INFS7901 Database Principles

Course Summary and Exam Review

Rocky Chen

Course Summary Final Exam Review Future INFS Courses Final Thoughts

Course-Level Learning Objectives

The course was designed to use tools and technologies that promote active learning and provide rich feedback to help you learn to

Course Objectives

- 1. Reason with the logical foundation of the relational data model and understand the fundamental principles of correct relational database design.
- 2. Express natural language queries using relational algebra and SQL.
- 3. Analyse the fundamental techniques and algorithms applied for sorting, tree manipulation, and hashing on structured data.
- 4. Reason with the logical foundation on how data is indexed and how a query is executed and optimised.
- 5. Design relational databases with considerations of data integrity and system performance.

Graduate Attributes

- 1. In-depth knowledge & skills in the field of study
- 2. Effective Communication
- 3. Independence and Creativity
- 4. Critical Judgement

Lectures

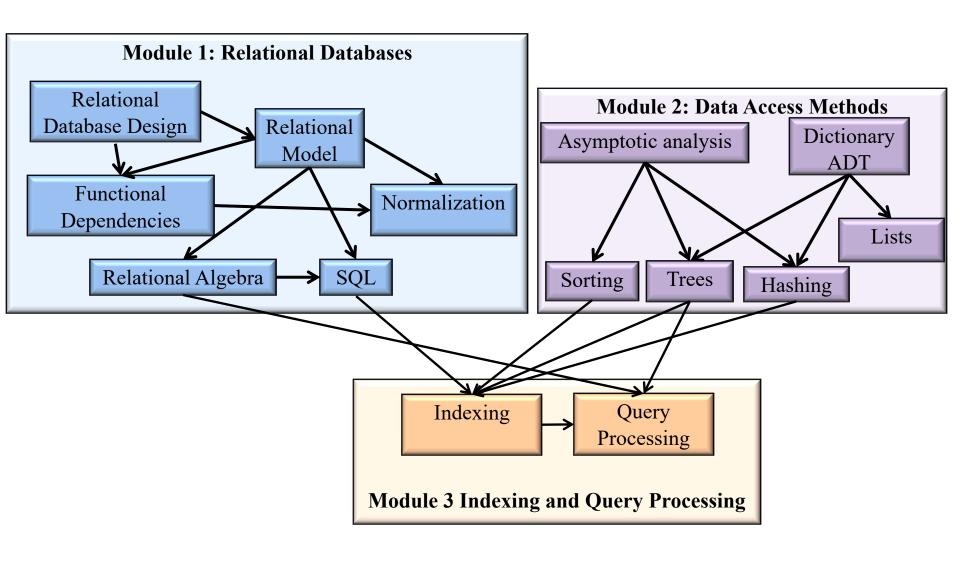
Ed

RiPPLE

Jupyter Notebooks

Project

INFS7901 Journey



Revision Checklist for ER Diagrams

Terminology

- 1. Entity (Weak entity)
- 2. Relationship (Degree, Recursive)
- 3. Attribute (Key and Partial Key, Composite, Multivalued, Derived)
- 4. Constraints (Cardinality ratio, Participation constraints)
- 5. Extended ER (Specialization, Generalization)

- 1. Variation in Notation
- 2. Subjectivity (Expressability, Design choices)
- 3. Mapping to Relational Model

Revision Checklist for the Relational Model

Terminology

- 1. Relations (Is a Set, Table with Rows and Columns)
- 2. Domains (Atomicity, Data type)
- 3. Attributes (Degree of a relation, Prime or Key attribute)
- 4. Tuples
- 5. Key (Super key, Minimal key, Primary key, Candidate key, Foreign key)
- 6. Mapping

- 1. Constraints (Domain, Key, Entity, Referential)
- 2. Constraint violations, constraints and operations, inconsistent database state
- 3. Step by step process for mapping

Revision Checklist for FDs and Normalisation

Terminology

- 1. Anomalies
- 2. Functional Dependencies
- 3. Normal Forms

- 1. How to determine and how to infer FDs
- 2. Closure computation
- 3. Definitions of Normal Forms
- 4. Normalization is a Process

