




3: Using joins and subqueries



© Copyright Microsoft Corporation. All rights reserved.

Agenda

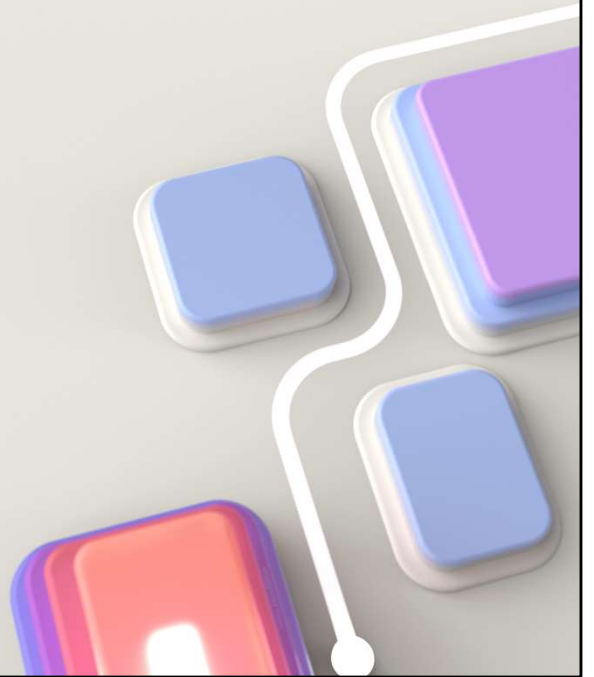


- Using joins
- Using subqueries

© Copyright Microsoft Corporation. All rights reserved.

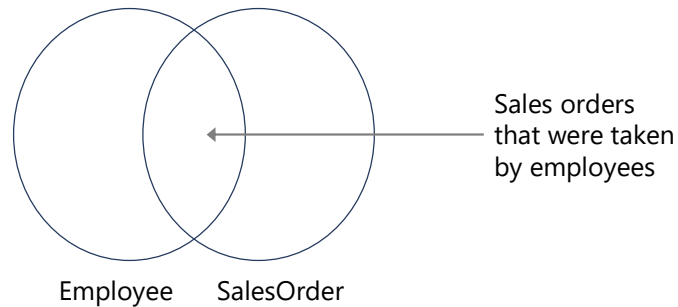
1: Using joins

© Copyright Microsoft Corporation. All rights reserved.



Join concepts

It can help to think of the tables as sets in a Venn diagram



Combine rows from multiple tables by specifying matching criteria

Usually based on primary key – Foreign key relationships

For example, return rows that combine data from the **Employee** and **SalesOrder** tables by matching the **Employee.EmployeeID** primary key to the **SalesOrder.EmployeeID** foreign key

© Copyright Microsoft Corporation. All rights reserved.

Join syntax

ANSI SQL-92

- Tables joined by JOIN operator in FROM clause
 - Preferred syntax

```
SELECT ...  
FROM Table1 JOIN Table2  
      ON <predicate>;
```

ANSI SQL-89

- Tables listed in FROM clause with join predicate in WHERE clause
 - Not recommended: can lead to accidental Cartesian products!

```
SELECT ...  
FROM   Table1, Table2  
WHERE  <predicate>;
```

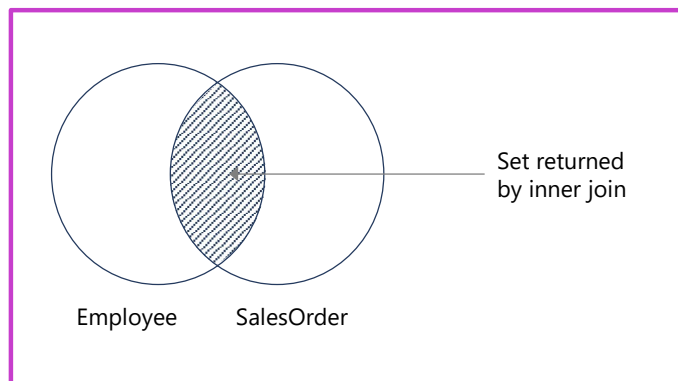
© Copyright Microsoft Corporation. All rights reserved.

