DATABASE METHODOLOGY

Stockholm University

Relational Database Theory

The Relational Model
Part 1 - Basics

The Relational Model - Basics

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- In this module you will learn some basics and background about the Relational Model:
  - What is the Relational Model?
  - Origins and background
  - Implementing the Relational Model
  - Why relational databases?

What Is The Relational Model?

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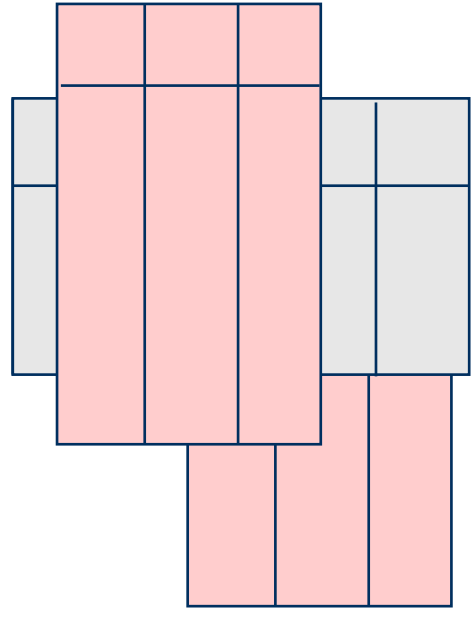
- A *meta (high-level)* model for how to structure data in a database
- That is, a *data model*
  - Not to be confused with lower level models created to describe some user domain
- The foundation of relational databases (RDB:s)



Origins And Background

- Introduced in 1970
- Based on:
  - *Predicate logic*, where statements of fact are expressed
  - *Set theory*, in order to manipulate sets of facts
- Well-defined components:
  - Logical data structure
  - Integrity rules
  - Data manipulation

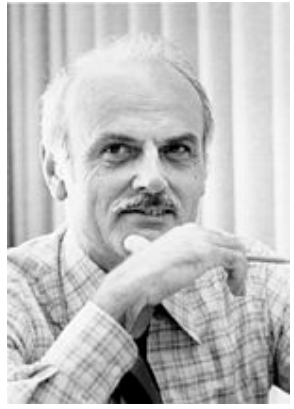
A Relational Model of Data for Large Shared Data Banks

E. F. Codd
IBM Research Laboratory, San Jose, California

Future users of large data banks must be protected from having to know how the data is organized in the machine (the internal representation). A prompting service which supplies such information is not a satisfactory solution. Activities of users at terminals and most application programs should remain unaffected when the internal representation of data is changed and even when some aspects of the external representation are changed. Changes in data representation will often be needed as a result of changes in query, update, and report traffic and natural growth in the types of stored information.

Existing noninferential, formatted data systems provide users with tree-structured files or slightly more general network models of the data. In Section 1, inadequacies of these models are discussed. A model based on *n*-ary relations, a normal form for data base relations, and the concept of a universal data sublanguage are introduced. In Section 2, certain operations on relations (other than logical inference) are discussed and applied to the problems of redundancy and consistency in the user's model.

KEY WORDS AND PHRASES: data bank, data base, data structure, data organization, hierarchies of data, networks of data, relations, derivability, redundancy, consistency, composition, join, retrieval language, predicate calculus, security, data integrity
CR CATEGORIES: 3.70, 3.73, 3.75, 4.20, 4.22, 4.29



Edgar F. ”Ted” Codd
The inventor of the Relational Model

The abstract from Codd’s defining seminal paper in:
”Communications of the ACM”, Volume 13, Number 6, June 1970

Implementing The Relational Model

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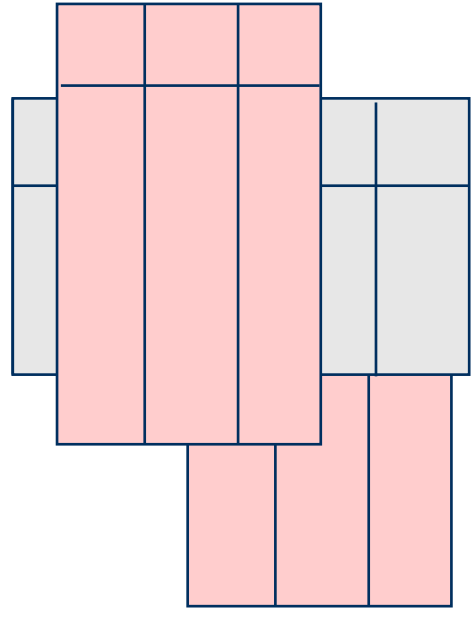
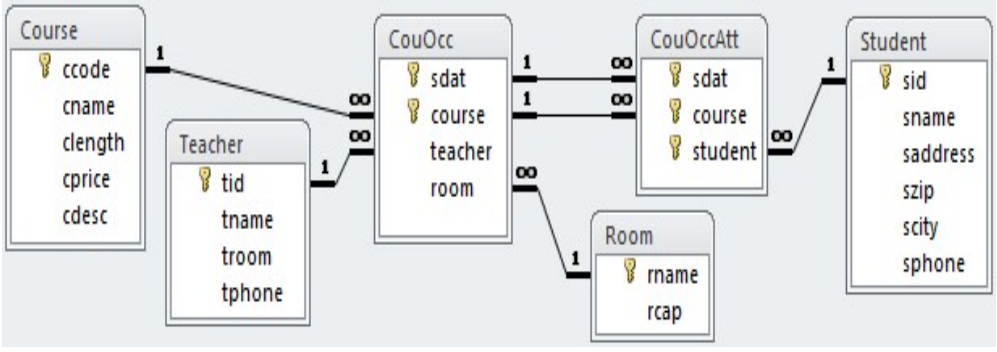
- **Databases complying with the model are implemented using tables**

