Databases Design. Introduction to SQL

LECTURE 1
Introduction

Course information

- Lectures
- Lab works (the University database)
- Course work (teams of 1-2 students, the database with the individual topic)
- Quizzes

- Midterm – MCQ
- Endterm – MCQ
- Final exam – Complex

Books

- **Connolly, Thomas M. Database Systems**: A Practical Approach to Design, Implementation, and Management / Thomas M. Connolly, Carolyn E. Begg.- United States of America: Pearson Education

- **Garcia-Molina, H. Database system**: The Complete Book / Hector Garcia-Molina.- United States of America: Pearson Prentice Hall

- **Sharma, N. Database Fundamentals**: A book for the community by the community / Neeraj Sharma, Liviu Perniu.- Canada

By the end of this course students will be able to:

- Design a database starting from the first stage to the physical implementation

- Demonstrate the programming skills with SQL (Structured Query Language)

- Work with the database management system (DBMS)

What are your association?

What is a database?

- Database is an organized collection of data, stored and accessed electronically.

Relational database

- **Relational database** is a database based on the relational model of data, as proposed by E.F. Codd in 1970.
- **Relational model** organizes data into one or more tables of columns and rows, with a unique key (or **Primary key**) identifying each row.
- **Tables** are also called relations.
- **Columns** are also called attributes.
- **Rows** are also called records or tuples

Relational database

- generally, each table represents one entity (such as Students).
- the rows represent instances of that type of entity (such as student1, student2, etc.)
- the columns representing values attributed to that instance (such as stud_id, last_name, etc.)

Attribute (column)

Entity (table, relation)

Students

stud_id	last_name	bdate	phone
001	student1	…	…
002	student2	…	…
003	student3	…	…

Tuple (row, record)

Database Design Stages

1. Subject Area Analysis
2. Conceptual Design
3. Logical Design
4. Physical Design

Subject Area Analysis

1.Specify stored information in the future database: "The DB is designed to hold information relating to/ about ..."

2.List entities and attributes. Every entity should have a Primary key.

Example

- The description of a table is the table name and its attributes:

  Students (stud_id, last_name, bdate, phone)

- **Primary key** is an attribute with unique values - underline it.

  Students (<u>stud_id</u>, last_name, bdate, phone)

Subject Area Analysis

3. Relationships between entities
To describe a relationship between two tables answer 2 questions.

First of them is how one row from the first table refers row(s) from the second table, and the **second** question (from the other side) is how one row from the second table refers row(s) from the first table.

1 student   1 group

Students ————————————————→ Groups
        ←————————————————

many students   1 group
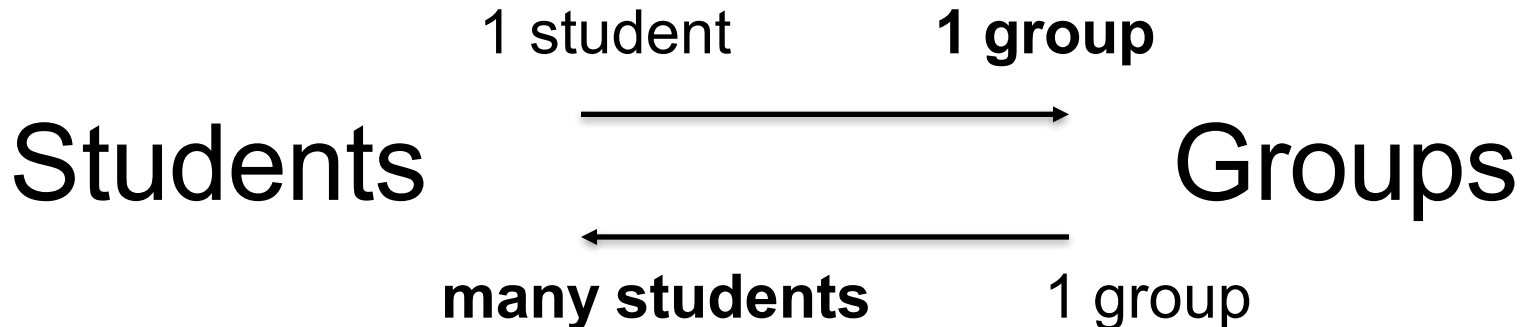
Subject Area Analysis

4. Constraints:
Student's date of birth must be later than 1980.

5.Specify groups of users and their access rights:
"The database is designed for ..."

6.List potential questions from users to the database (queries):

Find student's name by his id.

Database management systems

Database management systems (DBMSs) are specially designed applications that interact with the user, other applications, and the database itself to capture and analyze data.