Revision Checklist for SQL

Terminology

- 1. Declarative vs. Procedural
- 2. DDL statements (CREATE TABLE, ALTER TABLE, DROP TABLE)
- 3. DML statements (INSERT, DELETE, UPDATE, **SELECT**)

- 1. Selection, Projection, Sorting (WHERE/HAVING, SELECT, ORDER BY)
- 2. Aggregation (COUNT, SUM, AVG, MIN, MAX) and Grouping (GROUP BY)
- 3. Conditions on groups and aggregates (HAVING)
- 4. Multiple relation queries (Joins, Nesting)
- 5. When to join and when to nest?
- 6. Correlated and non-correlated sub-queries
- 7. Sub-query operators (IN, comparison with (or without) ANY/ALL, EXISTS)

Revision Checklist Asymptotic Analysis

Terminology

- 1. Input size
- 2. Big-O
- 3. Tractable and interactable algorithms
- 4. Best-, worst- and average case analysis

- 1. Categorise an algorithm into a common complexity class
- 2. Given code, measure number of steps as function of the input size

Revision Checklist for Sorting

Terminology

- 1. Time complexity
- 2. Space complexity
- 3. Stability

- 1. Understanding how different learning algorithms work
- 2. Analyse the complexity of different sorting algorithms
- 3. Compare and contrast different sorting algorithms

Revision Checklist for Binary Trees

Terminology

- 1. Dictionary data type
- 2. Tree terminology
- 3. Binary search trees

- 1. Demonstrate how arrays, linked lists and trees can be used to implement dictionary ADT
- 2. Compare and contrast algorithms for storing and retrieving values from a dictionary ADT

Revision Checklist for Hashing

Terminology

- 1. Hash functions
- 2. The pigeonhole principle
- 3. collision in hashing
- 4. Chaining and open addressing
- 5. Primary and secondary clustering
- 6. Linear probing, quadratic probing and double hashing

- 1. Have the ability to create good hash functions
- 2. Demonstrate how hashing can be used to implement dictionary ADT
- 3. Compare and contrast hashing algorithms for storing and retrieving values from a dictionary ADT

Revision Checklist for Indexing

Terminology

- 1. Primary, secondary and clustering indexing
- 2. Sparse and dense indexes
- 3. Multi-level indexes
- 4. Tree-based and hash-based indexes

- 1. Explain the benefits of using indexes
- 2. Explain how different indexing methods work
- 3. Given information about the most common queries in a database, recommend which attributes using which methods should be indexed.

Revision Checklist for Relational Algebra and Query Optimization

Terminology

- 1. Relational algebra and its supported operations
- 2. Initial query tree and final query tree

- 1. Write queries in relational algebra
- 2. Construct query trees
- 3. Understand heuristic rules to transform an initial query tree into a final query tree that is efficient to execute.

Final Exam Review Future INFS Courses Final Thoughts

Final Exam

- When: Confirm online
- Where:
 - External: Blackboard invigilated (proctorU)
 - Internal: UQ (paper-based)
- Open book: any printed/written (not digital)
 materials allowed good indexing may help
- Limited time: 10 min reading + 120 min exam.
 - -Feel free to come to the consultation hour next week.

Final Exam

• The final exam will address (theoretical) material from the entire semester

- Double-pass: Students are required to pass the final exam i.e. to obtain at least 50% in the Final Exam to pass the subject.
- In ECP: Students must receive a passing grade on the final exam in order to pass this course (i.e., achieve at least 50%). If you fail the exam, your final mark will be capped at 49 and your final grade will be capped at 3. Fractional marks achieved during assessments will be rounded up before calculation of final results.

