Final Lecture

SWEN 304

Trimester 2, 2017

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Engineering and Computer Science

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Outline

- What we have learned
- About Exam

What We Learned (1)

- Database Basics
  - What is a database
  - What is a DBMS and what are its tasks
  - Program - Data Independence
  - Three Schema Architecture
- Relational Data Model
  - Tuple
  - Relation
  - Relational Schema
  - Relational Database
  - Relational Database Schema
  - Relational Schema Key
  - Attribute Constraint
  - Referential Integrity Constraint

What We Learned (2)

- Structured Query Language
  - DDL, DML
  - VDL
  - UDF and Triggers
- JDBC
- Relational Algebra
  - Basic Operations (select, project, join)
  - Set Theoretic Operations (union, intersect, difference)
  - Aggregate Functions
- Query optimization
  - Heuristic Optimization
    - Reordering of algebraic operations
    - First execute unary than binary operations
  - Cost Based Optimization
    - Start from heuristic optimization tree
    - Calculate cost of each successive operation

What We Learned (3)

- Update Anomalies
  - Insertion, Deletion, and Modification Anomaly
- Lossless Join
  - Two Relations – A Key is in the Intersection
  - More Than Two Relations – A Relation Schema Contains A Key of the Universal Relation Schema
- Functional Dependencies
  - Inference Rules
  - Closure of a Set of Attributes
  - Finding a Minimal Cover of a Set of Functional Dependencies
  - A Relation Schema Set of Keys Is A Consequence of Functional Dependencies
    - A Key Finding Algorithm
    - Additional key Finding Algorithm

What We Learned (4)

- Normal Forms Based On Functional Dependencies
  - Definitions: 2NF, 3NF, BCNF

- Normalization Algorithms
  - Synthesis Algorithm: 3NF
  - Decomposition Algorithm: BCNF
  - Dependency preservation

What We Learned (5)

- Entity-Relationship (ER) Data Model
  - Regular entity type
  - Relationship type
  - Weak entity type
  - Multivalued attributes
  - Structural constraints
    - Cardinality ratio
    - Participation constraint
  - ISA hierarchy
    - Disjoint and overlapping classification
    - Partial and total classification
    - Each subclass entity inherits superclass properties

What We Learned (6)

- Mapping ER to the Relational Data Model
  - Mapping a regular entity type
  - Mapping a relationship type
    - As a separate relation schema (some (1:1) and all (M:N))
    - By the primary key propagation (some (1:1) and all (1:N))
    - Relationship types between the same entity type require key renaming
  - Mapping a Weak entity type by the key propagation
  - Mapping multivalued attributes (similar to week entity type)
  - Mapping an ISA hierarchy
    - Each super or subclass into a separate relation schema
    - Only subclasses into a separate relation schema
    - All super and subclasses into the same relation schema
    - Constraints for disjoint and total classifications

What We Learned (7)

- Transaction Processing
  - Dirty Read,
  - Unrepeatable Read,
  - Lost update
  - Phantom Record
- Concurrency Control
  - Shareable and Exclusive Locks
  - Basic two-phase locking (acquire all locks before releasing any)
  - Strict two-phase locking (release all locks after COMMIT)
  - Transaction Isolation Levels
  - Deadlock
  - Deadlock Prevention Protocols

Assessment

- Assessment:
  - Assignment 1: (marked) 5%
  - Assignment 2: (marked) 5%
  - Assignment 3: (marked) 5%
  - Assignment 4: (being marked) 5%

  20%
  - Project 1: (marked) 10%
  - Project 2: (to be sumited) 10%

  20%
  - Final examination 60%

40%

This Year's Exam

- Testing you understanding of what we:
  - discussed during the lectures and tutorials,
  - used to solve assignment and project questions

- 120 marks, 120 minutes

- Marks give you an idea of how much time to spend on each question

- Exam questions will cover all the important topics we learned

Exam (continued)

- In year 2012, there were the following questions on the exam:

Question 1. Relational Database Foundations	[15 marks]
Question 2. SQL and Database Queries	[40 marks]
Question 3. Query Processing and Optimisation	[35 marks]
Question 4. Entity Relationship Data Model	[15 marks]
Question 5. Mapping ER into the Relational Data Model	[30 marks]
Question 6. Database Normalisation	[45 marks]

Exam (continued)

- In year 2013, there were the following questions on the exam:
  - Question 1. Relational Database Foundations [20 marks]
  - Question 2. Database Updates and Queries [40 marks]
  - Question 3. Query Processing and Optimisation [30 marks]
  - Question 4. Entity Relationship Data Model [20 marks]
  - Question 5. Mapping ER into Relational Databases [25 marks]
  - Question 6. Database Normalisation [45 marks]

Exam (continued)

- In year 2014, there were the following questions on the exam:

  - Question 1. Relational Database Foundations [20 marks]
  - Question 2. Database Updates and Queries [40 marks]
  - Question 3. Query Processing and Optimisation [30 marks]
  - Question 4. Entity Relationship Data Model [20 marks]
  - Question 5. Mapping ER into Relational Databases [25 marks]
  - Question 6. Database Normalisation [45 marks]

Exam (continued)

- In year 2015, there were the following questions on the exam:

1.	Relational Database Foundations	[15 marks]
2.	Database Updates and Queries	[40 marks]
3.	Query Processing and Optimisation	[30 marks]
4.	Functional Dependencies	[15 marks]
5.	Database Normalization	[30 marks]
6.	Entity Relationship Data Model	[15 marks]
7.	Mapping ER Diagrams into Relational Databases	[15 marks]
8.	Transaction Processing and Concurrency Control	[20 marks]

Exam (continued)

- In year 2016, there were the following questions on the exam:

1.	Relational Database Foundations	[12 marks]
2.	Database Updates and Queries	[20 marks]
3.	Query Processing and Optimisation	[20 marks]
4.	Entity Relationship Data Model	[15 marks]
5.	Mapping ER Diagrams into Relational Databases	[15 marks]
6.	Transactions and Database Integrity	[14 marks]
7.	Database Normalisation	[24 marks]

SWEN 304 Exam

Good Luck!