What is a DBMS:

DBMS - a software package designed to store and manage databases

Three level architechture

Resource for us - Section 6.5 in book - “Database modifications” Making changes to existing tabels, etc.

We will use MySQL as a version. So be sure to specify MySQL whenever you google search.

There is a lecture notes folder in canvas with all the slide and notes from tom for the class.

External Level

Interacts directly with user

Collects data from a format that is familiar to user (Credit card info form)

Conceptual Level

Defines the logical view of the data

Main functions of DBMS are in this level

Internal Level

Determines where and how data are actually stored on the physical storage device.

We are gonna learn about *tuples* today

Databse Languages

* DDL (Data Definition Language)
  + It allows users to define the database.
  + Specify the data type, structure, and constraints on the data to be stored in the database
* DML (Data manipulation Language)
  + Language for accessing and manipulating the data organized by the appropriate data model
    - DML also known as query language
  + Two classes of Languages
    - **Procedural** - User (programmer) specifies what data is required AND how to get that data (java)
    - **Declarative** - User (programmer) specifies what data is required WITHOUT specifying how to get that data. (SQL)
* Two DB Languages will be introduced
  + Relational Algebra (Procedural)
    - Most of this will involve set theory and different things we can do with sets
  + SQL (Structured Query Language) (Declarative)

**DATABASE MODELS**

* A Database Model
  + Defines the logical (conceptual) design of the data
  + Hides low-level storage details (internal level takes care of this)
  + **Describes the relationships between different parts of data**
* 3 Models as Examples
  + Hierarchical Model (tree structure/root structure)
  + Network model (Graph??)
  + Relational model
* Hierarchical Model
  + Data is organized as an upside down tree
  + Each entity has only one parent but can have several children
* Network Model
  + Missed this bit CHECK CANVAS LECTURE NOTES
* Relational Model
  + Data is organized as two-dimensional tables called relations
  + The tables are related to each other
  + The most popular model used to represent data in databases today
  + Usually set up like Attributes/Fields head the columns, and the rows are items like user entries or employee info etc.

Primary Key - The Number that is used to uniquely identify each entry in that table.

Foreign Key - In some other table it’s a primary key.

When should you use hashing in programing? Whenever you can! Always use hash when you can. It's the best practice.

Real world data is not the same as academic data

* Users are differntiated by the way they expect to tinteractwith the system
  + End users - invoke on of the application programs that have been written previously
  + Application programmers - interact with system through DML calls
  + Database Administrator (DBA) - coordinates all the activites of the databasy system; the DBA has a good understanding of the enterprise’s information resources and needs; interact with system thorugh DDL and DML
    - Schema definition
    - Storage structure and access method defnintion
    - Schema and physical organization modification
    - Granting user authority to access the database
    - Specifying integrity constraints
    - Monitoring permance and responding to changes in infrastructure

Database Architechture

A centralized Computer System

Run on a single computer system and do not interact with other devices

Client-server systesm

Server systems satisfy reuqests generated at m client ssytems.

* Database funcitonality can be divided into
  + Back End
    - Manages access structues, query evaluation and optimization, conccurrenty contorl and recovery
  + Front end
    - Cnosists of tools such as forms, report-writers, and GUI facilities
* The interface between front end and the back end is thorugh SQL or through an application program interface (API).

Distributed Systems

* Data spread over multiple machines (also referred to as sites or nodes).
* Network interconnects the machines
* Data shared by users on multiple machines

History of SQL

Check out slide on canvas

Relational Databses

* Most command data model in modern
* Many commercial systesm
  + Oracle, MS SQL Server, IBM DB2, more…
* Also open source
  + MySQL, PostgreSQL, more…

Basic Structure

* Formally given sets A1, A2, …. AN a relation r is a subset of A1 \* A2 \* … \* An
  + Thus a relation is a set of n-tuples (a1, a2, ….. aN) where each ai is an element of Ai