

Introduction

In lab session 2, we learned different ways to retrieve data from a single table. However, we frequently need data from more than one tables

For example, suppose we need a report that displays



The first three attributes are present in EMP table where as the last one is in DEPT table.

EMP

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7839	KING	PRESIDENT		17-NOV-81	5000	\rightarrow	10
7698	BLAKE	MANAGER	7839	01-MAY-\$1	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7566	JONES	MANAGER	7839	02-APR-81	2975		20

DEPT

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
20	RESEARCH	DALLAS
30	SALES	CHICAGO
40	OPERATIONS	BOSTON

Cartesian Product(x)

Definition

One row of a first table into all rows of second table. Basically it will provide all possible rows combinations in 2 tables. It is represented by a symbol (X)

Examples:

Lets take example of 2 tables made by ourselves

	Student										
Student_ID	Student_Name	Student_courseID									
01	Usama	01									
02	Aisha	02									
03	Ali	02									

	Course								
Course_ID	Course_Name								
01	DBMS								
02	CCN								

Cartesian Product(x)

Now Cartesian product of two tables will be written as: Student **X** Course

Output rows would be

Student_ID	Student_Name	Student_courseID	Course_ID	Course_Name
01	Usama	01	01	DBMS
02	Aisha	02	01	DBMS
03	Ali	02	01	DBMS
01	Usama	01	02	CCN
02	Aisha	02	02	CCN
03	Ali	02	02	CCN

First table all rows with second table first row then First table all rows with second table Second row and so on ...

Now Find out the caretesian product of *Emp* and *Dept* table after writing following command on your screen

set wrap off This command makes your data properly wrapped

Cartesian Product(x)

