Oracle
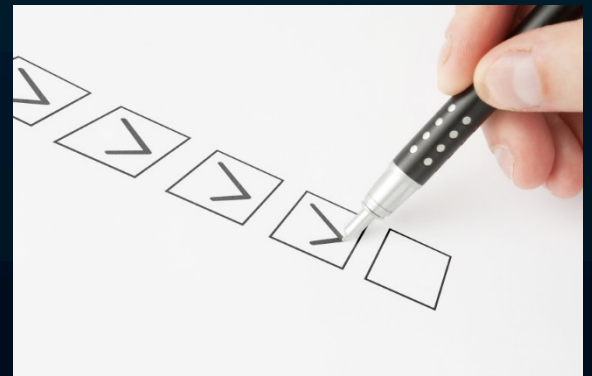# Version 12c

Introduction to Database

Enabling Objectives

After completing this chapter, in the next 30 minutes you will be able to :

- Define with an example at least 1 data model

- List and define at least 1 Database Normalization with an example

- List different Data Types used in a table creation

Key Topics

- The need of RDBMS
- Types of Data Models
- Different Levels of Database Normalization
- The purpose of SQL

Database and Data Models

Need of Database

- To manage large chunks of data
- Accuracy
- Ease of updating data
- Security of data

What is a Database

- A database is a collection of logically related data
- It is used to search data to answer queries
- A database may be designed for batch processing, real time processing, or online processing
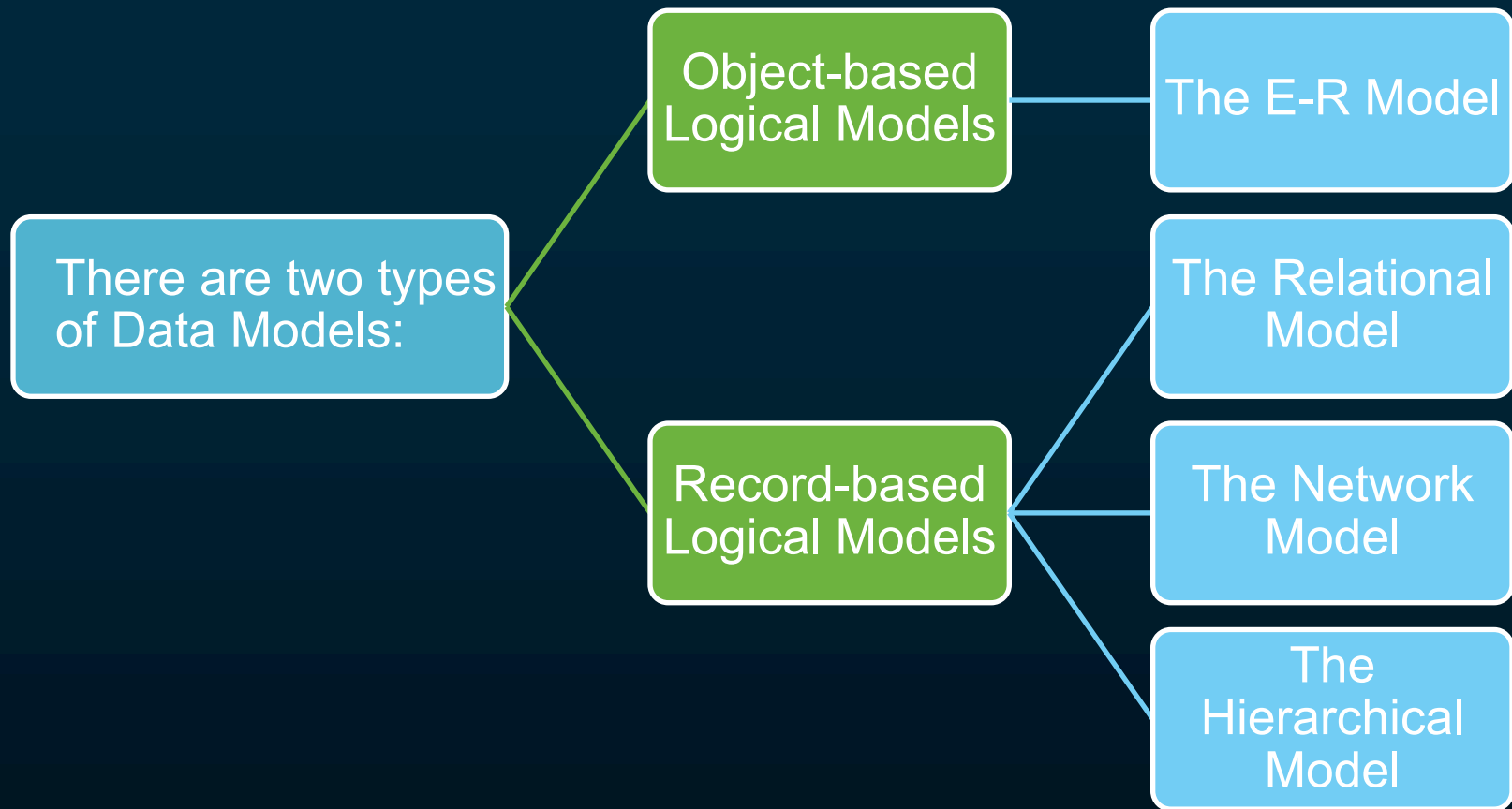
Database Management System

