Database Management Systems

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Lecture Session-4

Relational Data Model & Relational Constraints

Content

1. What is Relational model
2. Characteristics
3. Relational constrains
4. Representation of schemas

Relational Model

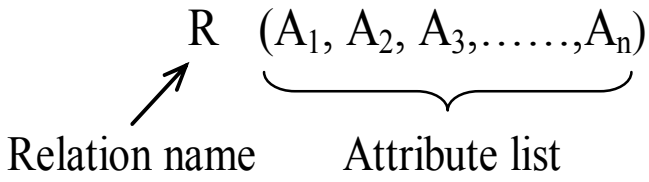
Edgar Codd proposed Relational Data Model in 1970.
It is a *representational* or *implementation* data model.

Using this representational (or implementation) model we represent a database as *collection of relations*.

The notion of *relation* here is different from the notion of *relationship* used in ER modeling.

Relation is the main construct for representing data in relational model.
Every relation consists of a relation schema and Relation instance.

Relation Schema is denoted by



The number of columns in a relation is known as its *degree* or *arity*'.

Relation instance or Relation State (r) of R (thought of as a table)
Each *row* in the table represents a collection of related data.
Each row contains facts about some entity of some entity-set.

$R = (A_1, A_2, A_3, \ldots\ldots, A_n)$
r(R) is a set of *n* tuples in R
$r = \{t_1, t_2, t_3, \ldots\ldots, t_n\}$

r is an instance of R each *t* is a tuple and is a ordered list of values.

$t = (v_1, v_2, \ldots, v_n)$ where v_i is an element of domain of A_i

Entities of each type/set are stored as rows in a single relation.

Hence in general, a *relation* corresponds to a single entity type in ER.

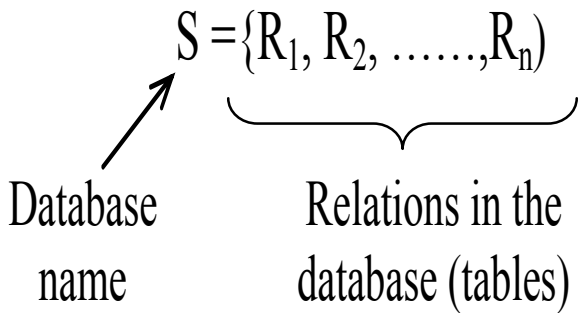
In some cases a relationship between two entities can have some specific attributes which can be captured in a relation (table).

A row is called a *tuple*.
The columns of the table represent attributes of that entity-set.

The column header is known as *attribute* or *field*.
Data type or format of an attribute: is the format of data for that attribute. Ex. Character strings, numeric, alphanumeric etc.

Values that can appear in a column for any row is called the *domain* of that attribute.

