COURSE DESCRIPTION CARD - SYLLABUS

Course name
Database Systems Administration [S2Inf1-TPD>SBD]

Course

Field of study
Computing

Year/Semester
1/1

Area of study (specialization)
Data Processing Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

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Prerequisites

The learning outcomes from the 1st cycle studies defined in the Resolution of the Senate of PUT, especially the effects K_W1-2, K_W4, K_W6-15, verified in the recruitment process for the 2nd cycle studies - these effects are presented on the faculty"s website. The learning outcomes of first cycle studies defined in the Resolution of the Senate of PUT, in particular effects K_U1-2, K_U4, K_U7-8, K_U14-20, K_U22-23, K_U26, verified in the process of recruitment for second cycle studies - these effects are presented on the faculty"s website. The learning outcomes from the 1st cycle studies defined in the Resolution of the Senate of PUT, especially the effects K_K1-9, verified in the process of recruitment for the 2nd cycle studies - these effects are presented on the faculty"s website. Moreover, in the scope of social competences, a 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 administering a commercial database system, in terms of: creating databases, creating data structures, optimizing SQL commands, tuning database performance, securing the database from failure, restoring the database after a data carrier failure, authorizing access to data, and sharing the database in a local and wide area network 2 Develop students" problem-solving skills related to: optimal selection of data structures, SQL command performance analysis, database performance bottlenecks, database security vulnerability search and remediation, database fail-safe strategy construction, media failure recovery techniques, and local and wide area network database configuration methods

Course-related learning outcomes

Knowledge:
1. student has advanced and in-depth knowledge of multitier and distributed applications, architectural patterns for such applications, tools, frameworks, libraries, and programming environments used to implement them (k2st_w1)
2. student has advanced detailed knowledge of selected issues in the field of multitier and distributed applications (k2st_w3)
3. student has advanced and detailed knowledge of processes occurring in the life cycle of web applications (k2st_w5)
4. student knows advanced methods, techniques, and tools used to create complex enterprise web applications (k2st_w6)

Skills:
student is able - when formulating and solving engineering tasks - to integrate knowledge from different areas of computer science (k2st_u5)
student is able to critically analyze existing database administration solutions and propose their improvements (k2st_u8)
student is able to assess the usefulness of methods and tools for solving an engineering task involving database administration, including recognizing the limitations of these methods and tools (k2st_u9)
student is able - using, among others, conceptually new methods - to solve complex tasks of database administration, including atypical tasks and tasks containing a research component (k2st_u10)
student is able to cooperate in a team, taking various roles in it (k2st_u15)

Social competences:
student understands the importance of using the latest knowledge in database administration in solving research and practical problems (k2st_k2)is able to assess the usefulness of methods and tools for solving an engineering task involving database administration, including recognizing the limitations of these methods and tools (k2st_u9)
student is able - using, among others, conceptually new methods - to solve complex tasks of database administration, including atypical tasks and tasks containing a research component (k2st_u10)
student is able to cooperate in a team, taking various roles in it (k2st_u15)

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Formative assessment:
(a) for lectures:
- On the basis of answers to questions on the material discussed in previous lectures,
b) in terms of laboratories:
- on the basis of the evaluation of the current progress of the tasks,
Summative evaluation:
a) in terms of lectures, verification of the established learning outcomes is realized by:
- evaluation of knowledge and skills demonstrated in a written test in the form of a multiple-choice test, consisting of 20 questions, for which 20 points can be earned, for a passing grade 11 points must be obtained,
- discussion of the results of the exam,
b) in the field of laboratories, verification of the established learning outcomes is carried out by:
- continuous evaluation, at each class (oral answers) - bonus of the increment of skills in the use of

learned principles and methods,
- evaluation of knowledge and skills related to the implementation of laboratory tasks through 1 test per semester,
Obtaining additional points for activity during classes, especially for:
- efficiency of application of the acquired knowledge during the solution of the assigned problem,
- comments related to the improvement of teaching materials,
- pointing out perceptual difficulties of students enabling ongoing improvement of the didactic process.

