Introduction to the Relational Model

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Based on Jennifer Widom slides

Agenda

The Relational Model

Relations

Tuples

Keys

The Relational Model

Proposed in 1969 by Edgar F. Codd

The most used model for databases

Very simple model

Query with high-level languages: simple yet expressive

Efficient implementations

Relations

Database = set of named relations (or tables)

Each relation has a set of named attributes (or columns)

The number of attributes is the arity of the relation

Student

ID	name	GPA	photo

College

name	state	enroll

Tuples

Each tuple (or row) has a value for each attribute

- No specific order between them

The number of tuples is the cardinality of the relation

Each attribute has a type (or domain)

- Set of possible values. Examples: integer, text

Student

ID	name	GPA	photo
123	Amy	3.9	☺
234	Bob	3.4	☹
	. .		

College

name	state	enroll
Stanford	CA	15,000
Berkeley	CA	36,000
MIT	MA	10,000
	. .	

Schema vs. Instance

Schema

- structural description of relations in database
- name, attributes and types of those attributes
- typically set up in advance

Instance

- actual contents at given point in time
- change over time

NULL value

Special value for “unknown” or “undefined”

Useful but one has to be careful when querying relations with NULL values

GPA>3.5; GPA<=3.5; GPA>3.5 OR GPA<=3.5

Student

ID	name	GPA	photo
123	Amy	3.9	☺
234	Bob	3.4	NULL
345	Craig	NULL	☺
	. .		

Key

Set of one or more attributes whose combined values are unique within a relation

Often denoted by underlying the set of key attributes

Importance

Identify specific tuples, efficiency, refer to tuples of another relation

Student

ID	**name**	**GPA**	**photo**
123	Amy	3.9	☺
234	Bob	3.4	☹
	. .		

Classroom

building	**number**	**capacity**
B	001	184
B	002	184
I	001	50
	. .	

Foreign Key

An attribute (or set of attributes) that always matches a key attribute in another relation

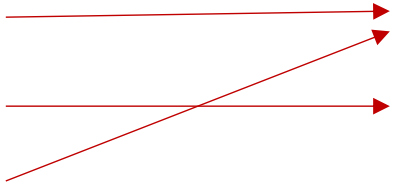
Often denoted by an arrow pointing to the name of the relation being referenced (see the Notation slide)

Student

ID	name	GPA	country
123	Amy	3.9	12
234	Bob	3.4	23
567	Louise	NULL	12
	. .		

Primary key

Foreign key



Country

ID	name
12	Germany
23	England
	. .

Primary key

Relational Notation

Student (ID, name, GPA, country->Country)

Classroom (building, number, capacity)

Country (ID, name)

In foreign keys, the name of the attribute can be different from the referenced attribute/relation

Country

ID	name
12	Germany
23	England
	. .

Student

ID	name	GPA	country
123	Amy	3.9	12
234	Bob	3.4	23
	. .		

Classroom

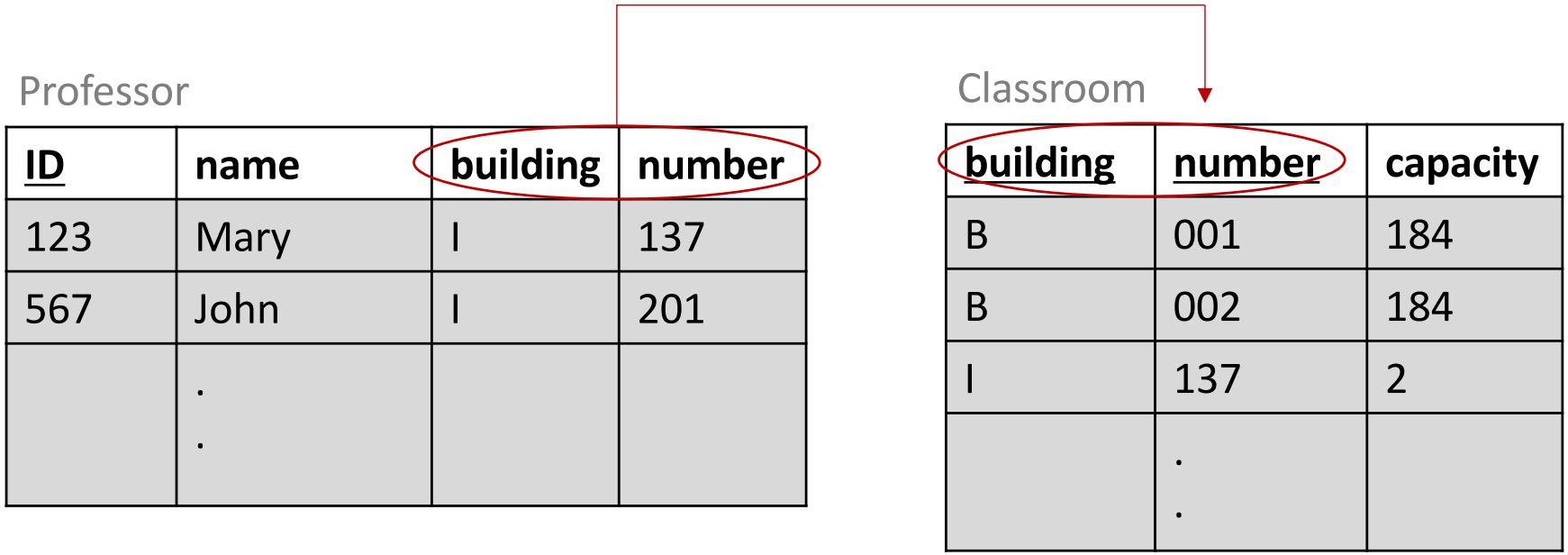
building	number	capacity
B	001	184
B	002	184
I	001	50
	. .	

Composite Keys

A composite key is a multi-column primary-key or foreign-key

Classroom (building, number, capacity)

Professor (ID, name, building->Classroom.building, number->Classroom.number)



Professor

ID	name	building	number
123	Mary	I	137
567	John	I	201
	. .		

Classroom

building	number	capacity
B	001	184
B	002	184
I	137	2
	. .	

Readings

Jeffrey Ullman, Jennifer Widom, A first course in Database Systems 3rd Edition

Section 2.1 – Basics of the Relational Model