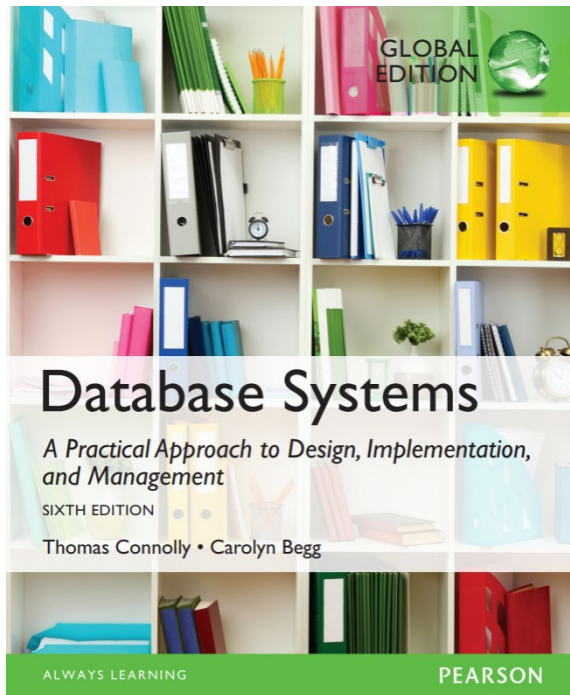


Database Design and Development

Unit 4



Lecture 2

The Relational Data Model

Objectives

- Terminology of relational model
- How tables are used to represent data
- Properties of database relations
- How to identify candidate, primary and foreign keys
- Meaning of entity integrity and referential integrity
- Purposes and advantages of Views

TERMINOLOGIES

Relational Model Terminologies

- A relation is a table with columns and rows
- Attribute is a named column of a relation
- Domain is the set of allowable values for one or more attributes
- Tuple is a row of a relation
- Cardinality of a relation is the number of tuples in a relation
- Relational Database is collection of normalized relations with distinct relation names

Relational Model Terminologies

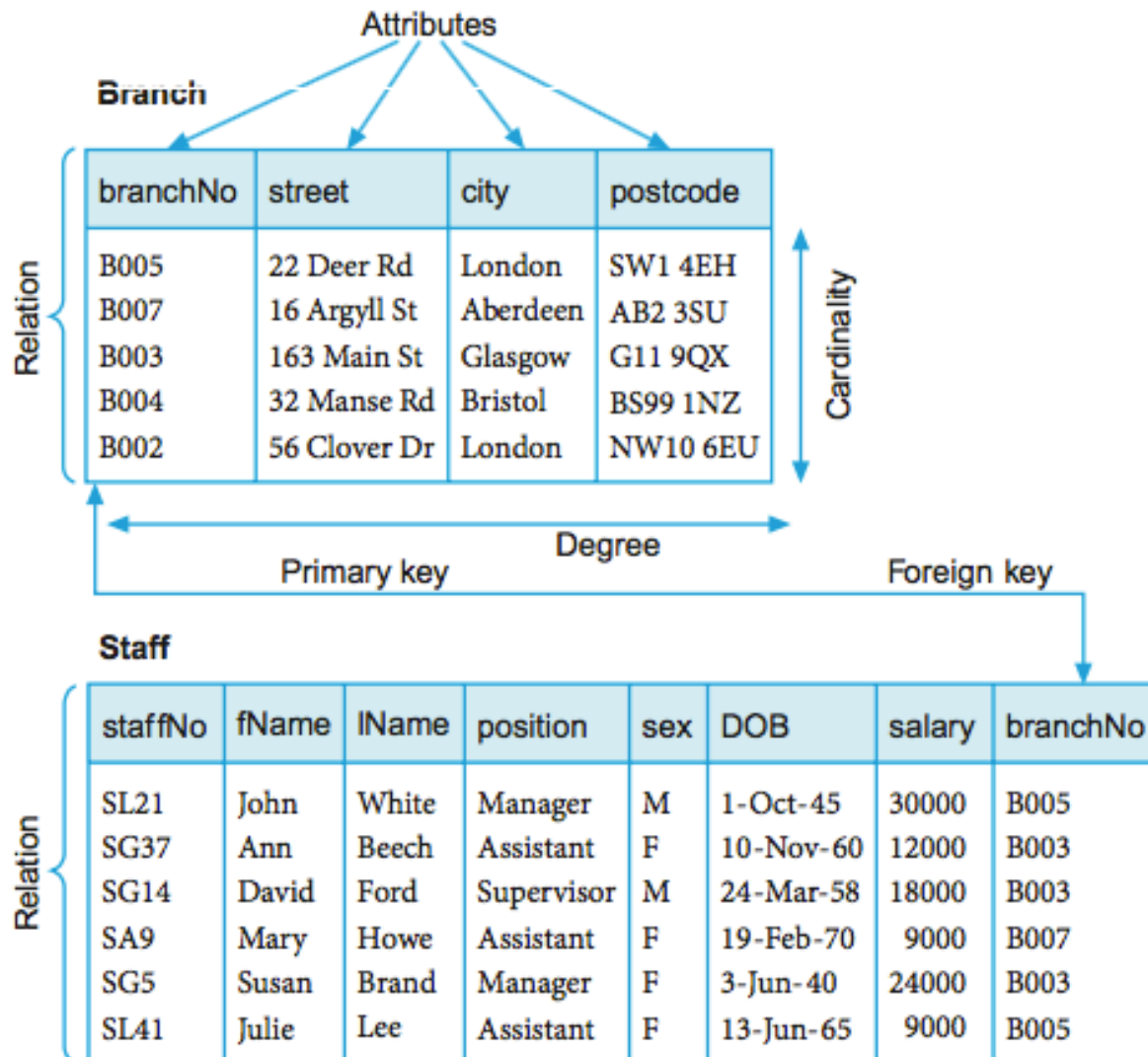


Figure 4.1
Instances of the
Branch and Staff
relations.

