DEPARTMENT OF CSE

DATA BASE MANAGEMENT SYSTEMS

23AD2102R

TOPIC

RELATIONAL MODEL , SQL INTRODUCTION

SESSION-6

AIM OF THE SESSION

To familiarize students with the basic concept

- ER to Relatational Model, SQL Introduction

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

- Relational Model
- Constraints, Schemas
- SQL Introduction

LEARNING OUTCOMES

At the end of this session, you should be able to:

- Know the conversion of ER to Relational Model
- Know the DBMS Constraints, Schemas
- Introduction of SQL.

DBMS – Relational Model

- **Relational Model (RM)** represents the database as a collection of relations. A relation is nothing but a table of values. Every row in the table represents a collection of related data values. These rows in the table denote a real-world entity or relationship.

SQL Introduction

- **SQL** is a language which is used to create & operate database.
- **SQL** is the basic language used for all the databases.
- **SQL** can be used by both casual users as well as skilled programmer.
- There are minor syntax changes amongst different databases, but the
- basic **SQL** syntax remains largely the same.

RELATIONAL MODEL

- **Relational Model (RM)** represents the database as a collection of relations. A relation is nothing but a table of values. Every row in the table represents a collection of related data values. These rows in the table denote a real-world entity or relationship.
- The table name and column names are helpful to interpret the meaning of values in each row. The data are represented as a set of relations. In the relational model, data are stored as tables. However, the physical storage of the data is independent of the way the data are logically organized.

BEST PRACTICES FOR CREATING A RELATIONAL MODEL

- Data need to be represented as a collection of relations
- Each relation should be exhibetd clearly in the table
- Rows should contain data about instances of an entity
- Columns must contain data about attributes of the entity
- Cells of the table should hold a single value
- Each column should be given a unique name
- No two rows can be identical
- The values of an attribute should be from the same domain

RELATIONAL MODEL CONCEPTS

1.Tables – In the Relational model the, relations are saved in the table format. It is stored along with its entities. A table consists of rows and columns. Rows represent records and columns represent attributes.

2.**Attribute:** Each column in a Table are called attribute. Attributes are the properties which define a relation. e.g., Student_Rollno, NAME,etc.

3.**Tuple** – It is nothing but a single row of a table, which contains a single record.

