes for lectures is carried out by:

- continuous assessment, at each class (oral answers) - bonus of incremental skills in the use of the learned principles and methods,
- evaluation of knowledge and skills demonstrated in the written exam.

The written exam is problem-based and consists of 9-10 tasks. The exam is an open exam, i.e. during the exam students can use any teaching materials. The scope of the exam includes the material of two subjects: Database Systems and SQL and NoSQL Database Management, devoted to the problems of database systems. A passing grade in the lecture requires at least 50% of the points on the written exam. The following grading scale is adopted depending on the number of points obtained: <0;50%>: ndst, (50%;60%>: dst, (60%;70%>: dst+, (70%;80%>: db, (80%;90%>: db+, (90%;100%>: bdb. The maximum number of points to be obtained in the exam is the sum of the maximum points obtained by students for individual tasks. The scoring of tasks is adapted annually to the exam tasks and is listed on the exam papers.

Verification of the established learning outcomes of the laboratory is realized by:
- assessment of the student's preparation for individual laboratory sessions,
- conducting a credit check in the form of a test (30 questions),
- preparation and defense by the student of a database application (credit project).
To receive a passing grade in the laboratory, it is necessary to get a grade of at least dst from the test and the credit project. The following grading scale is adopted depending on the number of points obtained: <0;50%>: ndst, (50%;60%>: dst, (60%;70%>: dst+, (70%;80%>: db, (80%;90%>: db+, (90%;100%>: bdb.
The final laboratory grade is determined by the average of the grades obtained from the test and for the project (weighting of 0.4 for the test grade and 0.6 for the project grade).

Programme content

The course syllabus covers the following topics:
- Transactional processing, definition and ACID properties of transactions.
- Database recovery (atomicity property); recovery of lost data (persistence property).
- Definition of correctness of concurrent transaction histories (isolation property).
- Synchronization of concurrent transaction histories using two-phase locking, timestamps, multiversion and optimistic protocols.
- Disk-based data structures, e.g., sorted, hash, and clustered files; single-level, tree-based, and bitmap indexes.
- Data access methods, e.g. binary search method, external sorting, sort-merge, nested-loop, hash join.
- Query Optimization techniques.
- Distributed database technology: fragmentation, data partitioning and sharding.
- Correctness of databases with data replication. Brewer's theorem, iPACeLC classification.

In the lab, students will learn about:
1) selected relational database access technologies (JDBC, JPA),
2) methods of user authentication,
3) principles of granting permissions and methods of authorizing database operations,
4) the process of optimizing SQL statements including:
5) elements of PL/SQL language.

Teaching methods

1. lecture: multimedia presentation, presentation illustrated by examples given on the blackboard,
2. laboratory exercises: multimedia presentation, presentation illustrated by examples given on the blackboard, practical exercises, workshops.

Bibliography

Basic

1. Garcia-Molina H., Ullman J.D., Widom J., Systemy baz danych. Kompletny podręcznik. Wydanie II, Helion 2011
2. Elmasri R., Navathe S., Wprowadzenie do systemów baz danych, Wyd. Helion, (4th Edition), 2005
3. Date, C.J. Wprowadzenie od systemów baz danych, WNT 2000

Additional

1. Database Management Systems, 2nd edition, R. Ramakrishnan, J. Gehrke, WCB/McGraw-Hill, 2001
2. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence 1st Edition, P. Sadalage, M. Fowler, Addison-Wesley Professional, 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	34	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	91	3

[1] delete or add other activities as appropriate