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Multi-Table Queries

- To combine columns from several tables into a result table, we need to use a join operation.
- To perform a join, we include more than one table name in the FROM clause and WHERE clause to specify the join columns.

Joins in SQL

- ➤ By using joins, you can retrieve data from two or more tables based on logical relationships between the tables.
- > A join condition defines the way two tables are related in a query by:

Specifying the column from each table to be used for the join. A typical join condition specifies a foreign key from one table and its associated key (Primary Key) in the other table.

Specifying a logical operator (for example, = or <>,) to be used in comparing values from the columns.

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Computing a Join

A join is a subset of the Cartesian product.

The Cartesian product of two tables is another table consisting of all possible pairs of rows from the two table.

The columns of the product table are all the columns of the first table followed by all the columns of the second table.

Format of SELECT statement for the Cartesian product:

```
SELECT [DISTICNT | ALL] {* | column_list }
FROM table name1 CROSS JOIN table name2;
```



Join Example

BRANCH

BranchNo	bCity			
B003	Glasgow			
B004	Bristol			
B002	London			

PROPERTY

PropertyNo	pCity
PA14	Aberdeen
PL94	London
PG4	Glasgow

BranchNo	bCity	PropertyNo	pCity
B003	Classow	PG4	01
B003	Glasgow		Glasgow
D002	London	PL94	London

SELECT b.*, p.*

FROM branch b, property p

WHERE b.bcity = p.pcity;

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Joins in SQL

Join Types:

INNER JOIN (Simple Join). An SQL INNER JOIN return all rows from multiple tables where the join condition is met. We can use it in FROM and WHERE Clause.

OUTER JOIN:

LEFT JOIN: Return all rows from the left table, and the matched rows from the right table

RIGHT JOIN: Return all rows from the right table, and the matched rows from the left table

FULL JOIN: Return all rows when there is a match in ONE of the tables



Inner Join / Simple Join

In the ISO standard, inner joins can be specified in either the FROM or WHERE clause. This is the only type of join that ISO supports in the WHERE clause. Inner joins specified in the WHERE clause are known as old-style inner joins.

STAFF (sno, fname, lname, position, gender, DOB, salary, bno) BRANCH (bno, street, city, postcode)

Example:

List the names of all staff members along with their branch addresses.

Alternative:

FROM staff WHERE s.bno = b.bno;

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Inner Join / Simple Join

This inner join is known as an equi-join. It will returns all the columns in both tables, and returns only the rows for which there is an equal value in the join column.

Result:

	sno	fname	salary	bno	bno	street
1	s001	Naeem	80000.00	ь001	ь001	17 - C Johar Town
2	s002	.: Rehmat	50000.00	ь001	ь001	17 - C Johar Town
3	s003	Shakoor	30000.00	ь001	ь001	17 - C Johar Town
4	s004	Kamal	75000.00	b002	b002	45 - A Model Town
5	s005	Saima	45000.00	ь002	ь002	45 - A Model Town
6	s006	Yaseen	70000.00	ь003	ь003	122 - C Model Town
7	s007	Irfan	40000.00	ь003	ь003	122 - C Model Town
8	s008	Subhan	25000.00	ь004	ь004	21 - Gulberg III



Inner Join / Simple Join

Joining more than two tables:

PROPERTYFORRENT (pno, street, area, city, pcode, type, rooms, rent, sno) STAFF (sno, fname, Iname, position, gender, DOB, salary, bno) BRANCH (bno, street, city, postcode)

Example:

List the names of all staff members along with their branch addresses working on some property.

SELECT b.bno, b.street, s.sno, s.fname, s.position, p.pno, p.street AS Location, p.sno AS P_Sno, p.area

FROM staff s INNER JOIN

branch b ON b.bno = s.bno INNER JOIN

propertyforrent p ON s.sno = p.sno

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Inner Join / Simple Join

Joining more than two tables:

Alternative:

SELECT b.bno, b.street, s.sno, s.fname, s.position, p.pno, p.street AS Location, p.sno AS P_Sno, p.area

from staff s ,branch b, propertyforrent p where s.bno = b.bno and s.sno = p.sno

Result:

	bno	street	sno	fname	position	pno	Location	P_Sno	area
1	ь001	17-C	s003	Shakoor	Supervisor	p001	23 - A	s003	Johar Town
2	ь001	17-C	s003	Shakoor	Supervisor	p002	45 - B	s003	Johar Town
3	ь001	17 - C	s002	Rehmat	Assistant	p003	34 - B	s002	Johar Town
4	ь002	45 - A	s004	Kamal	Manager	p004	87 - A	s004	Model Town
5	b002	45 - A	s004	Kamal	Manager	p005	272 - B	s004	Model Town
6	ь003	122 - C	s007	Irfan	Assistant	p006	32 - C	s007	Model Town



Inner Join / Simple Join

You can also use other comparison / arithmetic operators within the where clause in joins to further specify the required data.