Inner joins

Return only rows where a match is found in both input tables

- Match rows based on criteria supplied in the join predicate
- If join predicate operator is =, also known as *equi-join*

```
SELECT emp.FirstName, ord.Amount  
FROM HR.Employee AS emp  
[INNER] JOIN Sales.SalesOrder AS ord  
ON emp.EmployeeID = ord.EmployeeID
```



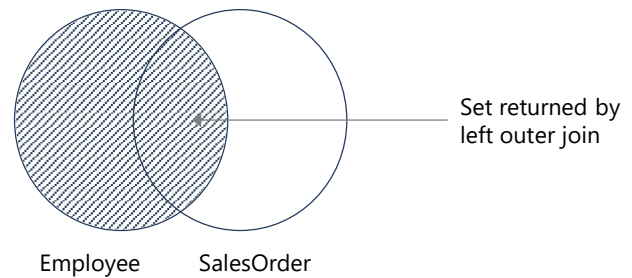
© Copyright Microsoft Corporation. All rights reserved.

Outer joins

Return all rows from one table and any matching rows from second table

- Outer table's rows are "preserved"
 - Designated with LEFT, RIGHT, FULL keyword
 - All rows from preserved table output to result set
- Matches from inner table retrieved
- NULLs added in places where attributes do not match

```
SELECT emp.FirstName, ord.Amount
FROM HR.Employee AS emp
LEFT [OUTER] JOIN Sales.SalesOrder AS ord
ON emp.EmployeeID = ord.EmployeeID;
```



© Copyright Microsoft Corporation. All rights reserved.

Cross joins

Combine all rows from both tables

- All possible combinations output
- Logical foundation for inner and outer joins
 - Inner join starts with Cartesian product, adds filter
 - Outer join takes Cartesian output, filtered, adds back non-matching rows (with NULL placeholders)

Cartesian product output is typically undesired

- Some useful exceptions:
 - Table of numbers
 - Generating data for testing

© Copyright Microsoft Corporation. All rights reserved.

Employee	
EmployeeID	FirstName
1	Dan
2	Aisha

Product	
ProductID	Name
1	Widget
2	Gizmo

```
SELECT emp.FirstName, prd.Name
FROM HR.Employee AS emp
CROSS JOIN Production.Product AS prd;
```

Result	
FirstName	Name
Dan	Widget
Dan	Gizmo
Aisha	Widget
Aisha	Gizmo

Self joins

- Compare rows in a table to other rows in same table
- Create two instances of same table in FROM clause
 - At least one alias required

© Copyright Microsoft Corporation. All rights reserved.

Employee		
EmployeeID	FirstName	ManagerID
1	Dan	NULL
2	Aisha	1
3	Rosie	1
4	Naomi	3

```
SELECT emp.FirstName AS Employee,  
       man.FirstName AS Manager  
FROM HR.Employee AS emp  
LEFT JOIN HR.Employee AS man  
      ON emp.ManagerID = man.EmployeeID;
```