Relational Model Terminologies

Figure 4.2

Domains for some attributes of the Branch and Staff relations.

Attribute	Domain Name	Meaning	Domain Definition
branchNo	BranchNumbers	The set of all possible branch numbers	character: size 4, range B001–B999
street	StreetNames	The set of all street names in Britain	character: size 25
city	CityNames	The set of all city names in Britain	character: size 15
postcode	Postcodes	The set of all postcodes in Britain	character: size 8
sex	Sex	The sex of a person	character: size 1, value M or F
DOB	DatesOfBirth	Possible values of staff birth dates	date, range from 1-Jan-20, format dd-mmm-yy
salary	Salaries	Possible values of staff salaries	monetary: 7 digits, range 6000.00–40000.00

Alternative Terminology for Relational Model

TABLE 4.1 Alternative terminology for relational model terms.

FORMAL TERMS	ALTERNATIVE 1	ALTERNATIVE 2
Relation	Table	File
Tuple	Row	Record
Attribute	Column	Field

Database Relations

- Relation Schema
 - Named relation defined by a set of attributes and domain name pairs
- Relational database schema
 - Set of relation schemas, each with a distinct name

Properties of Relations

- Relation name is distinct from all other relation names in relational schema.
- Each cell of relation contains exactly one atomic (single) value.
- Each attribute has a distinct name.
- Values of an attribute are all from the same domain.

Properties of Relations

- Each tuple is distinct; there are no duplicate tuples
- Order of attributes has no significance
- Order of tuples has no significance, theoretically

KEYS

Relational Keys

- Superkey
 - An attribute, or a set of attributes, that uniquely identifies a tuple within a relation
- Candidate Key
 - Superkey (K) such that no proper subset is a superkey within the relation
 - In each tuple of R, values of K uniquely identify that tuple (uniqueness)
 - No proper subset of K has the uniqueness property (irreducibility)

Relational Keys

- Primary Key
 - Candidate key selected to identify tuples uniquely within relation.
- Alternate Keys
 - Candidate keys that are not selected to be primary key.
- Foreign Key
 - Attribute, or set of attributes, within one relation that matches candidate key of some (possibly same) relation
 - Used to model relationships between relations

INTEGRITY

NULL

- Relational Integrity makes use of the concept of Null so we need to understand it
- Null
 - Represents value for an attribute that is currently unknown or not applicable for tuple
 - Deals with incomplete or exceptional data
 - Represents the absence of a value and is not the same as zero or spaces, which are values

Relational Integrity

- Entity Integrity
 - In a base relation, no attribute of a primary key can be null
- Referential Integrity
 - If foreign key exists in a relation, either foreign key value must match a candidate key value of some tuple in its home relation or foreign key value must be wholly null

Enterprise Constraints

- Enterprise Constraints
 - Additional rules specified by the user or database administrator
 - E.g., Student ID must be in form of GCHXXXX or GBHXXXXX (x is a digit)
 - Hanu: 123132324343
 - FTU: FTU121312

VIEWS

Views

- Base Relation
 - Named relation corresponding to an entity in conceptual schema, whose tuples are physically stored in database.
- View
 - Dynamic result of one or more relational operations operating on base relations to produce another relation.

Views

- A virtual relation that does not necessarily actually exist in the database but is produced upon request, at time of request.
- Contents of a view are defined as a query on one or more base relations.
- Views are dynamic, meaning that changes made to base relations that affect view attributes are immediately reflected in the view.

Purposes of Views

- Provides powerful and flexible security mechanism by hiding parts of database from certain users
- Permits users to access data in a customized way, so that same data can be seen by different users in different ways, at same time
- Can simplify complex operations on base relations

Updating Views

- All updates to a base relation should be immediately reflected in all views that reference that base relation.
- If view is updated, underlying base relation should reflect change.

Updating Views

- There are restrictions on types of modifications that can be made through views:
 - Updates are allowed if query involves a single base relation and contains a candidate key of base relation.
 - Updates are not allowed involving multiple base relations.
 - Updates are not allowed involving aggregation or grouping operations.

Updating Views

- Classes of views are defined as:
 - theoretically not updateable
 - theoretically updateable
 - partially updateable.

Summary

- Relational Model and its features
- Represent data
- Properties of database relations
- Candidate, primary, and foreign keys
- Entity integrity and referential integrity
- Views

References

- Connolly, T.M. & Begg, C.E., 2015. *Database Systems: A Practical Approach to Design, Implementation, and Management*. 4th ed. Pearson.