Universiteit Antwerpen

Introduction to Databases
Introduction

Floris Geerts

Course Organization

Lectures and Exercises

- Theory lectures:

  Tuesdays: 10:45-12:45 M.G.004

  Slides on blackboard

  Recording from previous year https://msevp.uantwerpen.be/Mediasite/Channel/inleidingdatabases/

- Exercise and Q&A sessions :

  Wednesdays: 10:45 – 12:45 M.G.025 (pc lab)

Lecturer and teaching assistent

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Marco Favier (Exercises)

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- Appointments: send an email to arrange a meeting

Learning Objectives

- (Design a conceptual model for a given data description with the entity-relationship (ER) modelling language.)
- Translate a conceptual ER model into a logical relational model including tables, primary keys, foreign key references, and constraints.
- Formulate database queries in the languages SQL and Relational Algebra.
- Understand and apply the principles of correct database design; this includes decomposing a given schema with functional dependencies into 3NF and BCNF.
- Explain techniques for efficient data retrieval such as indices and transaction management.
- ….

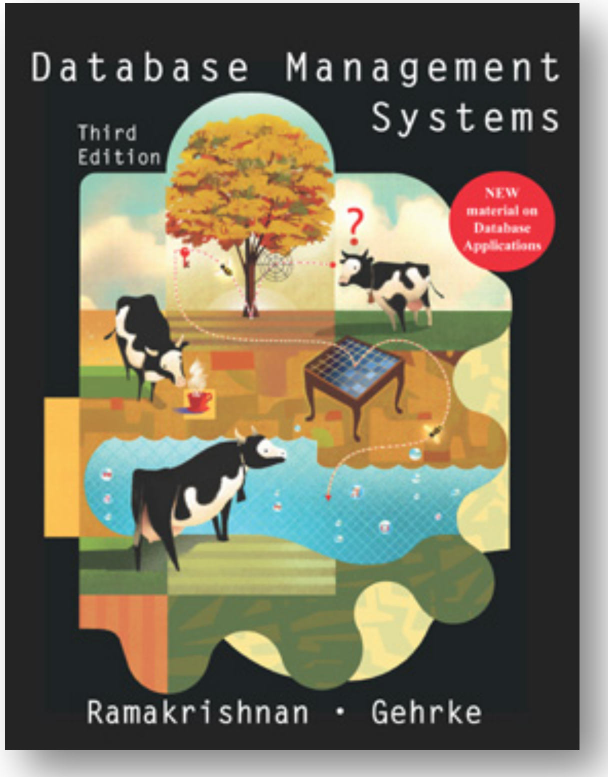
Examination

- The final exam is going to be a **written, closed-book exam** that addresses both of the lecture’s main components:
    - An exercise part with questions following the exercise sessions.
    - A theory part with questions about the lecture content.

- Typical question:
    - Given a conceptual model (ER diagram)
        - Translate this model into a logical schema
        - Formulate queries in one of the query languages
    - Find minimal keys, Check lossless/dependency preservation of decompositions, given BCNF, 3NF
    - Conflict serializability of schedules, Aries recovery method

Course Material

- Slides
- Recordings
- Book (mostly for extra background)


Database Management Systems
Third Edition
NEW material on Database Applications
Ramakrishnan • Gehrke

R. Ramakrishnan,J. Gehrke: Database Management Systems, 2nd Ed., McGraw-Hill, 2000

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Motivation: Databases Are Everywhere

- Information needs to be stored, used and manipulated in many types of applications:
  - administrative applications: banking, airline reservations and schedules, student administration, retail (customers, product recommendations, purchases, order tracking, bookkeeping), …
  - document-oriented applications: newspapers, news sites, (digital) libraries, websites, search engines
  - technical applications: air traffic control, airplane control, motor management, …

every MINUTE of the DAY
UBER PASSENGERS TAKE 694 RIDES
Facebook USERS LIKE 4,166,667 POSTS
TWITTER USERS SEND 347,222 TWEETS
YOUTUBE USERS UPLOAD 300 HOURS OF NEW VIDEO
Instagram USERS LIKE 1,736,111 PHOTOS
PINTEREST USERS PIN 9,722 IMAGES
APPLE USERS DOWNLOAD 51,000 APPS
Netflix SUBSCRIBERS STREAM 77,160 HOURS OF VIDEO
reddit USERS CAST 18,327 VOTES
AMAZON RECEIVES 4,310 UNIQUE VISITORS
VINE USERS PLAY 1,041,666 VIDEOS
Tinder USERS SWIPE 590,278 TIMES
SNAPCHAT USERS SHARE 284,722 SNAPS
Buzzfeed USERS VIEW 34,150 VIDEOS
Skype USERS MAKE 110,040 CALLS

Motivation: Why Do We Need Databases?

- In many systems the data is central

- Data is shared by many programs
  - Student registration system
  - Grade registration system
  - Tuition fees administration
  - Mailings to all students

- Many functionalities are shared among data-intensive applications

Why can’t we just use file systems?

- Data redundancy and inconsistency
  - Multiple file formats, duplication of information in different files
- Need to write a new program to carry out each new task
- Concurrent users
- Recovery after crashes

Summary: Motivation

- Database systems: highly specialized and optimized components
  - Data independence (changes to physical storage, or structure of data, hiddent from software layers above)
  - Efficient data access
  - Data integrity and security
  - Data administration
  - Concurrent access and crash recovery
  - Reduced application development cycle

- In this course we will learn about the most common type of database system: the **relational database**