Relational Database Schema is denoted by

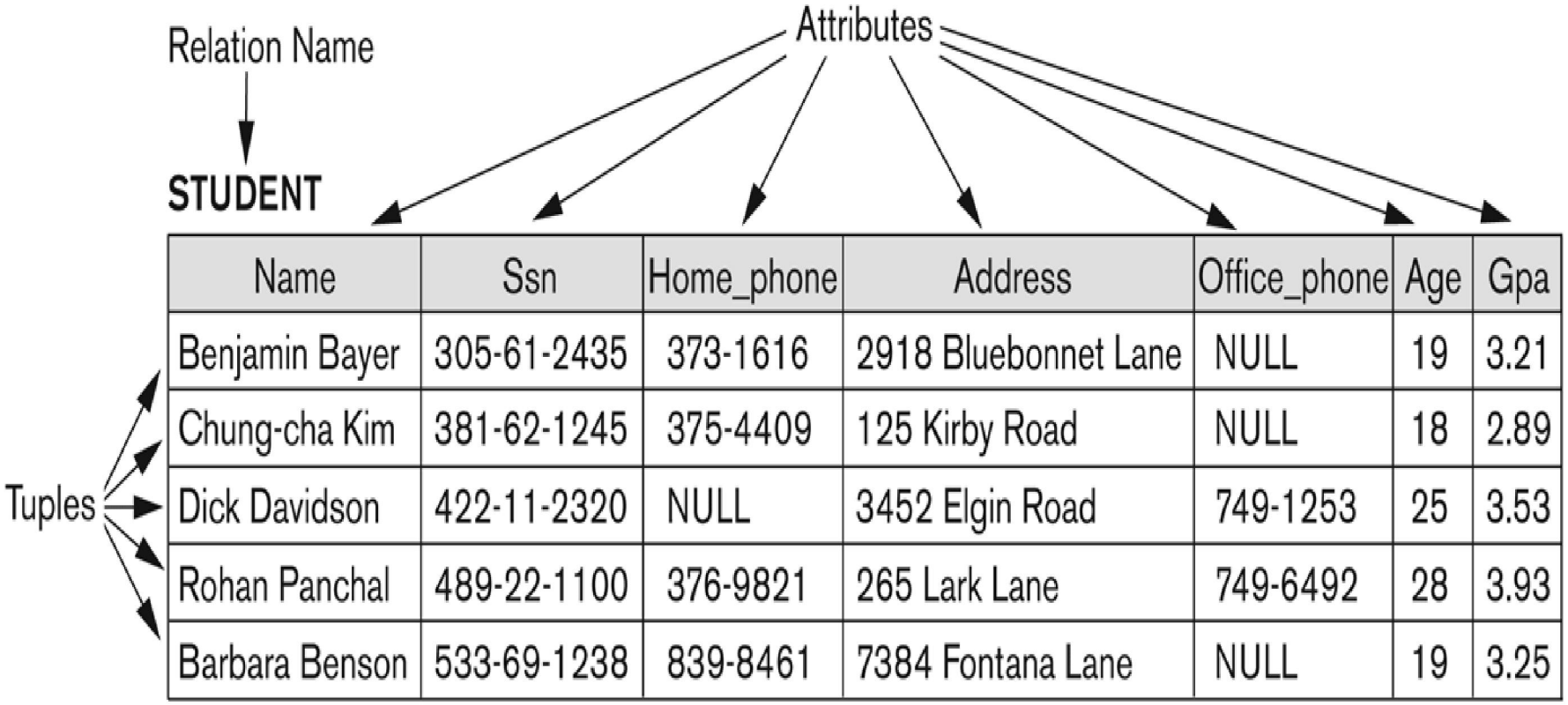


Attribute *A* of relation *R* is accessed by notation- *R.A.*

Ex: *Student (name, age, branch).* Here *Student* is the relation name.
Student.age - denotes *age* attribute of *Student* relation.

Characteristics of a Relation:

- Ordering of tuples is not significant.
- Ordering of values in a tuple is important.
- Values in a tuple under each column must be atomic (simple & single).



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

Figure 5.1
The attributes and tuples of a relation STUDENT.

Relational Model Terminology

Informal Terms		Formal Terms
Table		Relation
Column Header		Attribute
All possible Column Values		Domain
Row		Tuple
Table Definition		Schema of a Relation
Populated Table		State of the Relation

Relational Constraints

Constraints are restrictions on data of a relation.

- *Domain level Constrains* – Format of data Ex. Character numeric etc.

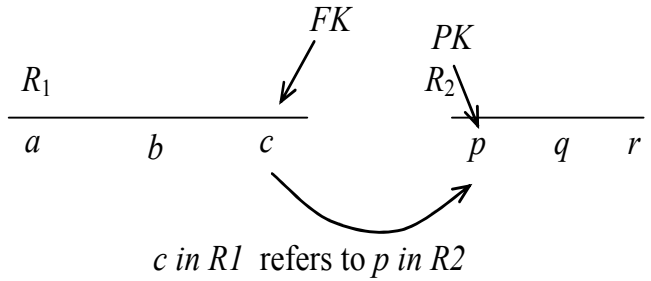
  Semantic – Not NULL etc.
- *Entity integrity constraints* – Primary key, unique key
- *Referential integrity* constraints– Foreign key
- *Dependencies* –

  Functional dependency : What attributes value defines the value of another attribute is known as dependency.

This concept is used in database design.

Referential integrity

The Referential Integrity constraint is specified between two relations and is used to maintain consistency among the tuples of two relations.



The FK attribute R_1 has the same domain as the primary key attribute of R_2.

The attribute *c* in R_1 is said to reference the attribute *p* in R_2.

The value of FK in a tuple *t* of R_1 either occurs as a value under *p* in R_2 for some tuple, or is a NULL.

$R_1 \rightarrow$ is known as referencing relation
$R_2 \rightarrow$is known as referenced relation

Constraints can be specified while defining the structure & also as triggers.

