Functional Dependencies

Designing Schemas

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Learning Objectives

By the end of this video, you will be able to:

- Define what functional dependency means.
- Give examples of functional dependencies.

Functional Dependencies

- A form of constraint, and therefore part of a schema.

- A key factor for determining and organizing good schemas.

About Major and Birthday

- How many majors do you have?
  - None, one, or multiple
  - **id ⟶ major?**

- How many birthdays do you have?
  - One
  - **id ⟶ birthday?**

id	name	major	birthday
1	Bugs Bunny	CS	2004-11-06
1	Bugs Bunny	Music	2004-11-06
2	Donald Duck	Bio	1997-02-01
3	Peter Pan	Econ	1998-10-01
3	Peter Pan	Social	1998-10-01
3	Peter Pan	ME	1998-10-01
4	Mickey Mouse	CS	1995-04-01

Example Students table

Functional Dependency (FD)

- Notation: $A_1, \ldots, A_m \longrightarrow B_1, \ldots, B_n$

- We say: $A_1, \ldots, A_m$ **functionally determines** $B_1, \ldots, B_n$.

- Meaning:
  - If any tuples agree on $A_1, \ldots, A_m$ values, then they must also agree on $B_1, \ldots, B_n$.
  - I.e., the mapping from $A_1, \ldots, A_m$ to $B_1, \ldots, B_n$ is **functional** (many-one).

- Whether FDs hold is your **knowledge/assumption** of the domain.
  - id $\longrightarrow$ birthday
  - id, course $\longrightarrow$ grade

A " Functionally Determines" B

- Given a value of A, there exists at most one value of B-- no ambiguity.

- It does not mean: B can be computed from A by a formula.
  - For id → birthday, you cannot compute birthday from id.

- It does not mean: B can be easily found by A.
  - For id → birthday, you may not be able to identify the birthday if it is not disclosed to you.

FD: Your Domain Knowledge/Assumption

- Understand the domain and make assumptions accordingly.

- id $\longrightarrow$ major
  - Possibly true, if a student can have only one major
- id, course $\longrightarrow$ grade
  - Possibly false, if a student can take a course multiple times