Programme content

The course program covers the following topics:

Architecture of commercial database systems: types of memory, service processes, configurations and checkpoints.
Data structures: files, logs, tablespaces, segments, extensions and data allocation.
Rollback data: read consistency, multi-version model, segments and rollback spaces.
Access authorization: users, roles, privileges, profiles and access control.
Database archiving: archiving procedures, multiplication, compression, encryption and backup maintenance strategies.
Database restoration: file and database restoration methods, security copy refreshing and file relocation.
Retrospecting: different types of retrospective queries and transaction replay.
Networking: listening processes, configuration, client and database connectors.
SQL statement optimization: index types, optimizers, statistics, table joins and profiling.
Database performance tuning: diagnostics, automatic monitoring, metrics, metrics and performance snapshots.

Course topics

The lecture program covers the following topics:
1. Architecture of commercial database systems: shared and private memory, service and secondary processes, dedicated and shared configuration of service processes, checkpoints.
2. Data structures: data and control files, redo logs, tablespaces, segments, block extensions, ways to allocate extensions, ways to allocate data to blocks.
3. Rollback data: read consistency, multi-version data model, rollback segments, rollback spaces.
4. Access authorization: users, roles, object and system privileges, profiles, fine-grained access control.
5. Database archiving: quick restore area, multiplication of control and redo log files, redo log file archiving, copy sets, image copies, backup compression and encryption, incremental backups, backup maintenance strategies, restore directory.
6. Database restoration: file restoration, tablespace restoration, whole database restoration, closed and open database restoration, full and incomplete restoration, incremental security copy refresh, changing the location of the restored data file.
7. flashback: flashback query, database flashback, table delete flashback, transaction flashback, table flashback.
8. Networking: listening process, configuration of shared service processes, database system client, database connectors.
9. SQL statement optimization: index types, rule and cost optimizer, system and data statistics, histograms, statistics gathering, dynamic sampling, table joins, sorting, pointers, SQL command profiling.
10. database performance tuning: database performance diagnostics, automatic load repository, automatic database performance monitor, metrics, metrics, thresholds, performance snapshots.
Laboratory classes are conducted in the form of 7 2-hour exercises, held in the laboratory, preceded by a 1-hour instructional session at the beginning of the semester. The exercises are carried out individually. The lab program includes the following topics:
1. Configuration of the virtual machine and operating system for the database software. Installation of the database software.
2. database development. Architecture of commercial database systems: shared and private memory, service and secondary processes, dedicated and shared configuration of service processes, checkpoints.
3. data structures: data and control files, redo logs, tablespaces, segments, block extensions, ways to allocate extensions, ways to allocate data to blocks. Rollback data: read consistency, multi-version data model, rollback segments, rollback spaces.
4. Access authorization: users, roles, object and system privileges, profiles, fine-grained access control.

5. Database archiving: fast recovery area, multiplication of control and redo log files, redo log file archiving, copy sets, image copies, backup compression and encryption, incremental backups, backup maintenance strategies, recovery catalog. Flashback: flashback query, database flashback, table delete flashback, transaction flashback, table flashback.
6 SQL statement optimization: Index types, rule and cost optimizer, system and data statistics, histograms, statistics gathering, dynamic sampling, table merging, sorting, pointers, SQL command profiling.
7. Database performance tuning: database performance diagnostics, automatic load repository, automatic database performance monitor, metrics, metrics, thresholds, performance snapshots. Database restoration: file restoration, tablespace restoration, whole database restoration, closed and open database restoration, full and incomplete restoration, incremental backup refresh, changing the location of the restored data file.

Teaching methods

1. lecture: multimedia presentation, presentation illustrated by examples given on the blackboard, solving tasks
2. laboratory exercises: solving tasks, practical exercises, performing experiments, discussion, teamwork, case study, demonstration

Bibliography

Basic
1. Fundamentals of Database Systems, R. Elmasri and SB Navathe, Addison Wesley, Edition III, 2000, ISBN 0-201-54263-3
2. Database System Implementation, Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom ISBN: 0-13-040264-8
Additional
1.1. Systemy zarządzania bazą danych Oracle 7 i Oracle 8, Robert Wrembel, Juliusz Jezierski, Maciej Zakrzewicz, Nakom, 1999, ISBN: 83-86969-34-2

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	30	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	45	1,50