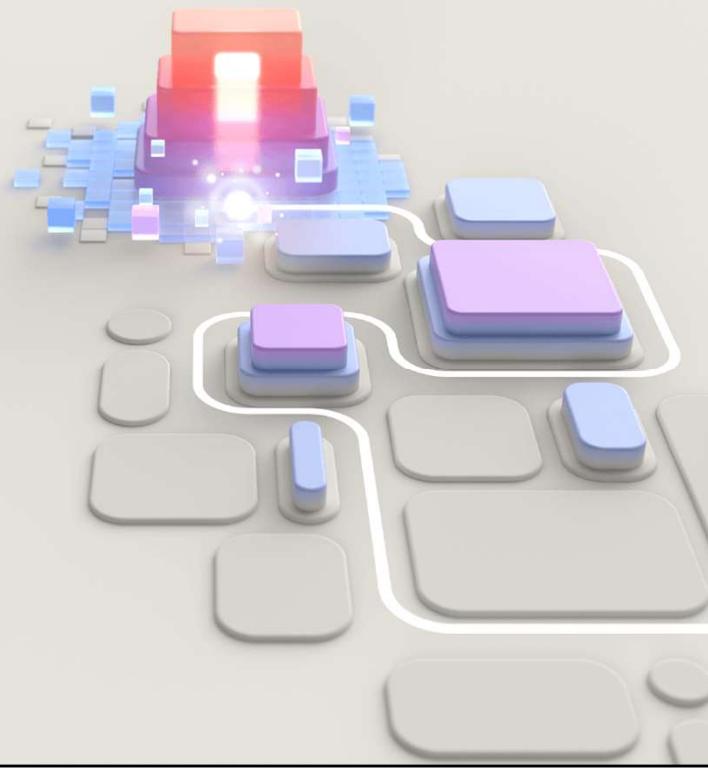


3: Using joins and subqueries



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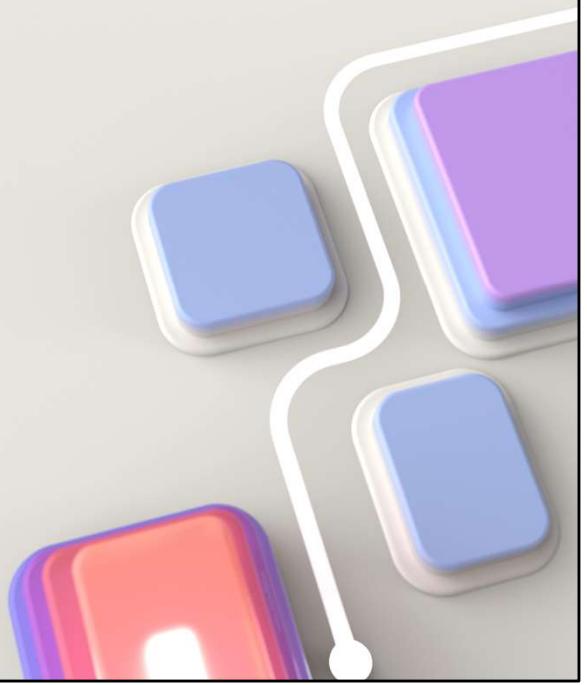
Agenda

- Using joins
- Using subqueries

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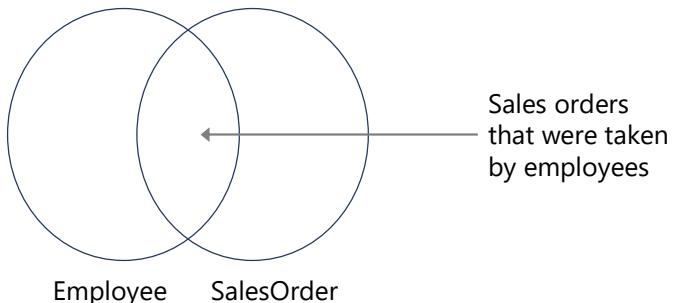
1: Using joins

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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

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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>;
```

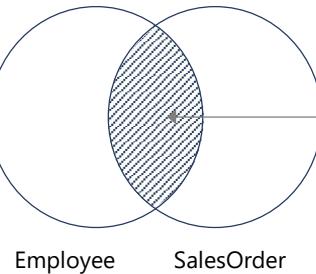
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Inner joins

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
```



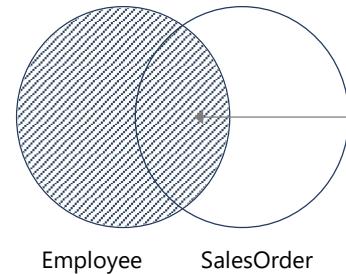
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Outer joins

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;
```



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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

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Employee		Product	
EmployeeID	FirstName	ProductID	Name
1	Dan	1	Widget
2	Aisha	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

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

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Lab: Query multiple tables with joins

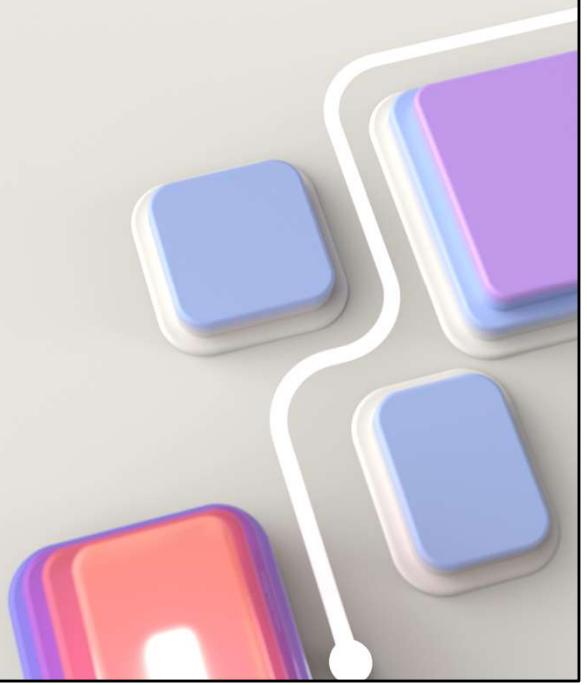


- Use inner joins
- Use outer joins
- Use a cross join
- Use a self join

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Lesson 2: Using subqueries

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Introduction to subqueries

```
SELECT * FROM...
```



```
SELECT * FROM...
```

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

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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');
```

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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

```
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;
```

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Lab: Use subqueries



- Use simple subqueries
- Use correlated subqueries

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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

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Use the slide animation to reveal the correct answers.



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