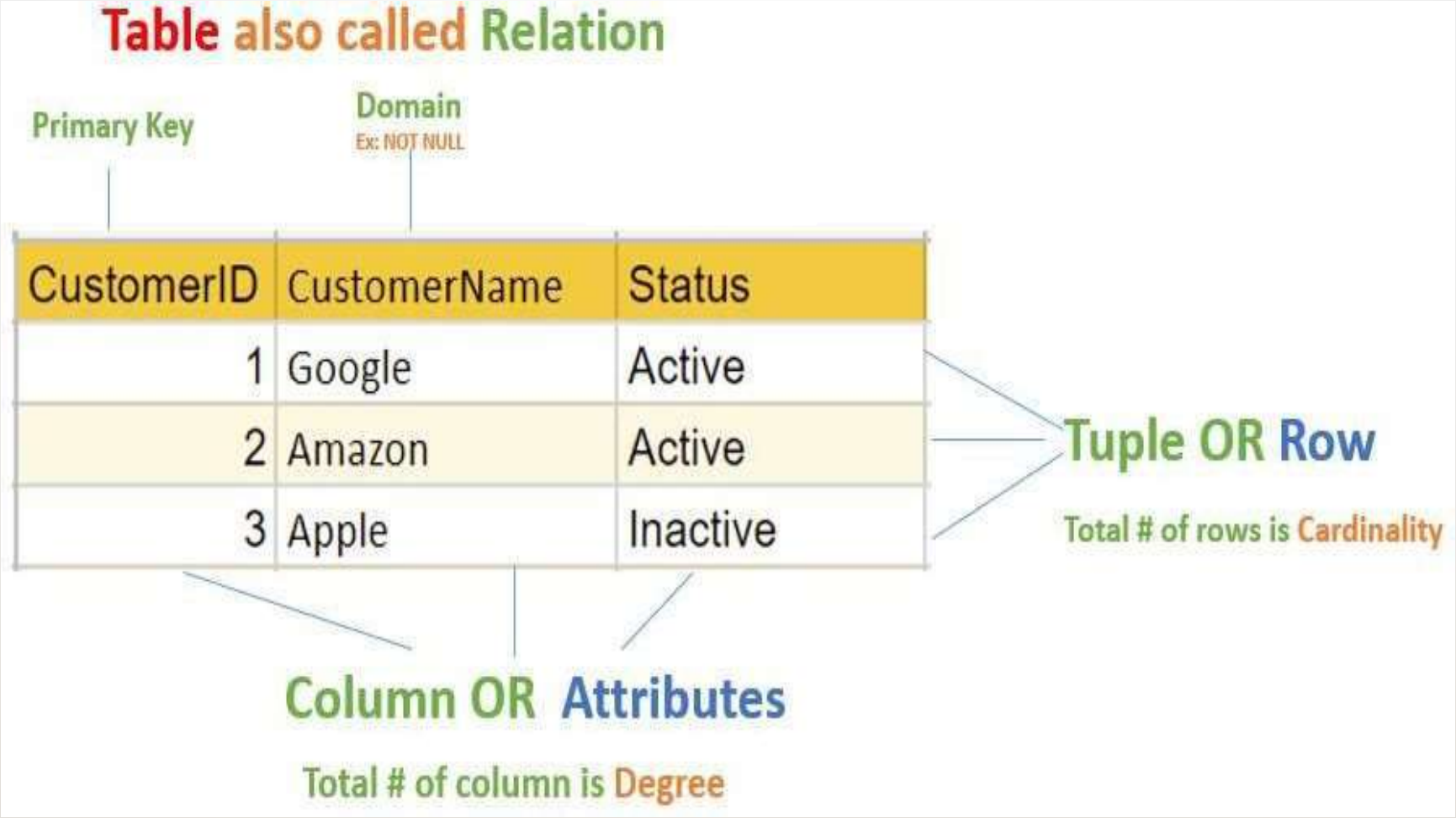
4.**Relation Schema**: A relation schema represents the name of the relation with its attributes.

5.**Degree**: The total number of attributes which in the relation is called the degree of the relation.

