Normal Forms

Designing Schemas

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Learning Objectives

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

- Describe what normal forms mean.

- Explain why the concept of normal forms is useful for designing schemas.

Recall the Problematic Schema

- Why is it bad?
- A student's name and birthday are repeated for each major.
- So? We should not store name and birthday with major.

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

A Better Design

Students

id	name	birthday
1	Bugs Bunny	2004-11-06
2	Donald Duck	1997-02-01
3	Peter Pan	1998-10-01
4	Mickey Mouse	1995-04-01

Majors

id	major
1	CS
1	Music
2	Bio
3	Econ
3	Social
3	ME
4	CS

Example Students and Majors tables

- Redundancy?
- Update anomaly?
- Delete anomaly?

Schema Refinement: Desired Properties

- Minimize redundancy.
- Avoid info loss.
- Preserve dependency.
- Ensure good query performance.

First Normal Form

- From the very beginning, when relational model was defined

- **First Normal Form (1NF)**: Each attribute contains only single atomic values.

- As proposed by E. F. Codd:

    E. F. Codd (1970). A Relational Model of Data for Large Shared Data Banks. *Communications of the ACM, 13*(6): 377-387

```
employee (man#, name, birthdate, jobhistory, children)
jobhistory (jobdate, title, salaryhistory)
salaryhistory (salarydate, salary)
children (childname, birthyear)
```

FIG. 3(a).   Unnormalized set

```
employee' (man#, name, birthdate)
jobhistory' (man#, jobdate, title)
salaryhistory' (man#, jobdate, salarydate, salary)
children' (man#, childname, birthyear)
```

FIG. 3(b).   Normalized set

Examples used in Codd's paper on relational model

Normal Forms

- **First Normal Form (1NF)**: Each attribute contains only single atomic values.

- Many normal forms were proposed, as more desired properties were discovered.
  - 2NF, 3NF, BCNF, 4NF, …

- We will study BCNF – Boyce Codd Normal Forms (and 3NF, 4NF).