

Introduction to the Relational Model

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Based on Jennifer Widom slides

Agenda

The Relational Model

Relations, Attributes and Tuples

Properties of Attributes and Tuples

Primary and Foreign Keys

Relational Model Notation

Composite 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, Attributes and Tuples

Database = set of named **relations** (or **tables**)

Student **relation** (table)

id	name	gpa	country

Relations, Attributes and Tuples

Database = set of named relations (or tables)

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

Student relation (table)

id	name	gpa	country



attributes (columns)

Relations, Attributes and Tuples

Database = set of named relations (or tables)

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

Each relation has a set of **tuples** (or **rows**)

Student relation (table)

id	name	gpa	country

attributes (columns)

tuples (rows)

Relations, Attributes and Tuples

Database = set of named **relations** (or **tables**)

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

Each relation has a set of **tuples** (or **rows**)

Student **relation** (table)

id	name	gpa	country

attributes (columns)

tuples (rows)

Properties of Attributes and Tuples

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

No specific order between them

Each **attribute** (or **column**) has a type

A set of possible values. Examples: integer, text, etc

Student

id	name	gpa	country
123	Amy	3.9	
234	Bob	3.4	
	.		
	.		

College

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

The 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	country
123	Amy	3.9	
234	Bob	3.4	NULL
345	Craig	NULL	
	.		
	.		

Primary Key

Minimum set of attributes that uniquely identify a tuple within a relation

Denoted by underlining the set of attributes

Student

<u>id</u>	<u>name</u>	<u>gpa</u>	<u>country</u>
123	Amy	3.9	
234	Bob	3.4	
	.		
	.		

Classroom

<u>building</u>	<u>number</u>	<u>capacity</u>
B	001	184
B	002	184
I	001	50
	.	
	.	

Primary Key

Minimum set of attributes that uniquely identify a tuple within a relation

Denoted by underlining the set of attributes

Student

<u>id</u>	name	gpa	country
123	Amy	3.9	
234	Bob	3.4	
	.		
	.		

↓
Primary key

Classroom

<u>building</u>	<u>number</u>	capacity
B	001	184
B	002	184
I	001	50
	.	
	.	

↓ ↓
Primary key

Foreign Key

An attribute (or set of attributes) that serves to establish a connection to another relation

A foreign key always points to the primary key of another relation

Student

<u>id</u>	name	gpa	country
123	Amy	3.9	12
234	Bob	3.4	23
567	Louise	NULL	12
	.		
	.		

↓
Primary key

Country

<u>id</u>	name
12	Germany
23	England
	.
	.

↓
Primary key

Foreign Key

An attribute (or set of attributes) that serves to establish a connection to another relation

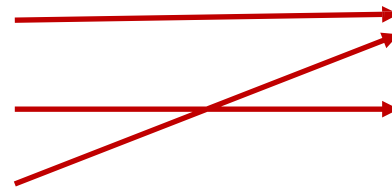
A foreign key always points to the primary key of another relation

Student

<u>id</u>	name	gpa	country
123	Amy	3.9	12
234	Bob	3.4	23
567	Louise	NULL	12
	.		
	.		

↓
Primary key

↓
Foreign key



Country

<u>id</u>	name
12	Germany
23	England
	.
	.

↓
Primary key

Relational Model Notation

Student

<u>id</u>	name	gpa	country
123	Amy	3.9	12
234	Bob	3.4	23
567	Louise	NULL	12
	.		
	.		

↓
Primary key

↓
Foreign key

Country

<u>id</u>	name
12	Germany
23	England
	.
	.

↓
Primary key

Relational Model Notation

Student (id, name, gpa, country->Country)

Country (id, name)

Student

<u>id</u>	name	gpa	country
123	Amy	3.9	12
234	Bob	3.4	23
567	Louise	NULL	12
	.		
	.		

↓
Primary key

↓
Foreign key

Country

<u>id</u>	name
12	Germany
23	England
	.
	.

↓
Primary key

Composite Keys

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

Classroom (building, number, capacity)

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

Professor

<u>id</u>	name	building	number
123	Mary	I	137
567	John	I	201
	.		
	.		

Classroom

<u>building</u>	<u>number</u>	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