National University of Computer and Emerging Sciences

Lab Manual 5

"Nested Queries"

Database Systems

Spring 2022

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Contents

Objective

- The purpose of this manual is to get stared with data retrieval queries, starting from Simple Join operation, covering Order by clause and Aggregate functions, Group by.

Pre-requisites

- Lab 2 manual, on how to get started with MS-SQL server
- How Select from Where clause work
- How Joining and all its type work
- How Order by clause works
- Aggregate functions, Group by

Task Distribution

Total Time	170 Minutes
Joining	15 Minutes
Group by	15 Minutes
Exercise	100 Minutes
Evaluation	Last 30 Minutes

1.

1. Nested Queries

A subquery (inner query) is a SQL select query nested inside a another select query (outer query)

A subquery may occur in:

- SELECT clause of outer query
- FROM clause of outer query
- WHERE clause of outer query (most commonly used)

A subquery can be nested inside:

- SELECT statement
- INSERT statement
- UPDATE statement
- DELETE statement
- Another subquery.

There are two types of subqueries

- Correlated subqueries: where we use some attribute of outer query in inner query, result of inner query will then change according to the attribute of outer query.
- Non-correlated Subqueries: where no attribute of outer query is used in inner query, in this case inner query always return same value

Scalar Vs Non-scalar

A select query can return a scalar value or a table. Scalar value means one column and one row
Example: result of the following query is scalar

```
Select top 1 StudentID from Students
```

Results | Messages

StudentID
1

A select query can also return non-scalar value, with more than one column and/or more than one row
Example:

```
Select StudentID from Students
```

Will give non-scalar result.

If you are writing a sub query in Select Clause, the inner query should be Scalar
If you are writiing a subquey in From Clause, inner query can be scalar or non-Scalar
If you are writing a subquery in Where Clause, inner query can be scalar or non-Scalar depending on conditon.

Non-Correlated Query:

Non-Correlated Subqueries in SELECT clause

```
SELECT <List of columns of T>
      (select ColumnName from <TableName>)
FROM <tablename> AS T
WHERE <condition>
**inner query should be scalar
```

TRY IT: Non-correlated nested query in Select is not very useful

```
select  StudentName, StudentID,
    (Select top 1 StudentName from Students)
from Students
```

Results | Messages

StudentName	StudentID	(No column name)
Ali	1	Ali
Aysha	2	Ali
Ahmed	3	Ali
Bilal	4	Ali
Zafar	5	Ali

Non-Correlated Subqueries in From Clause

```
SELECT <List of columns of T ( result of inner query)>
FROM (select ColumnName from <TableName>) as T WHERE <condition>
**inner query can be scalar of non-scalar
***always give alias to inner query in from clause
```

TRY THIS

```
select  *
from
( select StudentName, CourseID, GPA From
    Students S inner join Registration R on R.StudentID=S.StudentID
) as T
```

Results | Messages

StudentName	CourseID	GPA
Ali	1	3
Ali	3	3
Ali	4	2
Ali	5	3
Aysha	1	2.5
Aysha	2	0
Aysha	4	3

Non-Correlated Subqueries in Where Clause

```
SELECT <List of columns of T >
FROM TableName as T
WHERE <condition> (select ColumnName from <TableName>)
```

TRY THIS

```
--select all the teachers that are taking some course
Select * from Instructors
where InstructorID in (Select InstructorID from Courses)
```

Results | Messages

InstructorID	InstructorsName
1	Zafar
2	Sadia

Correlated queries

When inner query is correlated with outer query, then the inner query is executed for each row of outer query.

Correlated Subquery in Select Clause

TRY THIS

```
--Give name of all the students and there GPA in Database Course,
--show null if student has not registed in DB
Select S.StudentName,
    (
    Select GPA from Registration as R
    inner join Courses C on R.CourseID=C.CourseID
    where R.StudentID=S.StudentID
          and C.CourseName='Database'
    ) AS [GPA in DB]
from students S
```

This inner query will get the grade of each row of outer query.

Results | Messages

StudentName	GPA in DB
Ali	2
Aysha	3
Ahmed	NULL
Bilal	NULL
Zafar	NULL

Correlated Subquery in Where Clause

TRY THIS

```
--Select Names of all the students with Grade Higher GPA 2 in any course
Select *
from Students S
where exists
        (Select * from
        Registration R
        where R.StudentID=S.StudentID
        and GPA>2)
```

Results | Messages

StudentID	StudentName	StudentBatch	CGPA
1	Ali	2013	3.3
2	Aysha	2013	4

** WHAT DOES THE EXIST CLAUSE DO?

Correlated Subquery in Having Clause

You can also use subquery in having clause (correlated on non-correlated)

TRY THIS

```
--select name and IDs of all the students with CGPA given in student table not equal to calcuated CGPA
SELECT StudentName, S.StudentID
FROM Students S left join Registration R on R.StudentID=S.StudentID
    left join Courses C on C.CourseID=R.CourseID
GROUP BY StudentName, S.StudentID
HAVING isnull(SUM(C.CourseCreditHours* R.GPA)/ SUM(C.CourseCreditHours),0) !=
        (Select CGPA from Students S2 where S2.StudentID=S.StudentID  )
```

Results | Messages

StudentName	StudentID
Aysha	2
Ahmed	3
Bilal	4
Zafar	5

Modify the query given above to, Shown name, IDs, Calcuated CGPA and CGPA given in Student table of all the students with CGPA given in student table lesser to calcuated CGPA

**Refer to the slides on Neste Queries for more details