- Is a set of software or programs
  - Enables storing, modifying, and extracting information from a database

- Data can be accessed by using
  - query and reporting tools
  - application programs

Data Models

- Is a representation of a real world situation about which data is to be collected and stored.

- Depicts the dataflow and logical interrelationship among different data elements.

Evolution of Data Models

Generation	Time	Model
First	1960 – 1970's	File System
Second	1970's	Hierarchical and Network
Third	Mid 1970's to Present	Relational
Fourth	Mid 1980's to Present	Object Oriented Extended Rational

Types of Data Models

```
                                    ┌──────────────────┐      ┌──────────────────┐
                                    │  Object-based    │──────│  The E-R Model   │
                                    │  Logical Models  │      │                  │
                                    └──────────────────┘      └──────────────────┘
   ┌──────────────────┐                                       ┌──────────────────┐
   │ There are two    │                                       │  The Relational  │
   │ types of Data    │                                       │     Model        │
   │ Models:          │                                       └──────────────────┘
   └──────────────────┘             ┌──────────────────┐      ┌──────────────────┐
                                    │  Record-based    │──────│  The Network     │
                                    │  Logical Models  │      │     Model        │
                                    └──────────────────┘      └──────────────────┘
                                                              ┌──────────────────┐
                                                              │       The        │
                                                              │   Hierarchical   │
                                                              │      Model       │
                                                              └──────────────────┘
```

Object-based Logical Models

The E-R Model:

- They describe data at conceptual and view levels.

- The Entity-Relationship model is based on
  - Collection of basic objects (entities)
  - Relationships among these objects.

Record-based Logical Models

The Relational Model:

- Data and relationships are represented by a collection of tables.

The Network Model:

- Data are represented by collection of records.
- Relationships among data are represented by links.

The Hierarchical Model:

- Organization of the records is like a collection of trees, rather than arbitrary graphs.

Normalization

Relational Database Management System

- Relational Database Management System (RDBMS) is a DBMS that is based on the Relational model introduced by E.F Codd

- Important concept in RDBS is Normalization.

- Normalization is a process which reduces
  - Data redundancy
  - Inconsistency in database tables

Normalization

- Database Normalization is the process of organizing the fields and tables to
  - Minimize redundancy
  - Minimize dependency.

- Normalization involves
  - Dividing large tables into smaller tables
  - Defining relationships between tables.