RELATIONAL MODEL CONCEPTS

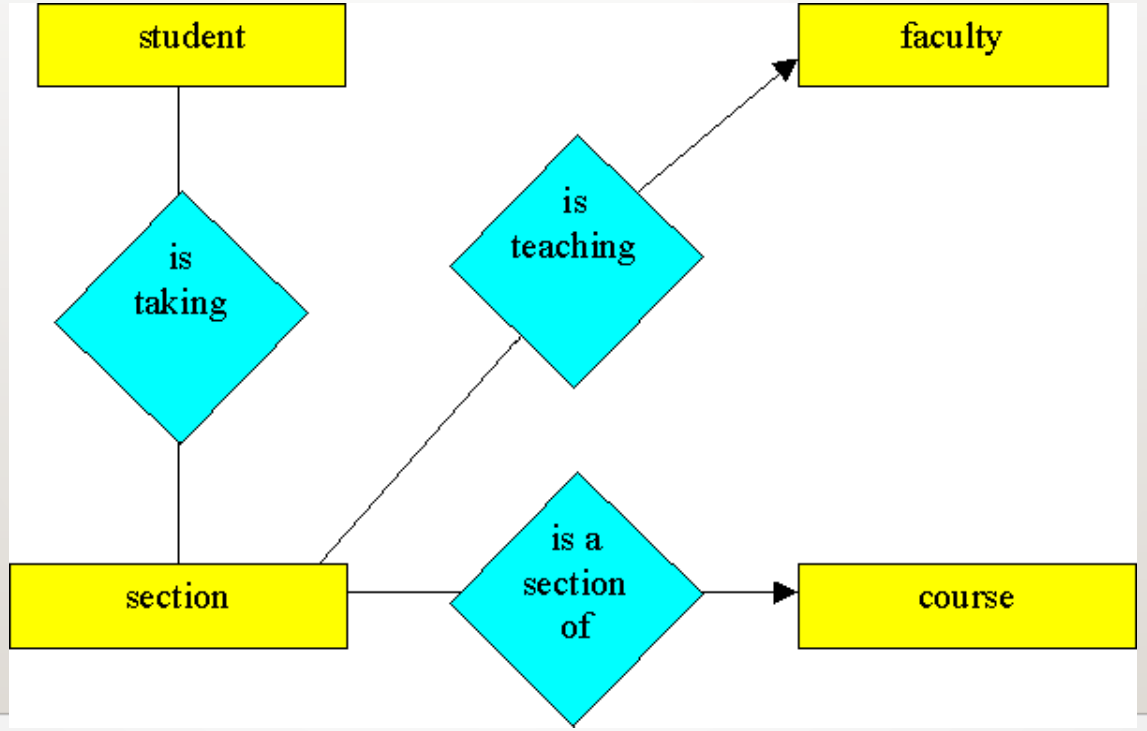
6. **Cardinality:** Total number of rows present in the Table.
7. **Column:** The column represents the set of values for a specific attribute.
8. **Relation instance** – Relation instance is a finite set of tuples in the RDBMS system. Relation instances never have duplicate tuples.
9. **Relation key** - Every row has one, two or multiple attributes, which is called relation key.
10. **Attribute domain** – Every attribute has some pre-defined value and scope which is known as attribute domain

TABLE



CONVERTING AN E-R DIAGRAM TO A RELATIONAL SCHEMA

E-R DIAGRAM TO A RELATIONAL SCHEMA. WE WILL USE THE STUDENT-SECTION-COURSE DATABASE AS AN EXAMPLE



CONVERTING AN E-R DIAGRAM TO A RELATIONAL SCHEMA

1. (non-weak) Entity sets.

- Create a relation for each entity set. It can use the same name and same set of attributes as the entity set. The key of the entity set is used as the primary key of the relation. For example,

- Student(ssn, last, first, streetaddress, city, state, country, zip)
- Course(dept,number, title, description, credits)
- Section(crn, days, time, room)
- Faculty(ssn, last, first, title, dept, office, phone)

CONVERTING AN E-R DIAGRAM TO A RELATIONAL SCHEMA

- Relationships

a. many-to-many relationships

- The attributes of this relation are the attributes of the relationship, together with the primary keys of the two related entity sets.
- The primary key of the relation combines the primary keys of the related entity sets.
- In the example database, the "is taking" relationship would be converted into

Enrolled(ssn, crn, gradeOption, credits)

CONVERTING AN E-R DIAGRAM TO A RELATIONAL SCHEMA

b. one-to-many relationships

- There are two ways to handle this type of relationship. One is to follow essentially the same approach as with the many-to-many relationship, by creating a new relation to represent the relationship. For example, for the "is teaching" relationship, we would create a relation

- Teaches(crn, ssn)
- n-ary relationships

- Create a relation representing the relationship. Include the primary key of each participating entity set. Any attributes of the relationship become attributes of the relation. For example, if students, majors, and faculty advisors are related by a ternary "advises in" relationship, we would create a relation:

- Advises(studentSsn, advisorSsn, major)

KEY

A DBMS Key is an attribute or set of attributes which helps us to identify a row (tuple) in a relation(table). It allows us to find the relation between two tables.

There are different types of keys:

1. Super Key
2. Unique Key
3. Primary Key
4. Candidate Key
5. Alternate Key
6. Foreign Key

SUPER KEY CANDIDATE KEY & NON-PRIME ATTRIBUTE

- **Super Key**: A super key is a set of one or more attributes(columns), which can uniquely identify a row in a table.
- **Candidate Key**: A super key with no redundant attribute is known as candidate key.
- **Non-prime Attribute:** An attribute that is not part of any candidate key is known as non-prime attribute.