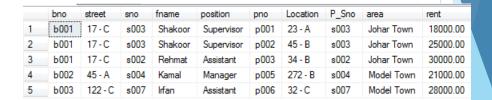
The following example uses a less-than (<) join to find sales prices of product 718 that are less than the list price recommended for that product.

Example:

List the names of all staff members along with their branch addresses working on some property where rent is less than 35000.

SELECT b.bno, b.street, s.sno, s.fname, s.position,
p.pno, p.street AS Location, p.sno AS P_Sno,
p.area, p.rent
FROM staff s INNER JOIN
branch b ON b.bno = s.bno INNER JOIN
propertyforrent p ON s.sno = p.sno
WHERE p.rent < 35000

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Sorting a Join

PROPERTYFORRENT (pno, street, area, city, pcode, type, rooms, rent, sno) STAFF (sno, fname, Iname, position, gender, DOB, salary, bno) BRANCH (bno, street, city, postcode)

Example:

For each branch office, list the names of staff who manage properties, and the properties they manage, ordered by branch number, staff number and property number.

```
SELECT s.bno, s.sno, fname, lname, pno
FROM staff s, propertyforrent p
WHERE s.sno = p.sno
ORDER BY s.bno, s.sno, p.pno;
```

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	bno	sno fname		Iname	pno
1	ь001	s002	Rehmat	Elahi	p003
2	ь001	s003	Shakoor	Ahmad	p001
3	ь001	s003	Shakoor	Ahmad	p002
4	ь002	s004	Kamal	NULL	p004
5	ь002	s004	Kamal	NULL	p005
6	ь003	s007	Irfan	Asghar	p006

Question

Assume the following relational schema:

EMPLOYEE (Fname, Lname, <u>SSN</u>, DOB, Address, gender, salary, <u>DeptNo</u>)
DEPARTMENT (Dname, <u>DNo</u>)
PROJECT (PName, <u>PNo</u>, PLocation, <u>Dno</u>)
WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours)

List all employees and identify the projects they are working on, ordered by department and, within each department, ordered alphabetically by last name, first name.

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	bno	sno	count
1	ь001	s002	1
2	ь001	s003	2
3	ь002	s004	2
4	ь003	s007	1

Outer Join

The **join** operation combines data from two tables by forming pairs of related rows where the matching columns in each table have the same value. If one row of a table is unmatched, the row is omitted from the result table.

Outer join include the unmatched rows in the result table.

Three types of outer join:

- Left Outer Join or Left Join
- Right Outer Join or Right Join
- Full Outer Join or Full Join

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Outer Join

Inner joins return rows only when there is at least one row from both tables that matches the join condition.

Inner joins eliminate the rows that do not match with a row from the other table.

Outer joins, however, return all rows from at least one of the tables or views mentioned in the FROM clause, as long as those rows meet any WHERE or HAVING search conditions.

All rows are retrieved from the left table referenced with a left outer join, and all rows from the right table referenced in a right outer join.

All rows from both tables are returned in a full outer join.

SQL Server uses the following ISO keywords for outer joins specified in a FROM clause:

Left Outer Join

PROPERTYFORRENT (pno, street, area, city, pcode, type, rooms, rent, sno) STAFF (sno, fname, lname, position, sex, DOB, salary, bno) BRANCH (bno, street, city, postcode)

Example:

List the staff members and properties on which they are working with any unmatched staff members.

SELECT s.sno, s.fname, s.bno, p.pno, p.area, p.city
FROM staff s LEFT OUTER JOIN propertyforrent p
ON s.sno = p.sno;

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STAFF

	sno	fname	Iname	position	sex	DOB	salary	bno	address
1	s001	Naeem	Luqman	Manager	M	1970-06-12	80000.00	ь001	H# 21 - Employeer Society Model Town Link Road L
2	s002	Rehmat	Elahi	Assistant	M	1982-08-19	50000.00	ь001	45 - Govt Society Johan Town Lahore
3	s003	Shakoor	Ahmad	Supervisor	M	1987-02-08	30000.00	ь001	33 - A Iqbal Avenue Lahore
4	s004	Kamal	NULL	Manager	M	1980-03-19	75000.00	ь002	45% - J Johar Town Lahore
5	s005	Saima	Asghar	Assistant	F	1983-09-28	45000.00	ь002	H# 561 - Y Block Defence Lahore
6	s006	Yaseen	Ahmad	Manager	M	1985-07-03	70000.00	ь003	61 - X Block Defence Lahore
7	s007	Irfan	Asghar	Assistant	M	1987-10-15	40000.00	ь003	233 - Izmir Society Canal Bank Lahore
8	s008	Subhan	NULL	Supervisor	M	1983-09-28	25000.00	NULL	445 - B Johar Town Lahore
9	s009	Naeem	Ramazan	Manager	M	1987-02-08	65000.00	NULL	21 - Zikriya Town Multan
10	s010	Irfan	Ali	Supervisor	M	NULL	25000.00	NULL	45 - Near 9 No Chowk Multan

