CMPSC 431W
Database Management Systems

Conceptual Database Design

ER Model

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Review

- Database – Collection of data to support applications.
- Relational Model – Common data model used by DBMS
- Relational Algebra/Calculus – Formal query languages
- SQL – Concrete Way (DSL) to talk with DBMS

- Given an application, how do we design the database to support it?

Motivation

- How to figure out this **database design**?
  - Customer = {customerID, firstName, lastName, income, birthDate}
  - Account = {accNumber, type, balance, branchNumber$^{\text{FK-Branch}}$}
  - Owns = {customerID$^{\text{FK-Customer}}$, accNumber$^{\text{FK-Account}}$}
  - Transaction = {transNumber, accNumber$^{\text{FK-Account}}$, amount}
  - Employee = {ssn, firstName, lastName, salary, branchNumber$^{\text{FK-Branch}}$}
  - Branch = {branchNumber, branchName, managerSSN$^{\text{FK-Employee}}$, budget}
- What **tables** to create?
- Which **attributes** should be added to each table?
- What are the **relationships** between tables?
- What **constraints** that tables have to follow?

Database Design

- Why do we need it? Why we need a good one?
  - Agree on **structure of the database** before deciding on a particular implementation.
  - Databases may be in operation for years. Updating structures of the data (schema) in production is **very expensive**.
- Consider issues such as:
  - What entities to model
  - How entities are related
  - What constraints exist in the domain
- Several formalisms exist: **ER diagrams**, UML, etc.

Database Design Process

1. Requirement Analysis
2. Conceptual Database Design  **This is where E/R Model fits in**
3. Logical Database Design
4. Schema Refinement
5. Physical Database Design
6. Application and Security Design

Requirement Analysis

- What data is going to be store?
- What are we going to do with the data?
- Who should access the data?

- Involves both technical and non-technical people.
- Usually very sloppy.
- Gap in understanding: **super tricky**

Conceptual Database Design

- Design a **high-level description** of the database.
- Sufficiently **precise** that technical people can understand it
- But, *not so precise that non-technical people can't participate*

- Should enable a **straightforward translation** into a data model supported by DBMS (e.g., relational model).
- E/R Model fits in here.