DBMS

Lecture 2

SQL

What is SQL ?

SQL

- Structured query language
- Language used to interact with database
- Comprises both data definition and data manipulation languages

Does SQL support programming language features ?

SQL Schema

- Represents logical view
- SQL schema can be divided in following categories -
  - **Physical Database Schema** - used to describe how the data will be stored in the secondary storage. It is related to the actual storage of data and its form of storage like files, indices etc.
  - **Logical Database Schema** - defines all the logical constraints that need to be applied on the data stored. This schema defines the tables, views and integrity constraints.

Constraints

- Set of rules to enforce database integrity.

Constraints

- Primary Key
- Composite Key
- Unique Key
- Foreign Key
- Check Constraint
- Not Null

Primary Key

- Defines each row/record uniquely in the database.
- Cannot have NULL values
- One table can have one primary key
- Contains unique values
- If multiple fields are used as a primary key – called Composite Key.

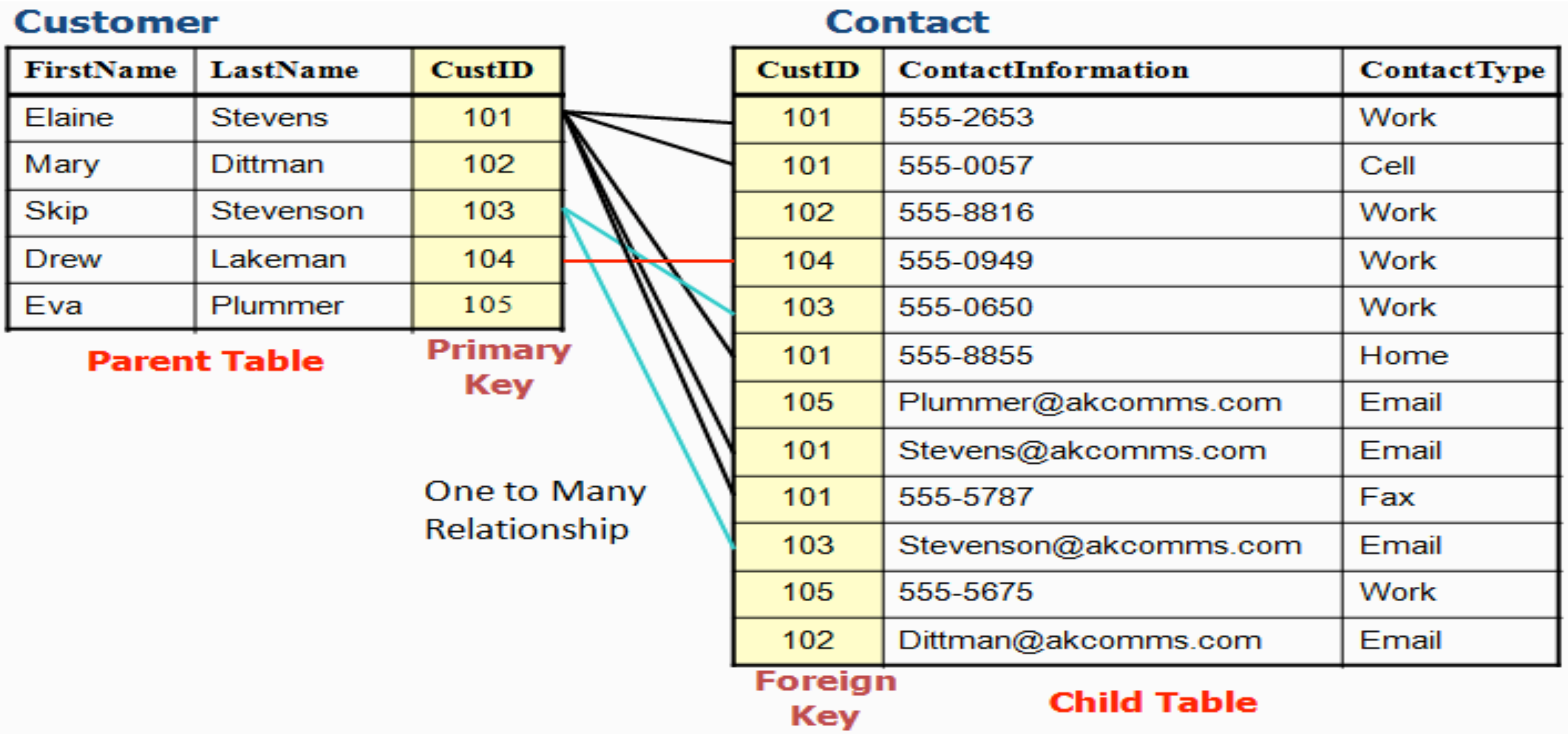
Unique Key

- Defines each row/record uniquely in the database.
- Contains unique values.
- A table can have multiple unique keys
- It can have one NULL value
- Primary Key = Unique Key + Not NULL

Foreign Key

- Used to link two tables together
- A foreign key is a field (or a set of fields) in a table that uniquely identifies a row of another table or you can say refers to the PRIMARY KEY of another table.
- The table in which the foreign key is defined is called the "child table" and it (often) refers to the primary key in the parent table.

Foreign Key example



Customer

FirstName	LastName	CustID
Elaine	Stevens	101
Mary	Dittman	102
Skip	Stevenson	103
Drew	Lakeman	104
Eva	Plummer	105

Contact

CustID	ContactInformation	ContactType
101	555-2653	Work
101	555-0057	Cell
102	555-8816	Work
104	555-0949	Work
103	555-0650	Work