Normal Forms (NF)

- Edgar F. Codd, the inventor of the Relational Model, introduced the concept of Normalization in 1970.
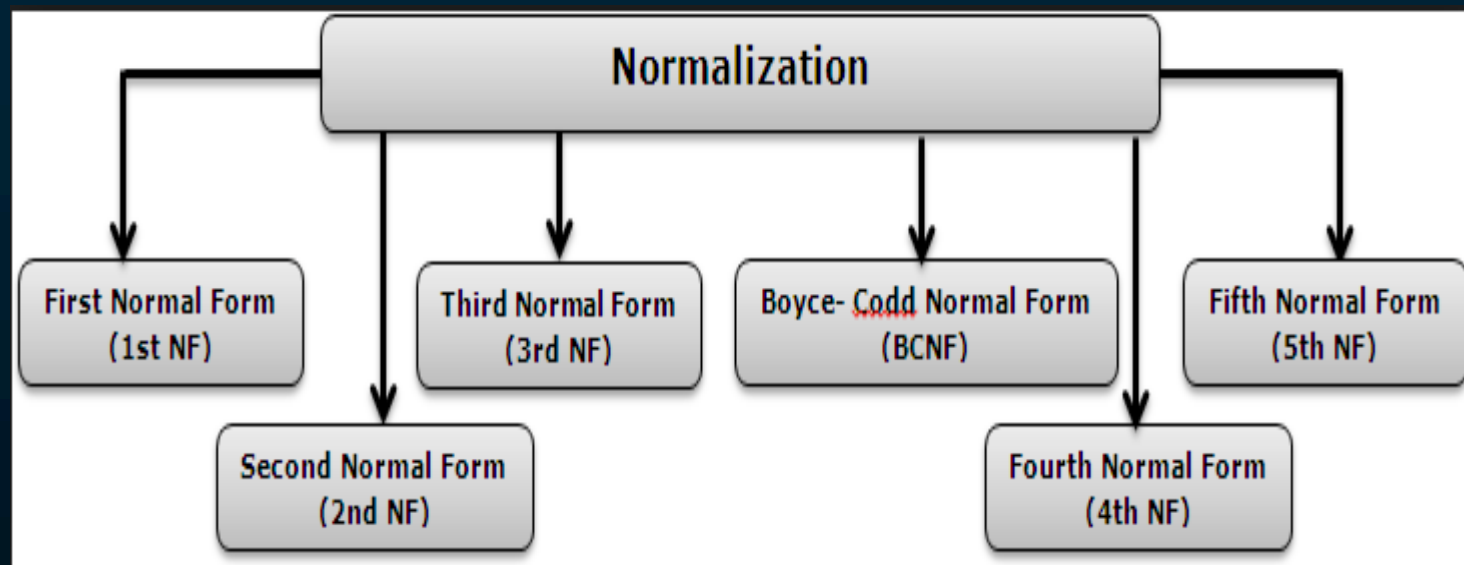
Lets take the below denormalized database table and will normalize the data using normal forms.

Project Code	Project Name	Project Manager	Project Budget	Employee No.	Employee Name	Department No.	Department Name	Hourly Rate
PC010	Reservation System	Mr. Ajay	120500	S100	Mohan	D03	Database	21.00
PC010	Reservation System	Mr. Ajay	120500	S101	Vipul	D02	Testing	16.50
PC010	Reservation System	Mr. Ajay	120500	S102	Riyaz	D01	IT	22.00
PC011	HR System	Mrs. Charu	500500	S103	Pavan	D03	Database	18.50
PC011	HR System	Mrs. Charu	500500	S104	Jitendra	D02	Testing	17.00
PC011	HR System	Mrs. Charu	500500	S315	Pooja	D01	IT	23.50
PC012	Attendance System	Mr. Rajesh	710700	S137	Rahul	D03	Database	21.50
PC012	Attendance System	Mr. Rajesh	710700	S218	Avneesh	D02	Testing	15.50
PC012	Attendance System	Mr. Rajesh	710700	S109	Vikas	D01	IT	20.50

First Normal Form (1NF)

A database table is said to be in 1NF if

- It contains no repeated fields/columns

- The process of converting the table into 1NF is as follows:
  - Separate the repeated fields into new database tables along with the key from denormalized database table