Final Exam Questions

5 MCQs (approx. 5 min each)

9 Short Answers:

- 1. ER Diagrams, relational model and mapping
- 2. Functional dependency and normalisation
- 3. SQL
- 4. Asymptotic analysis
- 5. Sorting
- 6. Trees
- 7. Hashing
- 8. Indexing
- 9. Relational algebra and optimization

Preparing for The Final

- Lecture Notes (incl. clicker questions)
- Past final exams
- Tutorials
- RiPPLE Questions
- Textbook

Course Summary Final Exam Review Future INFS Courses Final Thoughts

Core Courses

- INFS1200 Information Systems will give you foundations of what a database system does and how to use it
- INFS2200 Relational Database Systems on what the database management software does and how to administer it
- What effect multiple computers and huge amounts of data have in INFS3200 Advanced Database Systems

Advanced Courses

- INFS3202 Web Information Systems (how the Web affects information systems)
- INFS3204 Service-Oriented Architectures (how organizations can be tied together using information systems technology).
- INFS4205 High Dimensional Data covers techniques on managing spatial and multimedia data
- INFS4203 Data Mining covers discovery of patterns and anomalies in large volumes of data, including the Web
- INFS7410 Information Retrieval where you can learn how search engines work and are built

Course Summary Final Exam Review Future INFS Courses Final Thoughts

Have you rated INFS7901?



External: SECaT: INFS7901-25037 (STLUC-

EX-S1-2023) - Database Principles

Internal: SECaT: INFS7901-24459 (STLUC-

IN-S1-2023) - Database Principles

Technology has revolutionised the way we live



Upskilling

Skill type 1: Technical skills

- Data analysis methods: statistical methods, machine learning methods (e.g., deep learning), principles and pipelines of data analytics
- **New coding languages**: SQL, Python, R, Java, MatLab
- The ability to determine the right technique for the right task

Skill type 2: Soft skills

- **Communication**: Present data-driven insights to different audiences
- Critical thinking and creativity: Critically justify the pros and cons of solutions
- **Leadership, vision, and more**: The ability to develop business acumen and leadership to derive values from data science applications

Where I Might See You In The Future



Al Scientist - Machine Learning in NLP

21000W5F

AU-AU, Australia-Melbourne; AU-AU, Australia-Sydney

Al Scientist - Machine Learning in NLP

21000W5E

AU-AU, Australia-Melbourne; AU-AU, Australia-Sydney

Analyst - Data Scientist

21000V1M

AU-AU, Australia-Melbourne; AU-AU, Australia-Sydney



Machine Learning Engineer - AWS

Posted September 3, 2021

AU, NSW, Sydney | Job ID: 1713564

(Updated about 1 month ago)

Amazon Web Services (AWS) is the world leader in providing a highly reliable, scalable, lowcost infrastructure platform in the cloud that powers hundreds of thousands of businesses in 190 countries around...Read more

Machine Learning Applied Scientist - Anton van den Hengel

Posted October 18, 2021

(Updated 10 days ago)

AU, Sydney | Job ID: 1778641

There's never been a more exciting time to join Amazon Australia! Who are we and what do we do? We are a world class ML team based in Adelaide and created in April 2020 with the hire of the Director...Read more

Machine Learning Applied Scientist - Anton van den Hengel

Posted October 17, 2021 (Updated 14 days ago)

AU, QLD, Brisbane | Job ID: 1776834

There's never been a more exciting time to join Amazon Australia! Who are we and what do we do? We are a world class ML team based in Adelaide and created in April 2020 with the hire of the Director...Read more

Where I Might See You In The Future

Deloitte.

Consultant/Senior Consultant - Technology Strategy Consulting

Date: 06-Oct-2021

Location: Canberra, ACT, AU

Consultant / Senior Consultant - Digital Finance Technology - Anaplan (Perth)

Date: 17-Oct-2021 Location: Perth, WA, AU

Consultant/Senior Consultant - Technology Strategy Consulting

Date: 06-Oct-2021

Location: Canberra, ACT, AU



Technical Business Analyst

REQ148535 | Sydney CBD Area | Posted Today

Senior Insights Analyst

REQ137433 | Redfern, NSW - 166 Redfern Street | Posted 2 Days Ago

Business Analyst

REQ144552 | Sydney CBD Area | Posted Today

From my experience

- **Feel free to communicate!** We are here to help, not to discourage.
- Life is all about experiencing things, including a major, a job, or a sport...
- Starting early is a good habit
- Don't lock yourself in a single long-term vision
- Only the 1% luckiest can combine hobby with career, but almost 99% can contribute to a hobby with a career

Good Luck!

Thanks for the semester!

Good luck to you all!