101	555-8855	Home
105	Plummer@akcomms.com	Email
101	Stevens@akcomms.com	Email
101	555-5787	Fax
103	Stevenson@akcomms.com	Email
105	555-5675	Work
102	Dittman@akcomms.com	Email

Check Constraint

Not NULL

DDL Commands

DDL Commands

- Create
- Insert
- Rename
- Truncate
- Drop
- Alter

create

- Create Database
  - create database database-name
- Create Table –

  -
    ```
    create table table-name {
      column-name1 datatype1,
      column-name2 datatype2,
      column-name3 datatype3,
      column-name4 datatype4
    };
    ```

show

- Show Database
  - show databases;
- Select Database –
  - use database-name;
- Show Tables –
  - show tables;
- Describe table –
  - describe table-name;
- Display table content –
  - select * from table-name;

insert

- Insert into table-name values(data1,data2,..);

- insert INTO *table_name* (*column1*, *column2*, *column3*, ...) VALUES (*value1*, *value2*, *value3*, ...);

Alter

- Add a column to existing table
  - Single Column
  - Multiple columns
  - Column with default values
- Modify an existing column
- Change data type of any column or to modify its size
- Rename an existing column
- Drop a column

DML Commands

DML

- Used to store, modify, retrieve, delete and update data in a database.
- Different DML commands
  - Select
  - Insert
  - Update
  - Delete

Select

- Used to retrieve data from the database
- This command allows database users to retrieve the specific information they desire from an operational database. It returns a result set of records from one or more tables

Insert

- Used to insert data into a table.

Update

- Used to update a row of the table.
- Syntax :
  - update table_name set column_name = 'column_value';
  - update table_name set column_name = 'column_value' where condition;

Delete

- Delete command is used to delete data from a table.
- Syntax :

```
Delete from table_name;
```

- Above command will delete all data from given table name.