Emp_Id	Emp_Number	Emp_Name
E01	2264	Steve
E02	2278	John
E03	2288	Martin
E04	2297	Robert

Super Key:

1. {Emp_Id}
2. {Emp_Number}
3. {Emp_Id} {Emp_Number}
4. {Emp_Number} {Emp_Name}
5. {Emp_Id} {Emp_Name}
6. {Emp_Id} {Emp_Number} {Emp_Name}

Candidate Key:

1. {Emp_Id}
2. {Emp_Number}

Non-prime attribute

{Emp_Name}

UNIQUE KEY & PRIMARY KEY

- A **Unique key** uniquely identifies each record in the database. This provides uniqueness for the column or set of columns and it can accept only one null value. Unique key is a subset of super key.
- A **primary key** is a combination of fields which uniquely specify a row. This is a special kind of unique key, and it has implicit NOT NULL constraint. It means, Primary key values cannot be NULL.
  - A Primary key constraint has automatic unique constraint defined on it. But not, in the case of Unique Key.
  - Primary Key can be chosen from Candidate key.
  - There can be many unique constraint defined per table, but only one primary key constraint defined per table.

ALTERNATE KEY FOREIGN KEY

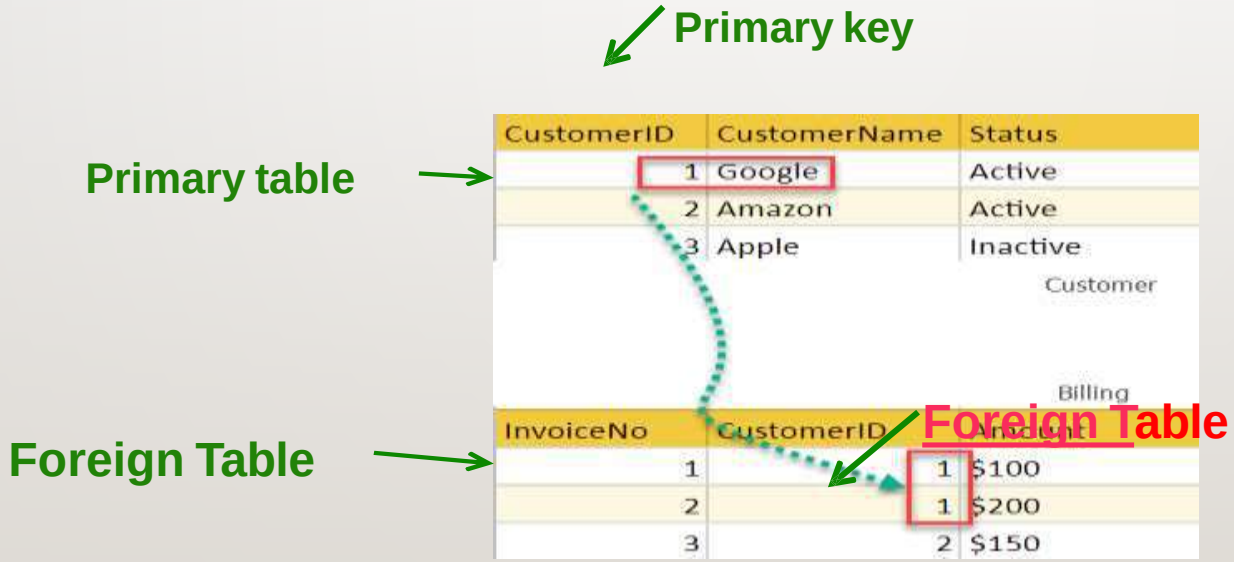
A candidate key, that is not a primary key is called an **Alternate key.**

A non key attribute(or a group of non-key attributes) whose values are derived from primary key of some other table is known as **Foreign key** in its current table.

