

- Logical data requirements / functional requirements
- Conceptual Model (ER Model)
- Implementation Model (Relational Data Model)
- Physical Model (SQL)

Relational Data Model

- Tables = Relations
- Rows = n-tuples
- Columns = Attributes

4 main components of the Relational Model

- Relations
- Attributes
- Tuples
- Domains

Header e.g. Home_phone, Cell_phone (role names)

Domain (D) - set of possible values for an attribute A. This can include NULL values.

dom(Home_phone)

Logical Definition of a Domain
Usa_phone_numbers - set of ten-digit phone numbers valid in the United States.

Data Type (Format) - primitive types (int, float, boolean, char)
i.e. Usa_phone_numbers - charater string that looks like (ddd)-(ddd)-(dddd).

Employee_ages = possible ages of employees between 15 and 80 (exclusive).

Data Type = integer

Format (implied by the data type) may specify ages have to be two digit integers*

3 parts of a domain

- Logical definition (name)
- Data Type
- Format

Relation state

r(R)

R - relation name

r - ordered set of tuples

$r = \{t1, t2, ..., tm\}$

$t = \{v1, v2, ..., vn\}$

$r(R)$ - subset of $\text{dom}(A1) \times \text{dom}(A2), ..., \times \text{dom}(An)$.

cardinality of a domain D
denoted $|D|$ - total number of possible values (assume Domain D is finite).

Departments = {"CSCI", "BUS", "JOUR"}
(cardinality = 3)

$R = \{A1, A2, ..., An\}$

Total number of possible Tuples for a given relation state r(R)

$|\text{dom}(A1)| \times |\text{dom}(A2)| \times ... \times |\text{dom}(An)|$

Relations

Relation schema $R(A1, A2, ..., An)$

R - relation name.

$A1, A2, ..., An$ - ordered list of attributes.

Ai - ith attribute of a relation schema $R(A1, A2, ..., An)$.

D - domain of Ai donoted ($D(Ai)$)

Degree (arity) of a relation - the number of attributes in the ordered list $A1, A2, ..., An$ i.e. n.

Anatomy of a Relation schema.

Relation name

STUDENT(Name, Ssn, Home_phone, Address, Office_phone, Age, Gpa)

What's the first attribute of the relation schema?
Name*

What's the degree of the STUDENT relation?
7*

STUDENT(Name: string, Ssn: string, Home_phone: string, Address: string, Office_phone: string, Age: integer, Gpa: float)

dom(Home_phone) = Usa_phone_numbers.

Logical definition
data type
format

Relation state - set of n-tuples.

- r(R)
- $r = \langle t1, t2, ..., tm \rangle$
- $t? t = \langle v1, v2, ..., vn \rangle$

Where does v1 have to be?

- Has to be in the $\text{dom}(A1)^*$

Relation Name		Attributes						
STUDENT		Name	Ssn	Home_phone	Address	Office_phone	Age	Gpa
Tuples		Benjamin Bayer	305-61-2435	(817)373-1616	2918 Bluebonnet Lane	NULL	19	3.21
		Chung-cha Kim	381-62-1245	(817)375-4409	125 Kirby Road	NULL	18	2.89
		Dick Davidson	422-11-2320	NULL	3452 Elgin Road	(817)749-1253	25	3.53
		Rohan Panchal	489-22-1100	(817)376-9821	265 Lark Lane	(817)749-6492	28	3.93
		Barbara Benson	533-69-1238	(817)839-8461	7384 Fontana Lane	NULL	19	3.25

Figure 5.1

The attributes and tuples of a relation STUDENT.

Common terminology

- Intension - Relation schema R
- Extension - Relation state r(R)