A relational **database** is a database that users *perceive* as a **collection of connected tables**, **independently** of how the information is stored **physically**.
[*Physical data independence*]



Why Relational Databases?

- In the Relational Model of data, data is visualized as being stored in tables logically connected to each other.
  - Very easy for us to understand!
- Relational databases have become the most used way of storing data.



A relational database ”relationship” window can efficiently visualize how the data in some part of the reality has been organized in tables for easy storage and retrieval.

Course

ccode	cname	clength	cprice	cdesc
Java1	Java 101	5	6700,00	Basic java programming.
Java2	Advanced Java	4	5999,99	Advanced java programming.
DBM1	DB Methodology 101	2	2800,00	DB basics, relational modeling, SQL.
LDBD	Logical DB Design	4	6000,00	Advanced design, patterns, meta modeling.
FDBD	Physical DB Design	5	7200,75	Storage structures, indexing, optimization.
Log1	Logic 101	3	4500,00	First-order logic, predicate logic.

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sdat	course	teacher	room
2008-03-06	Java1	2	Tellus
2008-04-02	DBM1	5	Sirius
2008-04-16	Java2	2	Orion
2008-04-16	Log1	3	Jupiter
2008-05-06	LDBD	5	Sirius
2008-05-06	Java1	2	Jupiter
2008-05-09	FDBD	4	Jupiter
2008-09-02	Java1	3	Tellus
2008-09-02	LDBD	4	Orion
2009-01-22	Java2	2	Orion
2009-01-28	DBM1	5	Jupiter

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sdat	course	student
2008-03-06	Java1	1
2008-04-02	DBM1	1
2008-04-16	Java2	7
2008-04-16	Log1	4
2008-05-06	LDBD	7
2008-05-06	Java1	2
2008-05-09	FDBD	8
2008-09-02	Java1	1
2008-09-02	LDBD	8
2009-01-22	Java2	2
2009-01-28	DBM1	3
2008-03-06	Java1	9
2008-04-02	DBM1	2
2008-04-16	Java2	5
2008-04-16	Log1	5
2008-05-06	LDBD	1
2008-05-06	Java1	6
2008-05-09	FDBD	6
2008-09-02	Java1	9
2008-09-02	LDBD	6
2009-01-22	Java2	9
2009-01-28	DBM1	5
2008-03-06	Java1	8
2008-04-02	DBM1	10
2008-04-16	Java2	6
2008-03-06	Java1	10
2008-04-02	DBM1	3
2008-03-06	Java1	3
2009-01-22	Java2	10

Room

rname	rcap
Jupiter	12
Orion	24
Sirius	16
Tellus	32

Teacher

tid	tname	troom	tphone
1	Anders Ödman	634	151576
2	Bo Åkerman	604	151526
3	Carl Nordin	603	151553
4	Lena Svensson	605	151556
5	Sofia Wilsson	622	151585

Student

sid	sname	saddress	szip	scity	sphone
1	Bo Dahl	Ahlgatan 6	16102	Bromma	163578
2	Ann Stål	Lindvägen 3	16429	Kista	373789
3	Ebba Ryd	Ankvägen 4	16107	Bromma	325305
4	Robert Ahl	Ekvägen 1	16425	Kista	123435
5	Lars Holm	Skolgatan 3	16966	Solna	203045
6	Siw Björk	Bokvägen 2	16431	Kista	452678
7	Sigge Ehn	Bokvägen 24	16429	Kista	245578
8	Kurt Grahn	Byvägen 112	19735	Bro	192292
9	Eva Jung	Storgatan 5	16966	Solna	131187
10	Lola Frid	Lillgatan 3	18754	Täby	723384

Example contents

Medverkande

Anders Thelemyr – Lärare

Lars In de Betou – Mediepedagog

Inspelat 2015-08-31

Institutionen för data- och systemvetenskap, DSV

Stockholms universitet