ows sel	ected.								
set w	an off								
select	* from	emp e .dept d;							
EMPNO	ENGME	ЈОВ	MGR	HIREDATE	SAL	COMM	DEPTNO	DEPINO DNAME	Loc
2499	SMITH	CLERK	2698	17-DEC-80 20-FEB-81 22-FEB-81	800 1600	300	20 30	10 ACCOUNTING	NEW YORK
7499 7521	ALLEN WARD	SALESMAN SALESMAN	7698	22-FEB-81	1250	500	30	10 ACCOUNTING 10 ACCOUNTING	NEW YORK NEW YORK
7566	JONES	MANAGER	7839	02-APR-81 28-SEP-81	2975		20	10 ACCOUNTING	NEW YORK
	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30	10 ACCOUNTING	NEW YORK
7698	BLAKE	MANAGER	7839	01-MAY-81 09-JUN-81	2850		30 10	10 ACCOUNTING	NEW YORK
7782	CLARK	MANAGER ANALYST			2450 3000		20	10 ACCOUNTING 10 ACCOUNTING	NEW YORK NEW YORK
7839	SCOTT	PRESIDENT	7566	17-HFR-87 17-NOU-81 08-SEP-81 23-MAY-87 03-DEC-81 03-DEC-81	5000		10	10 ACCOUNTING	NEW YORK
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30		MELL VODY
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20	10 ACCOUNTING 10 ACCOUNTING 10 ACCOUNTING 10 ACCOUNTING 10 ACCOUNTING 20 RESEARCH 20 RESEARCH 20 RESEARCH 20 RESEARCH 20 RESEARCH 20 RESEARCH	NEW YORK NEW YORK NEW YORK NEW YORK
7900	JAMES	CLERK	7698	Ø3-DEC-81	950		30	10 ACCOUNTING	NEW YORK
7902	FORD	ANALYST	7566	Ø3-DEC-81	3000		20	10 ACCOUNTING	NEW YORK
7934	MILLER	CLERK	7782	03-DEC-81 23-JAN-82 17-DEC-80 20-FEB-81 22-FEB-81 02-APR-81	1300		10	10 ACCOUNTING	NEW YORK
7369	SHITH	CLERK	7902	17-DEC-80	800	000	20	20 RESEARCH	DHLLHS
7499	ALLEN	SALESMAN SALESMAN	7698	20-FEB-81	1600	300	30	20 RESEARCH	DALLAS
2566	WARD JONES	MANAGER	2636	02-0PB-91	1250 2975	500	30 20	20 RESERROR	DALLAS DALLAS
2654	MARTIN	SALESMAN	2698	28-SEP-81	1250	1400	30	20 RESEARCH	DALLAS
	BLAKE	MONOGER	7839	01-MAY-81	2850	1.100	30		DALLAS
	CLARK	MANAGER ANALYST PRESIDENT	7839	09-JUN-81	2450		10	20 RESEARCH	DALLAS
7788	SCOTT	ANALYST			3000		20	20 RESEARCH	DALLAS
7839	KING	PRES I DENT		17-NOU-81	5000		10	20 RESEARCH	DALLAS
7844	TURNER	SALESMAN	7698	Ø8-SEP-81	1500	0	30	20 RESEARCH	DALLAS
28.26	ADAMS JAMES	CLERK	7788	17-HPR-87 17-NOU-81 08-SEP-81 23-MAY-87 03-DEC-81 03-DEC-81 23-JAN-82 17-DEC-80 20-FEB-81	1100		20 30	20 RESEARCH 20 RESEARCH	DALLAS
23003	FORD	ANALYST	7698	03-DEC-81	950 3000		20	20 RESEARCH	DALLAS DALLAS
2934	MILLER	CLERK	7782	23-JON-82	1300		10	20 RESEARCH	DALLAS
2369	SMITH	CLERK	2902	12-DEC-80	800		20	20 RESEARCH 30 SALES	CHICAGO
7499	OLLEN	SALESMAN	7698	20-FEB-81	1600	300	30	30 SALES	CHICAGO
7521	WARD JONES	SALESMAN MANAGER	7698	22-FEB-81 02-APR-81	1250 2975	500	30 20	30 SALES 30 SALES	CHICAGO
7566	JONES	MANAGER	7839	02-APR-81	2975		20	30 SALES	CHICAGO
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30	30 SALES	CHICAGO
2638	BLAKE	MANAGER	7839	01-MAY-81 09-JUN-81	2850 2450		30 10	30 SALES	CHICAGO CHICAGO
2299	CLARK	MANAGER	2637	19-0PB-97	3000		20	30 SALES 30 SALES	CHICAGO
2839	KING	ANALYST PRESIDENT	1300	19-APR-87 17-APR-87 17-NOU-81 08-SEP-81 23-MAY-87 03-DEC-81	5000		10	30 SALES	CHICAGO
7844	KING TURNER	SALESMAN CLERK	2698	98-SEP-81	1500	Ø	30	30 SALES	CHICAGO
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20	30 SALES	CHICAGO CHICAGO
7900	ADAMS JAMES	CLERK	7698	Ø3-DEC-81	950		30	30 SALES	CHICAGO
7902	FORD	ANALYST			3000		20	30 SALES	CHICAGO
	MILLER	CLERK	7782	23-JAN-82	1300		10	30 SALES	CHICAGO
	SHITH	CLERK	7982	23-JAN-82 17-DEC-80 20-FEB-81 22-FEB-81 02-APR-81	800	200	20	40 OPERATIONS 40 OPERATIONS	BOSTON
7477	ALLEN	SALESMAN SALESMAN	7698	20-FEB-81	1600 1250	300 500	30 30	40 OPERATIONS	BOSTON BOSTON
2566	WARD JONES	MANAGER	2839	02-0PB-81	2975	300	20	40 OPERATIONS	BOSTON
7654	MARTIN	SALESMAN	7698	28-SEP-81	2975 1250	1400	30	40 OPERATIONS	BOSTON
7698	BLAKE	MANAGER	7839	01-MAY-81 09-JUN-81	2850		30	40 OPERATIONS	BOSTON
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10	40 OPERATIONS	BOSTON
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20	40 OPERATIONS	BOSTON
7839	KING TURNER	PRES I DENT		17-NOU-81 08-SEP-81	5000		10	40 OPERATIONS	BOSTON
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	36	40 OPERATIONS	BOSTON
	ADAMS	CLERK	7788	23-MAY-87 03-DEC-81	1100		20	40 OPERATIONS	BOSTON
7900	JAMES	CLERK ANALYST	2698	03-DEC-81 03-DEC-81	950 3000		30 20	40 OPERATIONS 40 OPERATIONS	BOSTON
	MILLER	CLERK	7566	23-JAN-82	1300		10	40 OPERATIONS	BOSTON BOSTON

1. Inner-Join/Equi-Join

If the join contains an equality condition, it is called equi-join.

Example:

We discussed this example in lab 02 if you remember

To retrieve the employee name, their job and department name, we need to extract data from two tables, EMP and DEPT. This type of join is called *Equi join* that is values in the DEPTNO column must be equal in both tables. *Equi* join is also called *simple join* or *inner join*.