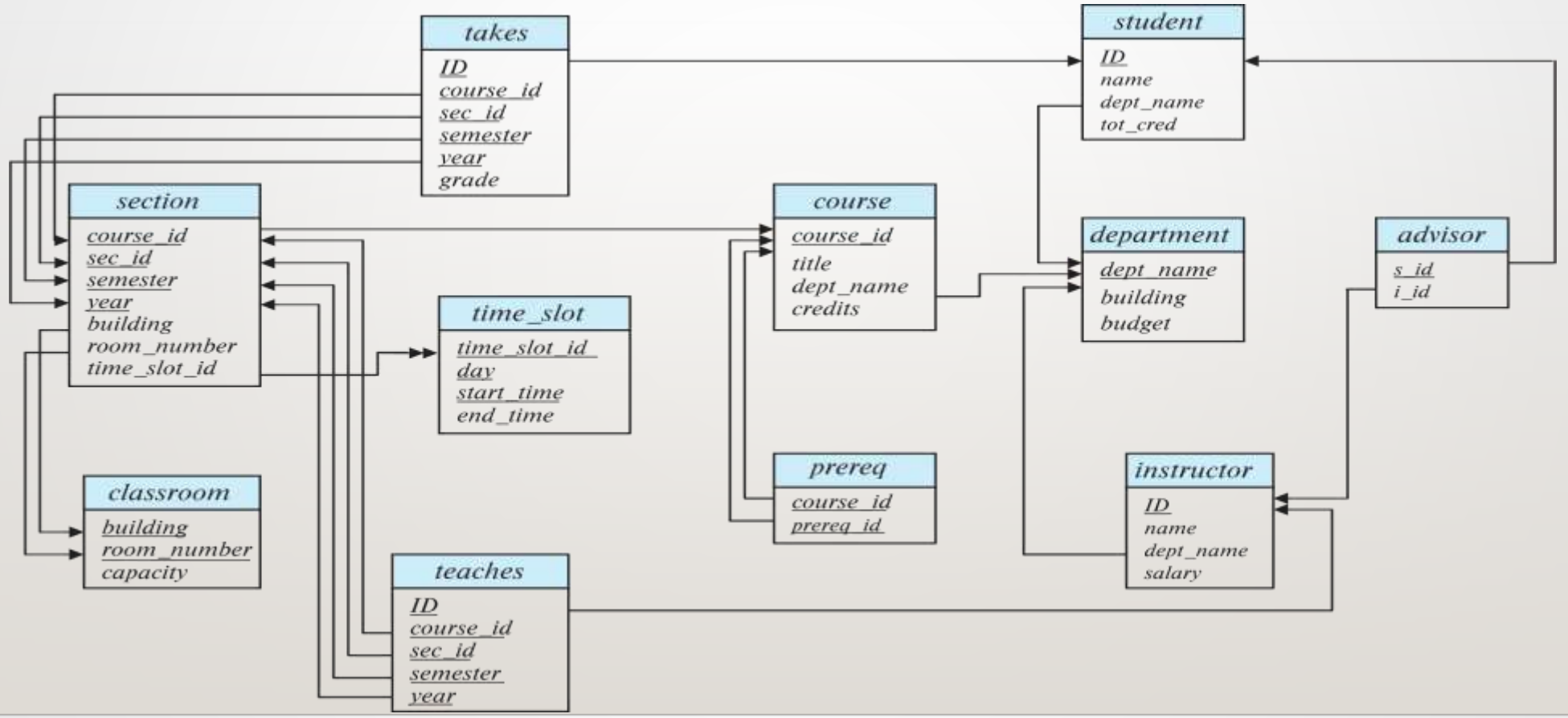
- Foreign key is used to represent the relationship between two tables.
- Foreign key of a table is a primary key of some other table.