Relational Schema Representation

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary	Super_ssn	Dno

DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

DEPT_LOCATIONS

Dnumber	Dlocation

PROJECT

Pname	Pnumber	Plocation	Dnum

WORKS_ON

Essn	Pno	Hours

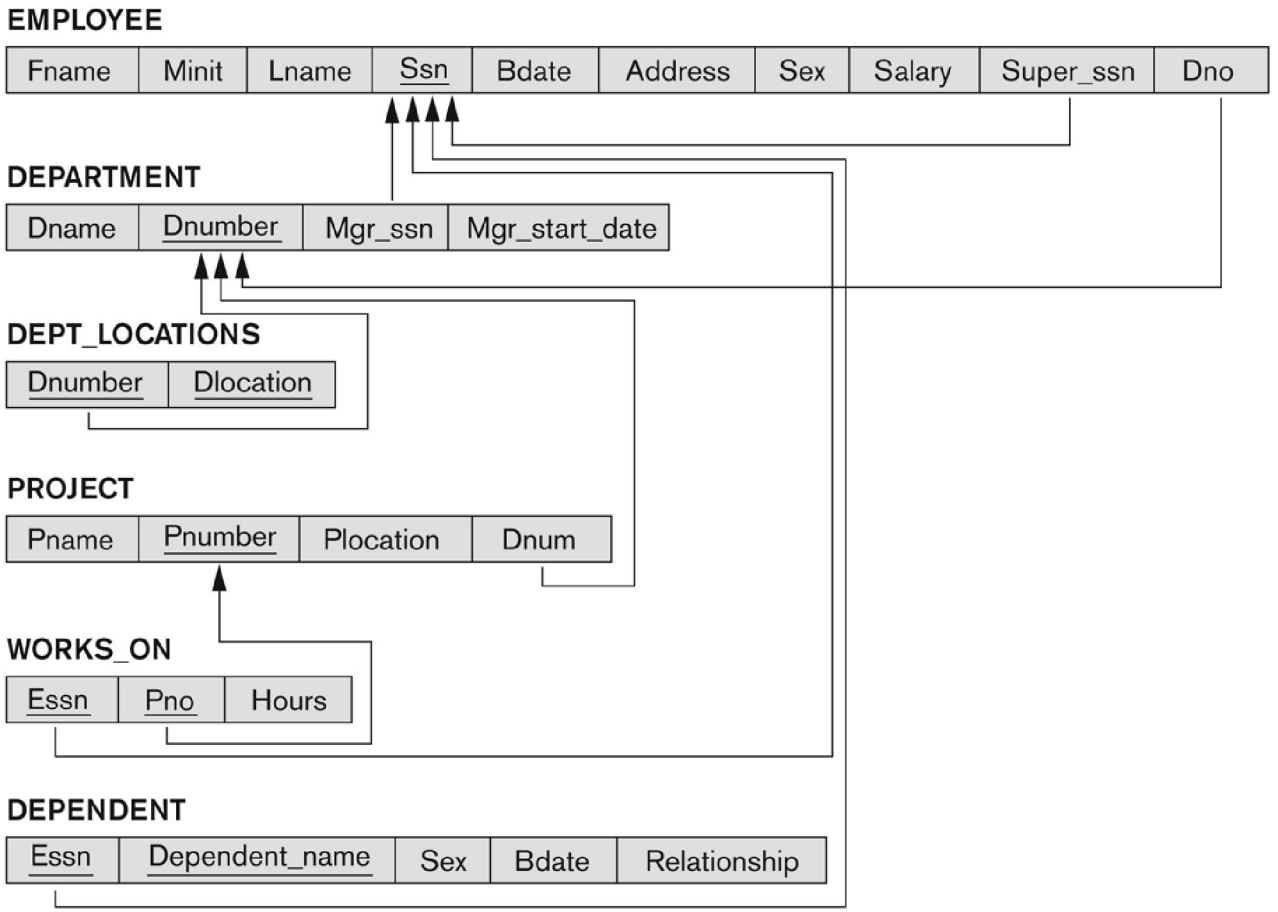
DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

Figure 5.5
Schema diagram for the COMPANY relational database schema.

Relational Schema Representation

Figure 5.7
Referential integrity constraints displayed on the COMPANY relational database schema.

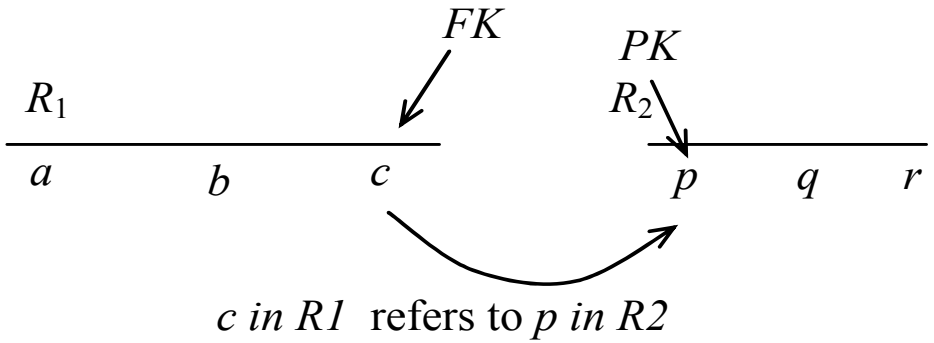


Operations on Relations and constraints

The following table indicates the constraints need to be taken care while performing certain operations on a relation.

Operation on relations	Constraints need to be taken care
Insert	Null, Not Null, PK, unique, FK, format, Domain
Delete	FK
Update	Null, Not Null, PK, unique, FK, domain, and Semantic

Actions need to be taken when FK is set , on operations like update, insert, and delete.



If insert a tuple in R1 where the value for *c* is not in *p* of R2, then don't allow.

What if a tuple in R2 is deleted: Cascade, don't allow, set to default, set to null.

What if update on R2's p happens:
Cascade, don't allow, set to default, set to null.

Summary

- ✓ *What are basics of relational model*
- ✓ *Relation instance*
- ✓ *Relational data constraints*
- ✓ *Referential integrity*
- ✓ *Relational scheme representation*