DBMS is a software system designed to allow the definition, creation, querying, update, and administration of databases.

Simplified database system environment
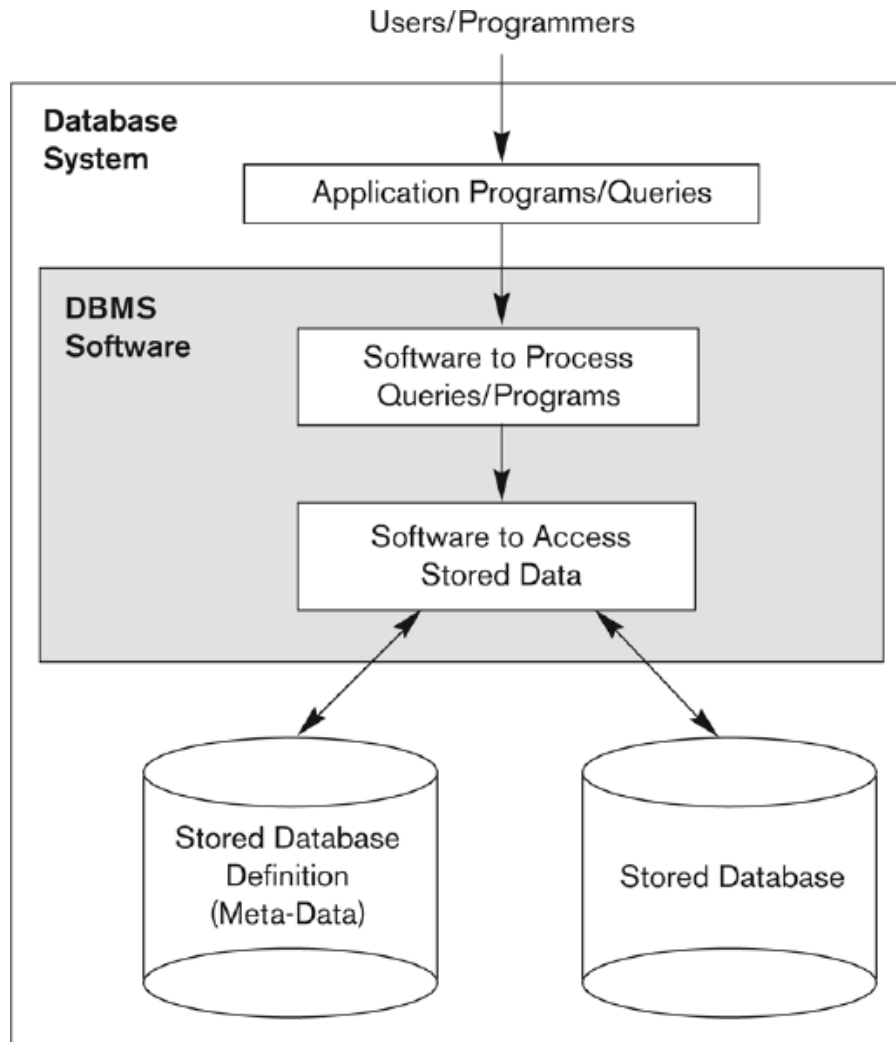
A simplified database system environment.

Database management systems

- **PostgreSQL (www.postgresql.org/download)**
- MS Access
- MS SQL Server
- Oracle
- MySQL
- etc

Why learn about databases?

- Nowadays databases are everywhere, but we never see them. They are hidden behind the tools and services that we use everyday.

- Almost any business has a database.
- It used to be about only boring things: employee records, bank records, etc.
- However databases are behind almost everything you do on the Web. For example, social networks or dl.iitu.kz.

Ideas for a Course work: institutions

bank

airport

hospital

hotel

restaurant

library

advertising agency

publishing house

recruiting agency

kindergarten

KazPost

travel agency

theatre

taxi

HR

ZOO

NASA

realtor

delivery service

language centre

Ideas for a Course work: social networks

vk.ru / fb.com

instagram.com

twitter.com

last.fm (music)

livelib.ru / goodreads.com (books)

blog platform

linkedIn.com

tripadviser.com (travel)

Ideas for a Course work: sport

FIFA World Cup

Olympic games

IT football league

NBA

NHL

FIVB Volleyball System

fitness club

dance club

Ideas for a Course work: sales

on-line store

book store

car sales

ticketon.kz/ kassir.kz

kino.kz

airastana.com

Ideas for a Course work: other databases

imdb.com

music

games

animals

countries

task manager

What's next?

Next week lecture will introduce the conceptual model of a database and how to design the entity-relational diagram.