```
Delete from table_name where condition;
```

Difference between Delete & Truncate

Aggregate functions

- Aggregate functions perform a calculation on a set of values and return a single value.
- It is used with Select statement.

Aggregate functions

- AVG
- MAX
- MIN
- SUM
- COUNT()
- COUNT(*)

DRL/DSL Commands

DRL/DSL Commands

- DRL/DSL stands for Data Retrieval Language/Data Selection Language.
- It is a set commands which are used to retrieve data from database server. It manipulates the data in database for display purpose like aggregate function.
- In DRL/DSL, for accessing the data it uses the DML command that is SELECT.
- The SELECT command allows database users to retrieve the specific information they desire from an operational database.

Types of DRL/DSL commands

- FROM - It is used for selecting a table name in a database.
- WHERE - It specifies which rows to retrieve.
- GROUP BY - It is used to arrange the data into groups.
- HAVING - It selects among the groups defined by the GROUP BY clause.
- ORDER BY - It specifies an order in which to return the rows.
- AS - It provides an alias which can be used to temporarily rename tables or columns.

Where

- Used to filter out the results
- A WHERE clause can be used along with DELETE or UPDATE SQL command also to specify a condition.
- The WHERE clause works like an if condition in any programming language.
- The WHERE clause is very useful when you want to fetch the selected rows from a table

Where

- where can be used with -
  - Select
  - Update
  - Delete
  - Aggregate functions

Where

- where can be used with -
  - AND
  - OR

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Group BY

- Used to group rows that have the same values.
- It summarizes data from the database.
- The GROUP BY clause groups a set of rows into a set of summary rows by values of columns or expressions. The GROUP BY clause returns one row for each group. In other words, it reduces the number of rows in the result set.

Group BY

- Can be used with -
  - Sum
  - Count
  - Min
  - max

Types of DRL/DSL commands

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Having

- The HAVING clause was added to SQL because the WHERE keyword could not be used with group functions.
- The HAVING clause is used in the SELECT statement to specify filter conditions for a group of rows or aggregates.
- The HAVING clause is often used with the GROUP BY clause to filter groups based on a specified condition. If the GROUP BY clause is omitted, the HAVING clause behaves like the WHERE clause.

Having

