



Module 4

Basic Query Formulation with SQL

Lesson 5: GROUP BY Clause



Lesson Objectives

- Write SELECT statements containing the GROUP BY clause
- Write SELECT statements with WHERE and HAVING clauses
- Write natural language explanations about SELECT statements containing the GROUP BY clause



Row Summaries

- Important for decision-making tasks
- Row summary details
 - Result contains statistical (aggregate) functions
 - Conditions involve statistical functions
- SQL keywords
 - Aggregate functions in the result list such as AVG and SUM
 - GROUP BY: summary columns
 - HAVING: summary conditions



Individual Rows versus Row Summaries

Example 1: Sort faculty by rank

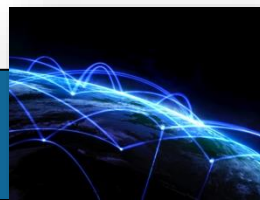
```
SELECT FacNo, FacRank, FacSalary
FROM Faculty
ORDER BY FacRank;
```

FACNO	FACRANK	FACSalary
-----	-----	-----
654-32-1098	ASSC	70000
987-65-4321	ASSC	75000
876-54-3210	ASST	40000
098-76-5432	ASST	35000
765-43-2109	PROF	65000
543-21-0987	PROF	120000

Example 2: Compute average salary for each faculty rank

```
SELECT FacRank,
       AVG(FacSalary) AS AvgSalary
FROM Faculty
GROUP BY FacRank
ORDER BY FacRank;
```

FACRANK	AVGSALARY
-----	-----
ASSC	72500
ASST	37500
PROF	92500



Filtering Rows and Groups

Example 3: List average GPA by major for upper class students

```
SELECT StdMajor, AVG(StdGPA) AS AvgGpa
FROM Student
WHERE StdClass IN ('JR', 'SR')
GROUP BY StdMajor;
```

STDMAJOR	AVGGPA
-----	-----
ACCT	3.50
FIN	2.80
IS	3.15

Example 4: List average GPA by major for upper class students
in which average GPA is greater than 3.1.

```
SELECT StdMajor, AVG(StdGPA) AS AvgGpa
FROM Student
WHERE StdClass IN ('JR', 'SR')
GROUP BY StdMajor
HAVING AVG(StdGPA) > 3.1;
```

STDMAJOR	AVGGPA
-----	-----
ACCT	3.50
IS	3.15



Syntax Errors with WHERE/HAVING

Example 5: Misplaced row condition

```
SELECT StdMajor, AVG(StdGPA) AS AvgGpa
FROM Student
GROUP BY StdMajor
HAVING AVG(StdGPA) > 3.1
      AND StdClass IN ('JR', 'SR');
```

Oracle error message

Not a GROUP BY expression

PostgreSQL error message:

"student.stdclass" must appear in the GROUP BY clause

Example 6: Misplaced row summary condition

```
SELECT StdMajor, AVG(StdGPA) AS AvgGpa
FROM Student
WHERE StdClass IN ('JR', 'SR')
      AND AVG(StdGPA) > 3.1
GROUP BY StdMajor;
```

Oracle error message

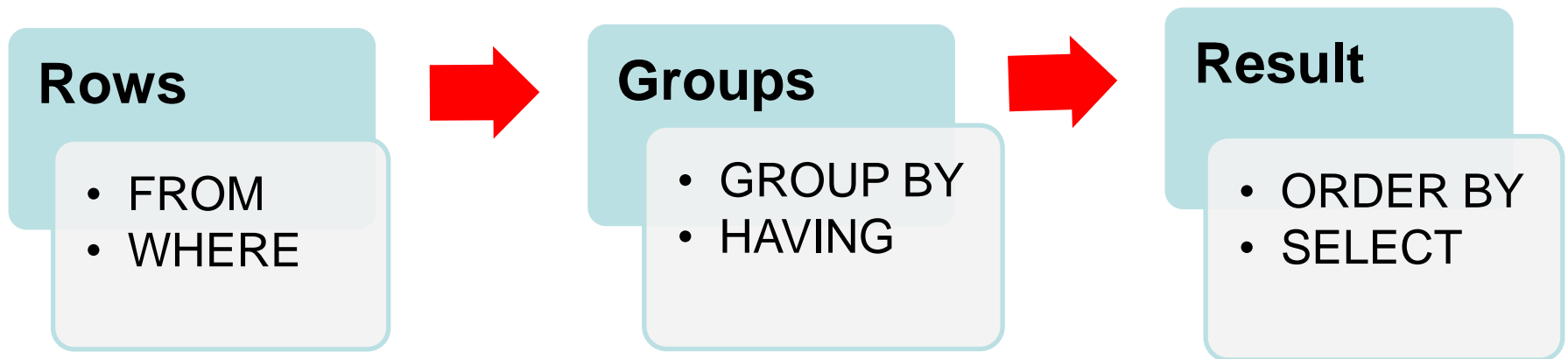
group function is not allowed here

PostgreSQL error message

aggregate functions are not allowed in WHERE



Query Clause Evaluation Order



Evaluation Order Lessons

- Row operations before group operations
 - FROM and WHERE before GROUP BY and HAVING
 - Check row operations first
- Grouping occurs only one time
- Use small sample tables



Summary

- Summarization queries common for business intelligence
- GROUP BY clause to calculate summary data for decision making
- Grouping after joins and row conditions
- Extensions to GROUP BY operator business intelligence queries