Primary Key

Project Code	Project Name	Project Manager	Project Budget
PC010	Reservation System	Mr. Ajay	120500
PC011	HR System	Mrs. Charu	500500
PC012	Attendance System	Mr. Rajesh	710700

First Normal Form (1NF)

Example :

Project Code	Employee No.	Employee Name	Department No.	Department Name	Hourly Rate
PC010	S100	Mohan	D03	Database	21.00
PC010	S101	Vipul	D02	Testing	16.50
PC010	S102	Riyaz	D01	IT	22.00
PC011	S103	Pavan	D03	Database	18.50
PC011	S104	Jitendra	D02	Testing	17.00
PC011	S315	Pooja	D01	IT	23.50
PC012	S137	Rahul	D03	Database	21.50
PC012	S218	Avneesh	D02	Testing	15.50
PC012	S109	Vikas	D01	IT	20.50

Composite Key (Unique Key) → Project Code, Employee No.

Second Normal Form (2NF)

- A database table is said to be in 2NF if
  - it is in 1NF and
  - contains only those fields/columns that are functionally dependent on the primary key

- The process of converting the database table into 2NF is as follows:
  - Remove the partial dependencies of any non-key field

Second Normal Form (2NF)

Example :

Employee No.	Employee Name	Department No.	Department Name
S100	Mohan	D03	Database
S101	Vipul	D02	Testing
S102	Riyaz	D01	IT
S103	Pavan	D03	Database
S104	Jitendra	D02	Testing
S315	Pooja	D01	IT
S137	Rahul	D03	Database
S218	Avneesh	D02	Testing
S109	Vikas	D01	IT

Primary Key → Employee No.

Project Code	Employee No.	Hourly Rate
PC010	S100	21.00
PC010	S101	16.50
PC010	S102	22.00
PC011	S103	18.50
PC011	S104	17.00
PC011	S315	23.50
PC012	S137	21.50
PC012	S218	15.50
PC012	S109	20.50

Composite Key → Project Code, Employee No.

Project Code	Project Name	Project Manager	Project Budget
PC010	Reservation System	Mr. Ajay	120500
PC011	HR System	Mrs. Charu	500500
PC012	Attendance System	Mr. Rajesh	710700

Primary Key → Project Code

Third Normal Form (3NF)

- A database table is said to be in 3NF if
  - it is in 2NF and
  - all non key fields are dependent on a primary key

- The process of converting a table into 3NF is as follows:
  - Remove the transitive dependencies
  - Make separate table for transitive dependent field

Third Normal Form (3NF)

Example :

Primary Key

Project Code	Project Name	Project Manager	Project Budget
PC010	Reservation System	Mr. Ajay	120500
PC011	HR System	Mrs. Charu	500500
PC012	Attendance System	Mr. Rajesh	710700

Composite Key

Project Code	Employee No.	Hourly Rate
PC010	S100	21.00
PC010	S101	16.50
PC010	S102	22.00
PC011	S103	18.50
PC011	S104	17.00
PC011	S315	23.50
PC012	S137	21.50
PC012	S218	15.50
PC012	S109	20.50
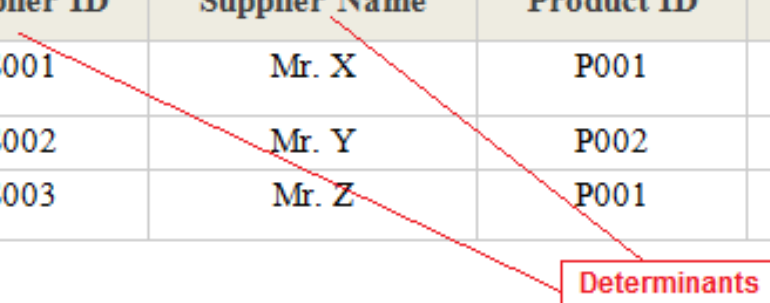
Primary Key

Employee No.	Employee Name	Department No.
S100	Mohan	D03
S101	Vipul	D02
S102	Riyaz	D01
S103	Pavan	D03
S104	Jitendra	D02
S315	Pooja	D01
S137	Rahul	D03
S218	Avneesh	D02
S109	Vikas	D01

Primary Key   **FK_Relationship**

Department No.	Department Name
D01	IT
D02	Testing
D03	Database

Boyce Codd Normal Form (BCNF)

- A database table is said to be in BCNF if
  - it is in 3NF and contains each and
  - every determinant as a candidate key.