PRIMARY TABLE & FOREIGN TABLE

- The table in which foreign key attribute exists, is called a **Foreign Table or Detail table.**
- The table that defines the primary key, which is the foreign key of the detail table or Foreign table refers to, is called **Primary table or Master table.**



SCHEMA DIAGRAM FOR UNIVERSITY DATABASE



SQL

Structural Query Language

SQL(Structured Query Language)

- **SQL** is a language which is used to create & operate database.
- **SQL** is the basic language used for all the databases.
- **SQL** can be used by both casual users as well as skilled programmer.

There are minor syntax changes amongst different databases, but the basic **SQL** syntax remains largely the same.

- According to ANSI (American National Standards Institute), **SQL** is the

standard language to operate a relational database management system.

- **SQL** is used in the accessing, updating, and manipulation of data in a database. Its design

allows for the management of data in an RDBMS, such as MYSQL and PostgreSQL.

QUERY & SUB-QUERY

A DB **query** is a code written in order to get the information back from the database.

Query can be designed in such a way that it matched with our expectation of the result set. Simply, a question to the Database.

A **sub-query** is a query within another query. The outer query is called as main query, and inner query is called sub-query.

Sub-query is always executed first, and the result of sub-query is passed on to the main query.

There are two types of sub-query - **Correlated and Non-Correlated.**

A **correlated sub-query** cannot be considered as independent query, but it can refer the column in a table listed in the FROM the list of the main query.

PROCESSING CAPABILITIES OF SQL

1. DATA DEFINITION LANGUAGE(DDL)

The SQL DDL provides commands for defining relation schemas, deleting relations, creating indexes and modifying relation schemas .

2.INTERACTIVE DATA MANIPULATION LANGUAGE(DML)

The SQL DML includes a query language based on both relational algebra and the tuple relational calculus. It includes the commands to insert, delete and modify tuples in the data base.

PROCESSING CAPABILITIES OF SQL

3. Embedded SQL

It is a method of combining the computing power of a programming language and the database manipulation capabilities of SQL.

4.**View Definition**

The SQL DDL also includes commands for defining views.(Views are the virtual tables that does not really exist in its own but is derived from one or more base table(s)).

5.Authorization

The SQL DDL also includes commands for specifying access rights to relation and views.

PROCESSING CAPABILITIES OF SQL

6.Integrity

The SQL provides limited forms of integrity checking. Future products and standards of SQL are likely to include enhanced features for integrity checking.

7.Transaction Control

SQL includes commands for specifying the beginning and ending of transactions along with the commands to have a control over transaction processing.

DATA DEFINITION LANGUAGE(DDL)

A set of definitions which are expressed by a special language.
An ideal DDL should perform the following functions :

1. Identify the types of data
2. Give a unique name
3. Specify the proper data types
4. Specify how to record types are related to make structures.
5. Define the type of encoding the program uses in the data items.
6. Define the length of data item.
7. Define the range of the values that a data item can assume
8. Specify means of checking for errors in the data.
9. Specify privacy locks.
10. Should not specify addressing, indexing or specify or searching techniques or specify the storage units.

Data Dictionary

Data dictionary is a file that contains metadata i.e. data about data.

DATA MANIPULATION LANGUAGE (DML)

Data manipulation language (DML) is a language that enables users to access or manipulate data as organized by the appropriate data model.

By data manipulation we mean:

1. Retrieval
2. Insertion
3. Deletion
4. Modification

TYPES OF DATA MANIPULATION LANGUAGE (DML)

DML's are Basically of two types

1) Procedural DML

It requires a user to specify what data is needed and how to get it.

2) Non-procedural DML

It requires a user to specify what data is needed without specifying how to get it.

SQL Processing

1. SQL is a language oriented specifically around relational databases.
2. The SQL command can operate on entire groups of tables as a single object and can treat any quantity of information extracted or derived from them as a single unit as well.

