Structured Query Language DML

MIS 520 – Database Theory

Fall 2001 (Day)

Lecture 10/11

SQL – Select

Select *<List of Columns and expressions (usually involving columns)>*

From *<List of Tables & Join Operators>*

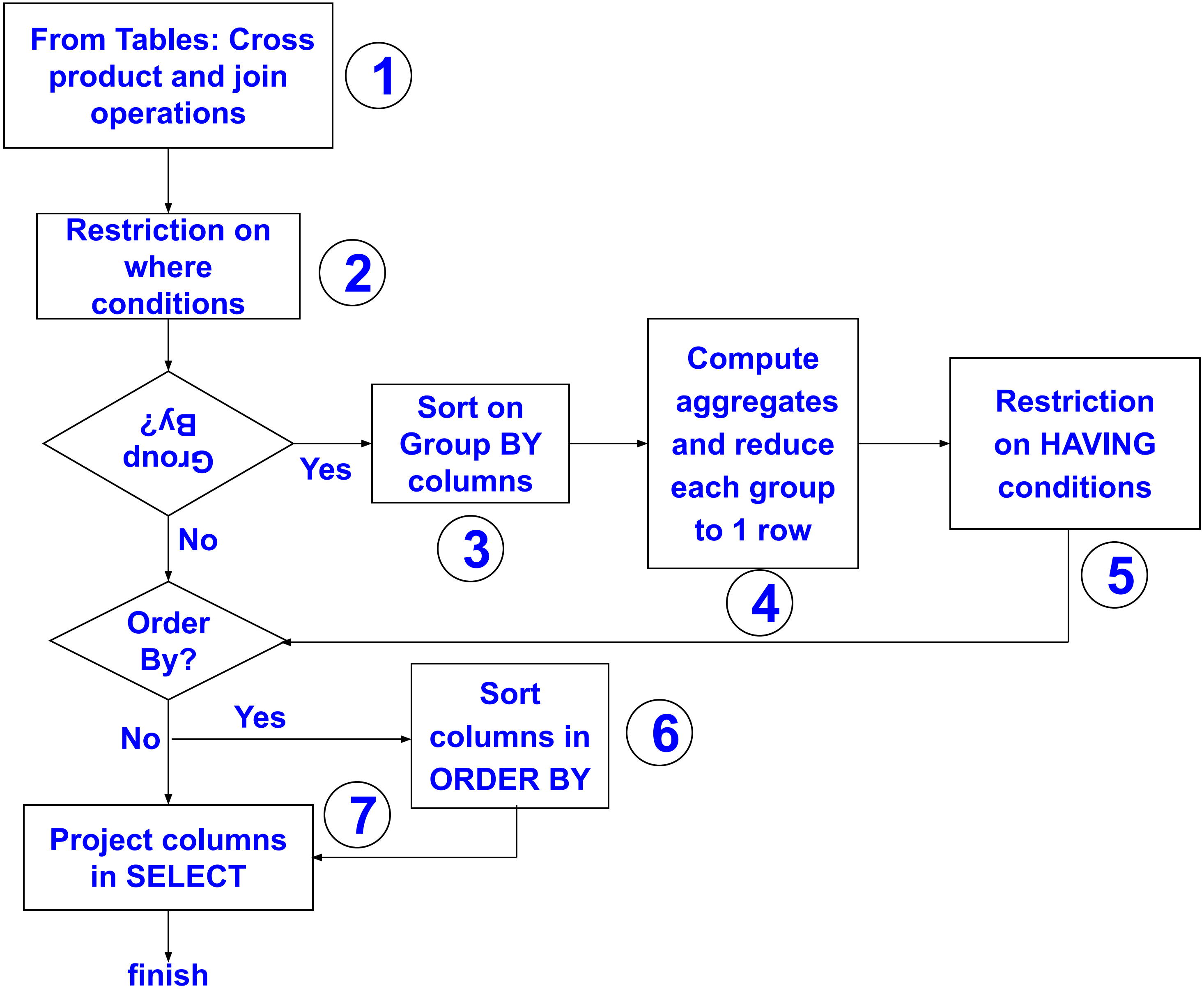
Where *<List of Row conditions joined together by And, Or, Not>*

Group By *<list of grouping columns>*

Having *<list of group conditions connected by And, Or, Not >*

Order By *<list of sorting specifications>*

Conceptual Evaluation



From Tables: Cross product and join operations

1

Restriction on where conditions

2

Group By?