SELECT E.ENAME, E.JOB, D.DNAME FROM EMP E,DEPT D WHERE E.DEPTNO=D.DEPTNO;

Have you notice one thing? By making a equi join few rows of **department table** that are not matching with any of the **employee table's** <u>department no</u> are not becoming the part of our output.

Employee Table

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7924 7345 7369 7499 7521 7566 7654 7698 7782	MICHEAL SANIA SMITH	COOK ENGINEER CLERK SALESMAN SALESMAN MANAGER SALESMAN MANAGER MANAGER MANAGER ANALYST PRESIDENT	7811 7904 7902 7698 7698 7839 7698 7839 7839	26-JUL-81 18-DEC-90 17-DEC-80 20-FEB-81 22-FEB-81	3000 9000 2340 800 1600 1250 2975 1250 2850 2450 3000		30 30 20 30 30 30 30 30 30 10 20
7876 7900 7902	TURNER ADAMS JAMES FORD MILLER	SALESMAN CLERK CLERK ANALYST CLERK	7698 7566	08-SEP-81 23-MAY-87 03-DEC-81 03-DEC-81 23-JAN-82	1500 1100 950 3000 1300	Ø	30 20 30 20 10

Department Table

DEPTNO	DNAME	LOC
60	MARKETING1 MIS	SAN DIEGO1
10	FINANCE ACCOUNTING RESEARCH	NEW YORK DALLAS
	SALES OPERATIONS	CHICAGO BOSTON

Inner Join Output is

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	DEPTNO	DNAME	LOC
	MICHEAL	СООК		26-JUL-81	9000		30		SALES	CHICAGO
	SANIA Smith	ENGI NEER CLERK		18-DEC-90 17-DEC-80	2340 800	600	30 20		SALES RESEARCH	CHICAGO DALLAS
	ALLEN	SALESMAN		20-FEB-81	1600	300	30		SALES	CHICAGO
7521		SALESMAN		22-FEB-81	1250	500	30		SALES	CHICAGO
	JONES	MANAGER		02-APR-81	2975	4.400	20		RESEARCH	DALLAS
	MARTIN BLAKE	SALESMAN Manager		28-SEP-81 01-MAY-81	1250 2850	1400	30 30		SALES SALES	CHICAGO CHICAGO
	CLARK	MANAGER		09-JUN-81	2450		10		ACCOUNTING	NEW YORK
	SCOTT	ANALYST		19-APR-87	3000		$\bar{20}$		RESEARCH	DALLAS
7839		PRES I DENT		17-NOV-81	5000	_	10		ACCOUNTING	NEW YORK
	TURNER	SALESMAN		08-SEP-81	1500	0	30		SALES	CHICAGO
	ADAMS James	CLERK CLERK		23-MAY-87 03-DEC-81	1100 950		20 30		RESEARCH SALES	DALLAS CHICAGO
7902		ANALYST		03-DEC-81	3000		20		RESEARCH	DALLAS
7934	MILLER	CLERK	7782	23-JAN-82	1300		10	10	ACCOUNTING	NEW YORK
rows sel										

Can I say this those departments that are not matching with the Employee table or that are missing in the employee table are not becoming the part of our output?

Answer is Yes. And in real time most of the time we need to see whole data even if its not matching with any one of the table and for that case we use a join named as **OUTER JOIN**

In actual whole Data is as

EMPNO ENAME	JOB	MGR HIREDATE	SAL	COMM	DEPTNO	DEPTNO	DNAME	LOC
7924 MICHEAI 7345 SANIA 7369 SMITH 7499 ALLEN 7521 WARD 7566 JONES 7654 MARTIN 7698 BLAKE 7788 SCOTT 7839 KING		7811 26-JUL-81 7904 18-DEC-90 7902 17-DEC-80 7698 20-FEB-81 7698 22-FEB-81 7839 02-APR-81 7698 28-SEP-81 7839 09-JUN-81 7839 09-JUN-81 7566 19-APR-87	9000 2340 800 1600 1250 2975 1250 2850 2850 2450 3000	600 300 500 1400	30 30 20 30 30 30 20 30 30 10 20	30 30 20 30 30 20 30 30 10	SALES SALES RESEARCH SALES SALES RESEARCH SALES ALES ALES ACOUNTING RESEARCH ACCOUNTING	CHICAGO CHICAGO DALLAS CHICAGO CHICAGO DALLAS CHICAGO CHICAGO CHICAGO CHICAGO NEW YORK DALLAS NEW YORK
7844 TURNER 7876 ADAMS 7900 JAMES 7902 FORD 7934 MILLER	SALESMAN CLERK CLERK ANALYST CLERK	7698 08-SEP-81 7788 23-MAY-87 7698 03-DEC-81 7566 03-DEC-81 7782 23-JAN-82	1500 1100 950 3000 1300	0	30 20 30 20 10	30 20 30 20 10 50 70	SALES RESEARCH SALES RESEARCH ACCOUNTING MARKETING1 MIS FINANCE OPERATIONS	CHICAGO DALLAS CHICAGO DALLAS NEW YORK SAN DIEGO1