Result	
Employee	Manager
Dan	NULL
Aisha	Dan
Rosie	Dan
Naomi	Rosie

Lab: Query multiple tables with joins

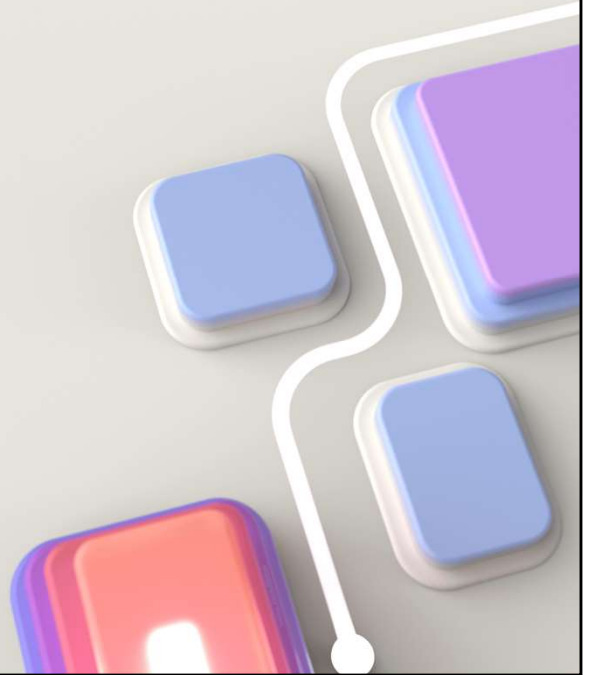


- Use inner joins
- Use outer joins
- Use a cross join
- Use a self join

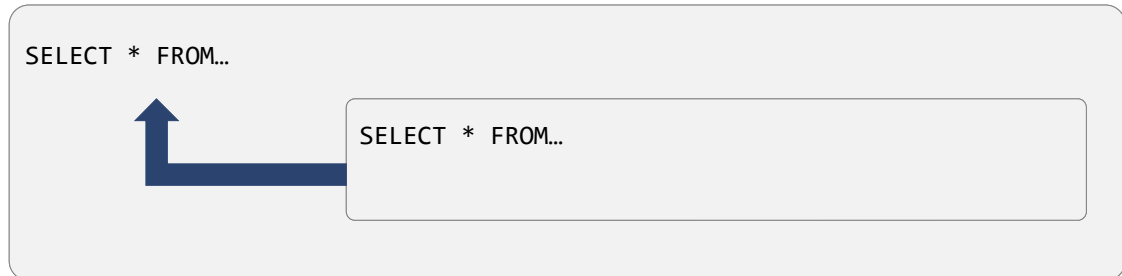
© Copyright Microsoft Corporation. All rights reserved.

Lesson 2: Using subqueries

© Copyright Microsoft Corporation. All rights reserved.



Introduction to subqueries



Subqueries are nested queries: queries within queries

Results of inner query passed to outer query

- Inner query acts like an expression from perspective of the outer query

© Copyright Microsoft Corporation. All rights reserved.

Scalar or multi-valued subqueries?

Scalar subquery returns single value to outer query

- Can be used anywhere single-valued expression is used: SELECT, WHERE, and so on

```
SELECT SalesOrderID, ProductID, OrderQty
FROM Sales.SalesOrderDetail
WHERE SalesOrderID =
    (SELECT MAX(SalesOrderID)
     FROM Sales.SalesOrderHeader);
```

Multi-valued subquery returns multiple values as a single column set to the outer query

- Used with IN predicate

```
SELECT CustomerID, SalesOrderID
FROM Sales.SalesOrderHeader
WHERE CustomerID IN (
    SELECT CustomerID
    FROM Sales.Customer
    WHERE CountryRegion = 'Canada');
```

© Copyright Microsoft Corporation. All rights reserved.

Self-contained or correlated subqueries?

Most subqueries are self-contained and have no connection with the outer query other than passing results to it

Correlated subqueries refer to elements of tables used in outer query

- Dependent on outer query, cannot be executed separately
- Behaves as if inner query is executed once per outer row
- May return scalar value or multiple values

© Copyright Microsoft Corporation. All rights reserved.

```
SELECT SalesOrderID, CustomerID, OrderDate
FROM SalesLT.SalesOrderHeader AS o1
WHERE SalesOrderID =
    (SELECT MAX(SalesOrderID)
     FROM SalesLT.SalesOrderHeader AS o2
     WHERE o2.CustomerID = o1.CustomerID)
ORDER BY CustomerID, OrderDate;
```

Lab: Use subqueries



- Use simple subqueries
- Use correlated subqueries

© Copyright Microsoft Corporation. All rights reserved.

Review



- 1** You must return a list of all sales employees that have taken sales orders. Employees who have not taken sales orders should not be included in the results. Which type of join is required?
 - ☒ INNER
 - ☐ LEFT OUTER
 - ☐ FULL OUTER

- 2** What does the following query return?
`SELECT p.Name, c.Name FROM Store.Product AS p CROSS JOIN Store.Category AS c;`
 - ☐ Only data rows where the product name is the same as the category name.
 - ☐ Only rows where the product name is not the same as the category name.
 - ☒ Every combination of product and category name.

- 3** A correlated subquery...
 - ☐ Returns a single scalar value
 - ☐ Returns multiple columns and rows
 - ☒ References a value in the outer query

© Copyright Microsoft Corporation. All rights reserved.

Use the slide animation to reveal the correct answers.



© Copyright Microsoft Corporation. All rights reserved.