Database Management System (DBMS)

Lecture-3

Dharmendra Kumar

August 9, 2020

Data Independence

Data independence can be explained using the three-schema architecture.
Data independence refers characteristic of being able to modify the schema at one level of the database system without altering the schema at the next higher level.

There are two types of data independence:

1. Logical data independence
2. Physical data independence

Logical Data Independence

- Logical data independence refers characteristic of being able to change the conceptual schema without having to change the external schema.
- Logical data independence is used to separate the external level from the conceptual view.
- If we do any changes in the conceptual view of the data, then the user view of the data would not be affected.
- Logical data independence occurs at the user interface level.

Physical Data Independence

- Physical data independence can be defined as the capacity to change the internal schema without having to change the conceptual schema.
- If we do any changes in the storage size of the database system server, then the Conceptual structure of the database will not be affected.
- Physical data independence is used to separate conceptual levels from the internal levels.
- Physical data independence occurs at the logical interface level.

Data Models

Data model is a collection of conceptual tools for describing data, data relationships, data semantics, and consistency constraints. Data models define how the logical structure of a database is modeled. Data models define how data is connected to each other and how they are processed and stored inside the system.

There are different types of data models are used in DBMS. Here, we are going to explain some data models.
(1) Entity relationship model
(2) Relational model
(3) Network model
(4) Hierarchical model

Entity-relationship model

The entity-relationship (E-R) data model is based on a perception of a real world that consists of a collection of basic objects, called entities, and of relationships among these objects. An **entity** is a "thing" or "object" in the real world that is distinguishable from other objects. For example, each person is an entity, and bank accounts can be considered as entities.

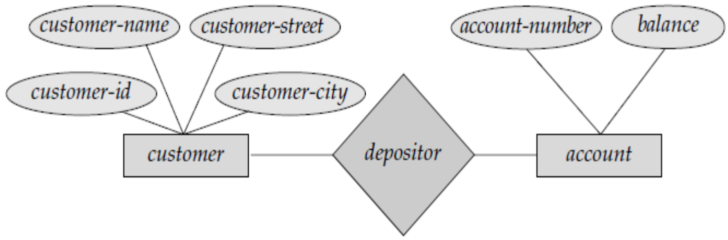
Entities are described in a database by a set of **attributes**. For example, the attributes account-number and balance may describe one particular account in a bank, and they form attributes of the account entity set. Similarly, attributes customer-name, customer-street address and customer-city may describe a customer entity.

A **relationship** is an association among several entities. For example, a depositor relationship associates a customer with each account that she has. The set of all entities of the same type and the set of all relationships of the same type are termed an **entity set** and **relationship set**, respectively.

The overall logical structure (schema) of a database can be expressed graphically by an E-R diagram, which is built up from the following components:

- **Rectangles**, which represent entity sets
- **Ellipses**, which represent attributes
- **Diamonds**, which represent relationships among entity sets
- **Lines**, which link attributes to entity sets and entity sets to relationships

For example, consider part of a database banking system consisting of customers and of the accounts that these customers have. Following figure shows the corresponding E-R diagram. The E-R diagram indicates that there are two entity sets, customer and account, with attributes as outlined earlier. The diagram also shows a relationship depositor between customer and account.



E-R diagram

Relational model

The relational model uses a collection of tables to represent both data and the relationships among those data. Each table has multiple columns, and each column has a unique name. Following figure presents a sample relational database comprising three tables: One shows details of bank customers, the second shows accounts, and the third shows which accounts belong to which customers.

Fundamentals of Database

customer-id	*customer-name*	*customer-street*	*customer-city*
192-83-7465	Johnson	12 Alma St.	Palo Alto
019-28-3746	Smith	4 North St.	Rye
677-89-9011	Hayes	3 Main St.	Harrison
182-73-6091	Turner	123 Putnam Ave.	Stamford
321-12-3123	Jones	100 Main St.	Harrison
336-66-9999	Lindsay	175 Park Ave.	Pittsfield
019-28-3746	Smith	72 North St.	Rye

Customer table

account-number	*balance*
A-101	500
A-215	700
A-102	400
A-305	350
A-201	900
A-217	750
A-222	700

Account table

customer-id	*account-number*
192-83-7465	A-101
192-83-7465	A-201
019-28-3746	A-215
677-89-9011	A-102
182-73-6091	A-305
321-12-3123	A-217
336-66-9999	A-222
019-28-3746	A-201

Depositor table

- The relational model is an example of a record-based model. Record-based models are so named because the database is structured in fixed-format records of several types. Each table contains records of a particular type. Each record type defines a fixed number of fields, or attributes. The columns of the table correspond to the attributes of the record type.
- The relational data model is the most widely used data model, and a vast majority of current database systems are based on the relational model. The relational model is at a lower level of abstraction than the E-R model. Database designs are often carried out in the E-R model, and then translated to the relational model.