- The process of converting a table into BCNF is as follows:
  - Remove the non-trivial functional dependency
  - Make separate table for the determinants
- Let's consider the special situation given below to understand BCNF:

Supplier ID	Supplier Name	Product ID	Quantity
S001	Mr. X	P001	120
S002	Mr. Y	P002	102
S003	Mr. Z	P001	100

Determinants
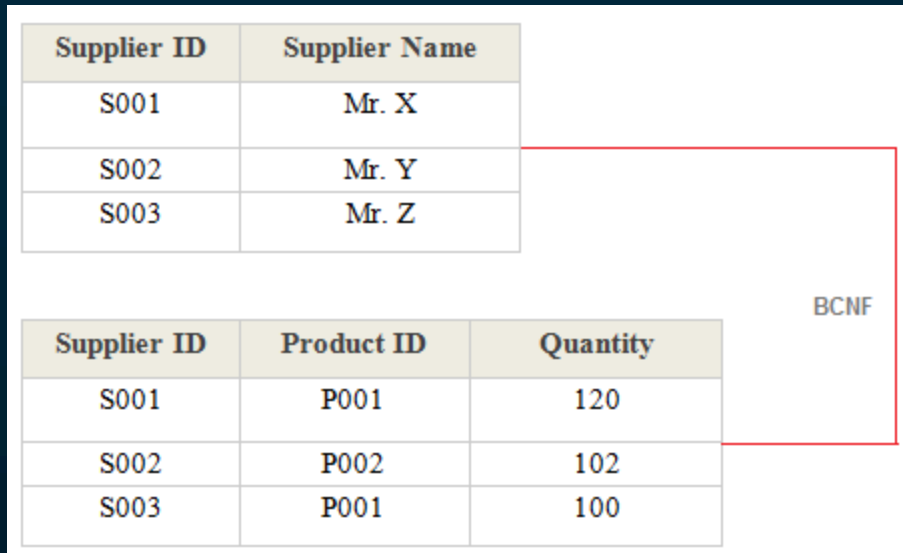
Boyce Codd Normal Form

After applying BCNF:

Supplier ID	Supplier Name
S001	Mr. X
S002	Mr. Y
S003	Mr. Z

Supplier ID	Product ID	Quantity
S001	P001	120
S002	P002	102
S003	P001	100

BCNF

Structured Query Language(SQL)

It is a special-purpose programming language designed for managing data in RDBMS.

SQL statements are used to perform tasks such as

- Execute queries against a database
- Retrieve data from a database
- Insert/ Update/ Delete records in a database
- Create new databases and Tables

Some common RDBMS that use SQL are:

- Oracle, Sybase, Microsoft SQL Server, Access, Ingres.

Check Your Understanding

1. what is a Data Model?

2. What is RDBMS?

3. What is Normalization?

4. Describe the various Normal Forms?

5. What is SQL?

Recap

In this session you have learned the following:

- Data Base is a collection of logically related data.

- DBMS is a set of software that
  - enables storing, modifying, and extracting information from a database.

- Data Model is a representation of a real world situation about which data is to be collected and stored in a database.

Recap

In this session you have learned the following:

- Database Normalization is the process of organizing the fields and tables to
  - Minimize redundancy
  - Minimize dependency.

- Normalization involves
  - Dividing large tables into smaller tables
  - Defining relationships between tables.

- SQL is programming language designed for managing data in RDBM

You have successfully completed the session on Introduction to database