```
SELECT expression1, expression2, ... expression_n,
        aggregate_function (expression)
FROM tables
[WHERE conditions]
GROUP BY expression1, expression2, ... expression_n
HAVING condition;
```

Difference between where and having

- HAVING clause applies a filter condition to each group of rows, while the WHERE clause applies the filter condition to each individual row.

Order By

- The ORDER BY keyword is used to sort the result-set in ascending or descending order.
- The ORDER BY keyword sorts the records in ascending order by default. To sort the records in descending order, use the DESC keyword.

As - SQL Alias

- **Alias** is used to give an alias name to a table or a column,
- Alias is mainly used for giving a short alias name for a column or a table with complex names.

SELECT column-name FROM table-name AS alias-name

- An alias only exists for the duration of the query.

Distinct Keyword

Distinct

- Eliminate duplicate rows
- If column contains NULL value, distinct treats NULL as same value.
- Can be used with more than one column.
- Can be used with
  - Select
  - Where
  - Group by
  - Aggregate functions
  - Limit clause

Distinct - Group by

- Group by behaves like distinct if used without aggregate functions.
- DISTINCT clause is a special case of the GROUP BY clause.
- The difference between DISTINCT clause and GROUP BY clause is that the GROUP BY clause sorts the result set whereas the DISTINCT clause does not.

Distinct - Aggregate functions

- You can use the DISTINCT clause with an aggregate function e.g., SUM, AVG, and COUNT, to remove duplicate rows before MySQL applies the aggregate function to the result set.

Distinct - Limit

- MySQL stops searching immediately when it finds the number of unique rows specified in the LIMIT clause.

IN Keyword

IN

- The IN operator allows you to determine if a specified value matches any one of a list or a subquery.
- The IN operator returns 1 if the value of the column or the result of the expr expression is equal to any value in the list, otherwise, it returns 0.

  SELECT 10 IN(15,10,25);
- Applies Binary search for searching of values if all values are constants.

IN

- Syntax -

  SELECT column1,column2,...FROM table_name WHERE (expr|column_1) IN ('value1','value2',...);

- You can use a column or an expression (expr) with the IN operator in the WHERE clause.
- The values in the list must be separated by a comma (,).
- The IN operator is a shorthand for multiple OR conditions.

Not IN

- You can combine the IN operator with the NOT operator to determine if a value does not match any value in a list or a subquery.

Between

SELECT *column_name(s)* FROM *table_name* WHERE *column_name* BETWEEN *value1* AND *value2;*

- BETWEEN Condition will return the records where *expression* is within the range of *value1* and *value2* (inclusive).
- You can use BETWEEN clause to replace a combination of "greater than equal AND less than equal" conditions.

Between

- Can be used with different commands
  - Select
  - Update
  - Delete
  - IN

Not Between

- You can combine the Between operator with the NOT operator to return all rows where value does not lie in the given range.

Like

Like

- The LIKE operator is used in a WHERE clause to search for a specified pattern in a column.
- There are two wildcards used in conjunction with the LIKE operator:
    - % - The percent sign represents zero, one, or multiple characters
    - _ - The underscore represents a single character
- SELECT *column1, column2, ...*FROM *table_name* WHERE *column* LIKE *pattern*;

Examples

Statements	Description
LIKE 'S%'	It finds any value which starts with 'S'.
LIKE '%S%'	It finds any value which have 'S' in any position.
LIKE '_SS%'	It finds any value which have 'SS' in the second and third positions.
LIKE 'S_%_%'	It finds any value which starts with 'S' and have at least three characters in length.
LIKE '%S'	It finds any value which ends with 'S'.
LIKE '_S%P'	It finds any value which have 'S' in the second position and ends with 'P'.
LIKE 'S___P'	It finds any value in a five digit numbers which start with 'S' and ends with 'P'.

Escape Characters

- Let's say you wanted to search for a % or a _ character in the MySQL LIKE condition. You can do this using an Escape character.
  - *SELECT * FROM table_name WHERE column_name LIKE 'G\%';*
- We can override the default escape character in MySQL by providing the ESCAPE modifier as follows:
  - *SELECT * FROM table_name WHERE column_name LIKE 'G!%' ESCAPE '!';*

DCL Commands

DCL Commands

- DCL stands for Data Control Language.
- Controls user access in a database. This command is related to the security issues.
- Allows or restricts the user from accessing data in database schema.
- Mainly deals with the rights, permissions and other controls of the database system.
- Types
  - Grant
  - Revoke

Create user

- Syntax for show current users -

  Select user from mysql.user;
- Syntax for creating a new user -

  CREATE USER 'new_user'@'localhost' IDENTIFIED BY 'password';
- Show grants for an existing user -

  SHOW GRANTS FOR ‘user’@'localhost';
- A new user can only execute -
  - Show databases
  - And show tables;

Grant

- This command is used by administrators to add new permissions to a database user.
- Syntax -

```
GRANT [privileges] ON [table_name] TO [user]
```

Privileges

- SELECT Ability to perform SELECT statements on the table.
- INSERT Ability to perform INSERT statements on the table.
- UPDATE Ability to perform UPDATE statements on the table.
- DELETE Ability to perform DELETE statements on the table.
- CREATE Ability to perform CREATE TABLE statements.
- ALTER Ability to perform ALTER TABLE statements to change the table definition.
- DROP Ability to perform DROP TABLE statements.
- GRANT Allows you to grant the privileges that you possess to other users.
- ALL Grants all permissions except GRANT OPTION.

Revoke

- Once you have granted privileges, you may need to revoke some or all of these privileges. To do this, you can run a revoke command.
- You can revoke any combination of SELECT, INSERT, UPDATE, DELETE, REFERENCES, ALTER, or ALL.
- Syntax -

```
REVOKE [privileges] ON [table_name] FROM [user]
```