CONCEPT OF BASIC DATATYPE

Class	Data Type
Text	CHAR(or, CHARACTER)
Exact Numeric	DEC(or, DECIMAL)
	NUMERIC
	INT(or, INTEGER)
	SMALLINT
Approximate Numeric	FLOAT
	REAL
	DOUBLE(or, DOUBLE PRECISION)
Date & Time	
Currency	

DATE & TIME

		Date		Time	
Standard	**Full Form**	**Format**	**Example**	**Format**	**Example**
ISO	International Organization for Standard	yyyy-mm-dd	2020-03-15	hh-mm-ss	23-13-41
JIS	Japanese Industrial Standards	yyyy-mm-dd	2020-03-15	hh-mm-ss	23-13-41
EUR	IBM European Standard	dd.mm.yyyy	15.03.2020	hh.mm.ss	23.13.41
USA	IBM USA Standard	mm/dd/yyyy	03/15/2020	hh.mm AM/PM	11.13 PM

DATE & TIME can be added subtracted or compared

VARIOUS SQL COMMANDS AND FUNCTIONS

1. **Keywords** : The words that have a special meaning. SQL keywords have been printed in capital letters.

   e.g. NULL, UNIQUE, DEFAULT, CHECK, …etc.

2. **Commands or Statements** : Instructions to a SQL database
3. **Clauses** : Commands consist of one or more logically distinct parts
4. **Arguments** : Modify the meaning of a clause
5. **Objects** : Structures in the database that are given names and stored in memory. They include *base tables, views & indexes*

SYMBOLS USED IN SYNTAX OF STATEMENT

Symbols	Meaning
|	or
{ }	treated as a unit
[ ]	everything enclosed in it is optional
…	repeated any number of times
… .	repeated any number of times with the individual occurrences separated by commas
< >	SQL and other special terms are in angle brackets

RELATIONAL OPERATORS

Symbols	Meaning
=	equal to
>	greater than
<	less than
>=	greater equal to
<=	less equal to
<>	not equal to

ACTIVITIES/ CASE STUDIES/ IMPORTANT FACTS RELATED TO THE SESSION

❖The relational model in DBMS is an abstract model used to organize and manage the data stored in a database. It stores data in two-dimensional inter-related tables, also known as relations in which each row represents an entity and each column represents the properties of the entity.

❖SQL stands for Structured Query Language. It is used for storing and managing data in relational database management system (RDMS).It is a standard language for Relational Database System. It enables a user to create, read, update and delete relational databases and tables.

❖All the RDBMS like MySQL, Informix, Oracle, MS Access and SQL Server use SQL as their standard database language.

SUMMARY

The relation, which is a two-dimensional table, is the primary unit of storage in a relational database.

A relational database can contain one or more of these tables, with each table consisting of unique set of rows and columns.

A single record is stored in a table as a row, also known as a tuple, while attributes of the data are defined in columns or fields in the table.

Each column has a unique name and the content within it must be of the same type.

The characteristics of the data, or the column, relates one record to another.

SELF-ASSESSMENT QUESTIONS

1. .....first formulated and proposed in 1969 by Edgar Codd.

(a) Relational model
(b) DBMS model
(c) Virtual Model
(d) Data Model

Ans: a

2. A..... is a set of attributes..

(a) Headings
(b) entities
(c) All
(d) None

Ans: a

SELF-ASSESSMENT QUESTIONS

3..... is the term used in the theory for what is commonly referred to as a column.

(a) Entity

(b) Attributes

(c) Relations

(d) All of the above

ANS: b

TERMINAL QUESTIONS

1. Describe the relational model concept of DBMS.
2. What do you mean by alternatives to the relational model?
3. Describe NULL concept in database.
4. Describe various data types in SQL.
5. List out the DBMS languages and explain the use of the languages.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

Reference Books:

1. Database System Concepts, Sixth Edition, Abraham Silberschatz, Yale University Henry, F. Korth Lehigh University, S. Sudarshan Indian Institute of Technology, Bombay.
2. Fundamentals of Database Systems, 7th Edition, RamezElmasri, University of Texas at Arlington, Shamkant B. Navathe, University of Texas at Arlington.

Sites and Web links:

1. https://nptel.ac.in/courses/106105175
2. https://beginnersbook.com/2018/11