Propertyforrent

	pno	street	area	city	pcode	type	rooms	rent	sno
1	p001	23 - A	Johar Town	Lahore	54000	Flat	3	18000.00	s003
2	p002	45 - B	Johar Town	Lahore	54000	House	5	25000.00	s003
3	p003	34 - B	Johar Town	Lahore	54000	House	5	30000.00	s002
4	p004	87 - A	Model Town	Lahore	54300	House	6	35000.00	s004
5	p005	272 - B	Model Town	Lahore	54300	Flat	4	21000.00	s004
6	p006	32 - C	Model Town	Lahore	54200	House	4	28000.00	s007
7	p007	99 - A	Gulgusht	Multan	60000	House	4	18000.00	NULL
8	p008	34 - B	Shah Shamas Colony	Multan	60000	House	5	20000.00	NULL

Result

	sno	fname	bno	pno	area	city
1	s001	Naeem	ь001	NULL	NULL	NULL
2	s002	Rehmat	ь001	p003	Johar Town	Lahore
3	s003	Shakoor	ь001	p001	Johar Town	Lahore
4	s003	Shakoor	ь001	p002	Johar Town	Lahore
5	s004	Kamal	b002	p004	Model Town	Lahore
6	s004	Kamal	b002	p005	Model Town	Lahore
7	s005	Saima	b002	NULL	NULL	NULL
8	s006	Yaseen	ь003	NULL	NULL	NULL
9	s007	Irfan	ь003	p006	Model Town	Lahore
10	s008	Subhan	NULL	NULL	NULL	NULL
11	s009	Naeem	NULL	NULL	NULL	NULL
12	s010	Irfan	NULL	NULL	NULL	NULL

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Question

Assume the following relational schema:

PROPERTYFORRENT (pno, street, area, city, pcode, type, rooms, rent, sno) STAFF (sno, fname, Iname, position, sex, DOB, salary, bno) BRANCH (bno, street, city, postcode)

List all staff members and branches in which they are working and the unmatched staff members.

Answer to Question

SELECT s.sno, s.fname, s.bno, b.bno, b.area, b.city FROM staff s LEFT OUTER JOIN branch b ON s.bno = b.bno;

	sno	fname	bno	bno	area	city
1	s001	Naeem	ь001	ь001	Johar Town	Lahore
2	s002	Rehmat	ь001	b001	Johar Town	Lahore
3	s003	Shakoor	ь001	ь001	Johar Town	Lahore
4	s004	Kamal	b002	b002	Model Town	Lahore
5	s005	Saima	b002	b002	Model Town	Lahore
6	s006	Yaseen	ь003	b003	Model Town	Lahore
7	s007	Irfan	b003	b003	Model Town	Lahore
8	s008	Subhan	NULL	NULL	NULL	NULL
9	s009	Naeem	NULL	NULL	NULL	NULL
10	s010	Irfan	NULL	NULL	NULL	NULL

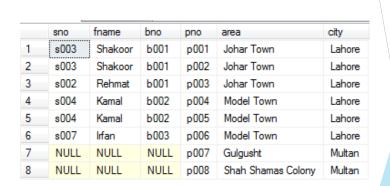
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Right Outer Join

Example:

List the staff members and properties on which they are working with unmatched staff or properties.

SELECT s.sno, s.fname, s.bno, p.pno, p.area, p.city
FROM staff s RIGHT OUTER JOIN propertyforrent p
ON s.sno = p.sno;



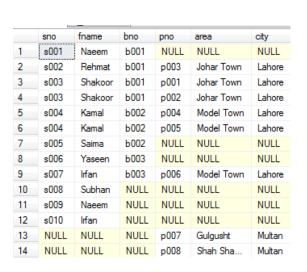
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Full Outer Join

Example:

List the branch offices and properties that are in the same city and unmatched branches or properties.

SELECT s.sno, s.fname, s.bno, p.pno, p.area, p.city
FROM staff s FULL OUTER JOIN propertyforrent p
ON s.sno = p.sno;





Question

Assume the following relational schema:

EMPLOYEE (Fname, Lname, <u>SSN</u>, DOB, Address, Sex, salary, <u>DeptNo</u>) DEPARTMENT (Dname, <u>DNo</u>) PROJECT (PName, <u>PNo</u>, PLocation, <u>Dno</u>) WORKS_ON(<u>SSN</u>, <u>PNo</u>, Hours)

Retrieve the names of employees who works on no project.

INSERT with subqueries

STAFF(sno, fname, Iname, position, sex, DOB, salary, bno)
PROPERTYFORRENT(Pno, street, city, postcode, type, rooms, rent, ono, sno, bno)
StaffPropCount(sno, fname, Iname, propcount)

Example:

Insert rows into the StaffPropCount table using the staff and property_for_rent tables.

```
INSERT INTO staffPropCount
(SELECT s.sno, fname, lname, COUNT(*)
FROM staff s, PropertyForRent p
WHERE s.sno = p.sno
GROUP BY s.sno, fname, lname)
```

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For further reading

http://technet.microsoft.com/en-us/library/ms191517(v=sql.105).aspx