Yes

Sort on Group BY columns

3

Compute aggregates and reduce each group to 1 row

4

Restriction on HAVING conditions

5

No

Order By?

Yes

Sort columns in ORDER BY

6

No

Project columns in SELECT

7

finish

SQL – DISTINCT

- Eliminates all the duplicate entries in the table resulting from the query.

Syntax:

```
        Select [DISTINCT] select_list
        From table[,  table, …]
        [Where expression]
        [Order By expression]
```

Example:

```
Select DISTINCT studio_id, director_id
From Movies
```

studio_id	director_id
1	1
2	2
2	10
3	1
3	9

SQL – Order By

- Used to sort the results based on contents of a column
- Multiple levels of sort can be done by specifying multiple columns
- An expression can be used in Order By clause

Syntax:

```
Select function(column)
    From table1 [, table2 …]
    [Where condition]
    [Order By {Column | alias | position} [ASC | DESC]]
```

SQL – Order By

Example: **Sort Movies by profits in Ascending order**

```
Select MovieTitle, Gross, Budget, (Gross – Budget) as profits
From movies
Order BY profits
```

Movie_title	**Gross**	**Budget**	**Profit**
Great Escape	67.5	70	-2.5
Upside Down	54	50	4
Green Warrior	96	80	16
Blue Oranges	28	7	21

Aggregate Queries – Group By

- Categorizes the query results according to the contents of a column in the database
- Multiple levels of subgroups can be created by specifying multiple columns

Syntax:

```
Select column1, [column2, …]
From table [, table …]
[Where condition]
Group By column1, [column2, ….]
Having [Condition]
```

Aggregate Queries – Group By

Example: Get # of movies by each director for each studio

```
Select studio_id, director_id, count(*)
From Movies
Group By director_id, studio_id
```

Example: Get # of movies by each studio ordered by studio_id

```
Select studio_id, count(*)
From Movies
Group By studio_id
Order By studio_id
```

Aggregate Queries – Group By

Example:

```
Select studio_id, Sum(budget)
From movies
Group  by studio_id
Having Sum(budget) > 60
```

Example:

```
Select studio_id, count(*)
      From Movies
      Group By studio_id
      Order By studio_id
```

Aggregate Queries

- Aggregate queries provides a more holistic view of the data by further processing the retrieved data.
- They can work on
  - On all the rows in a table
  - A subset of rows in a table selected using a where clause
  - Groups of selected data organized using Group By clause.

Syntax:

```
Select function(column)
  From <list of tables>
  Where <condition>
  Group By <list of columns>
  Having <condition>
```

Aggregate Queries

- Functions:
  - Sum() Returns a sum of the column
  - Count() Returns a total number of rows returned by a query
  - Avg() Returns the average of a column
  - Min() Returns minimum value of the column returned by query
  - Max() Returns maximum value of the column returned by query

Notes 1: Count function does not include columns containing null values in total

Notes 2: Count can be used with distinct to count the number of distinct rows

Example:

Query:

```
Select sum(budget)
From movies
Where studio_id = 3
```

Output:

```
Sum(budget)
---------------
65.1
```

SQL – Join

- A Join is a Query that combines data from multiple tables
  - Multiple tables are specified in the From Clause
  - For two tables to be joined in a sensible manner, they need to have data in common

Example:

Schema: Movies (movie_title, director_id, release_date)

People(person_fname, person_lname, person_id)

Query:

```
Select movie_title, person_fname, person_lname
From Movies, People
Where director_id = person_id
```

SQL – Joining Condition

- For a useful Join query a joining condition is required
  - Defined in where clause as relationships between columns
  - Multiple conditions may be defined if multiple columns shared
  - More than two tables can be joined in a query

Example: Find people who live in same state as studio

Schema:

```
Studios(studio_id, studio_state, studio_name, studio_city)
People(person_fname, person_lname, person_id, person_state, person_city)
```

Query:

```
Select person_fname, person_lname, studio_name
From Movies, People
Where studio_city = person_city
AND studio_state = person_state
```

SQL – More than two tables

Example: Get title, director, studio, city for all movies in the database

Schema:

Studios(studio_id, studio_state, studio_name, studio_city)

People(person_fname, person_lname, person_id, person_state, person_city)

Movies(movie_title, director_id, studio_id)

Query:

```
Select M.movie_title, M.studio_id, P.person_fname, P.person_lname,
    S.studio_city
From Movies M, People P, Studio S
Where M.director_id = P.person_id
AND M.studio_id = P.person_id
```

SQL – Self Join

- Required to compare values within a single column
  - Need to define aliases for the table names

Example: Find actors living in the same state

Schema:

People(person_fname, person_lname, person_id, person_state, person_city)

Query:

```
Select p1.person_id, p1.person_fname, p1.person_lname, p1.person_state
From People p1, People p2
Where p1.person_state = p2.person_state
AND p1.person_id != p2.person_id
```

Note: Distinct operator is critical because if there are more than two people from any state each person will appear as many times as there are people from the state

SQL-92 – Join

- More verbose than pervious versions of SQL
  - Need to define aliases for the table names
- Separates the condition for joining from condition for filtering

Example: Find actors living in the same state

Schema:

People(person_fname, person_lname, person_id, person_state, person_city)
Movies(movie_title, director_id, studio_id)

Query:

```
Select movie_title, person_fname, person_lname
From Movies INNER JOIN People
ON director_id = person_id

Select movie_title, person_fname, person_lname
From Movies INNER JOIN People
ON director_id = person_id
Where studio_id = 1
```

SQL-92 – Multiple Table Join

Example: Get title, director, studio, city for all movies in database

Schema:

Studios(studio_id, studio_state, studio_name, studio_city)

People(person_fname, person_lname, person_id, person_state, person_city)

Movies(movie_title, director_id, studio_id)

Query:

```
Select Movies.movie_title, Movies.studio_id, Person.person_fname,
    Person.person_lname, Studio.studio_city
From (People Inner Join
       (Movies Inner Join Studio
        On Studio.studio_id = Movie.studio_id)
        On Movie.director_id = Person.person_id
```

SQL-92 – Left/Right Join

Example:

Schema:

People(person_fname, person_lname, person_id, person_state, person_city)

Movies(movie_id, movie_title, director_id, studio_id)

Location(movie_id, city, state)

Query:

```
Select movie_title, city, state
From Movies Left Join Locations
    On Movies.movie_id = Locations.movie_id
```

Includes all non matched movie titles

```
Select movie_title, person_fname, person_lname
From Movies Right Join People
    On Movies.director_id = Person.person_id
```

Includes all people not matching to directors

Nested Queries

- A sub query is a query nested within another query
  - The enclosing query also called outer query
  - Nested query is called inner query
- There can be multiple levels of nesting

Example:

```
Select movie_title
From movies
Where director_id IN (
        Select person_id
        From People
        Where person_state = ‘TX’)
```

Nested Queries - Types

Non-Correlated Sub Queries:

- Requires data required by outer query before it can be executed
- Inner query does not contain any reference to outer query
- Behaves like a function

Example:

People(person_fname, person_lname, person_id, person_state, person_city)

Movies(movie_id, movie_title, director_id, studio_id)

```
Select movie_title, studio_id
        From Movies
        Where director_id IN (
                Select person_id
                From People
                Where person_state = ‘TX’)
```

Steps:

1. Subquery is executed
2. Subquery results are plugged into the outer query
3. The outer query is processed

Nested Queries - Types

Correlated Sub Queries:

- Contains reference to the outer query
- Behaves like a loop

Example:

People(person_fname, person_lname, person_id, person_state, person_city)
Cast_Movies(cast_member_id, role, movie_id)

```
Select person_fname, person_lname
From People p1
Where 'Pam Green' in (
        Select role
        From Cast_Movies
        Where p1.person_id = cast_member_id
)
```

Steps:

- Contents of the table row in outer query are read
- Sub-query is executed using data in the row being processed.
- Results of the inner query are passed to the where in the outer query
- The Outer query is Processed

Equivalent Join Query

Example:

People(person_fname, person_lname, person_id, person_state, person_city)
Cast_Movies(cast_member_id, role, movie_id)

```
Select person_fname, person_lname
From People, Cast_Movies
Where Cast_member_id = person_id
      And role = ‘Pam Green’
```