2. Outer-Join

A join between two tables that returns the results of the inner join as well as unmatched rows in the **left** or unmatched rows in the **right** tables is a **left** or **right** outer join respectively.

a) Left Outer Join

A join between two tables that returns the results of the inner join as well as unmatched rows in the **left table**

Example:

SELECT E.ENAME, D.DEPTNO, D.DNAME FROM EMP ELEFT OUTER JOIN DEPT D'ON (E.DEPTNO = D.DEPTNO);

Display left table's All rows that are not even matching with the right table

Employee is Left Table & Dept Is Right Table

As All rows of Employee table contains such a department that is present in a department table so above query's result will be same as inner join

Alternate Syntax

SELECT E.ENAME, D.DEPTNO, D.DNAME FROM EMP E, DEPT D WHERE E.DEPTNO = D.DEPTNO(+); Plus is on right side show this is a left Outer join & can be convent as we are showing unmatched rows as blank in department table

a) Left Outer Join(Cont.)

Just For Learning keeping integrity constraints a side for few minutes let say I have inserted a new row in employee table For Employee ALI whose Dept no is 04

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7566	JONES	MANAGER	7839	02-APR-81	2975		20
	MARTIN	SALESMAN		28-SEP-81	1250	1400	30
	BLAKE	MANAGER	7839	01-MAY-81	2850		30
	CLARK	MANAGER		09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRES I DENT		17-NOU-81	5000		10
	TURNER	SALESMAN		08-SEP-81	1500	0	30
	ADAMS	CLERK		23-MAY-87	1100		20
	JAMES	CLERK	7698	03-DEC-81	950		30
7902		ANALYST		Ø3-DEC-81	3000		20
	MILLER	CLERK_		23-JAN-82	1300		10
7999	ALI	ANALYST	7566	20-FEB-81	1100		04

Now simple inner join will return only matched rows so output of inner join will be same after and before row addition. But that join is missing lefts table one row that is not matching with Right table any row if I will write the same Left Outer Join query as:

a) Left Outer Join(Cont.)

So Missing information of *Ali* in the Left table will now be visible from following query:

SELECT *FROM EMP E LEFT OUTER JOIN DEPT D ON (E.DEPTNO = D.DEPTNO);

2 EMP E	T *FROM LEFT OUTER .DEPTNO = D	JOIN DEPT D .DEPTNO>								
EMPN0	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	DEPTNO	DNAME	LOC
7839 7782 7902 78788 7566 7369 7900 7844 7654 7521		CLERK PRESIDENT MANAGER ANALYST CLERK ANALYST MANAGER CLERK CLERK SALESMAN MANAGER SALESMAN SALESMAN SALESMAN ANALYST	7839 7566 7788 7566 7839 7902 7698 7698 7839 7698 7698	23-JAN-82 17-NOU-81 09-JUN-81 03-DEC-81 23-MAY-87 19-APR-87 02-APR-81 17-DEC-80 03-DEC-81 08-SEP-81 01-MAY-81 28-SEP-81 20-FEB-81 20-FEB-81	1300 5000 2450 3000 1100 3000 2975 800 950 1500 2850 1250 1250 1100	0 1400 500 300	10 10 10 20 20 20 20 20 30 30 30 30	100 100 200 200 300 300 300	ACCOUNTING ACCOUNTING ACCOUNTING RESEARCH RESEARCH RESEARCH RESEARCH SALES SALES SALES SALES SALES SALES SALES	NEW YORK NEW YORK NEW YORK DALLAS DALLAS DALLAS DALLAS CHICAGO CHICAGO CHICAGO CHICAGO CHICAGO CHICAGO

b) Right Outer Join:

A join between two tables that returns the results of the inner join as well as unmatched rows in the **Right table Example:**



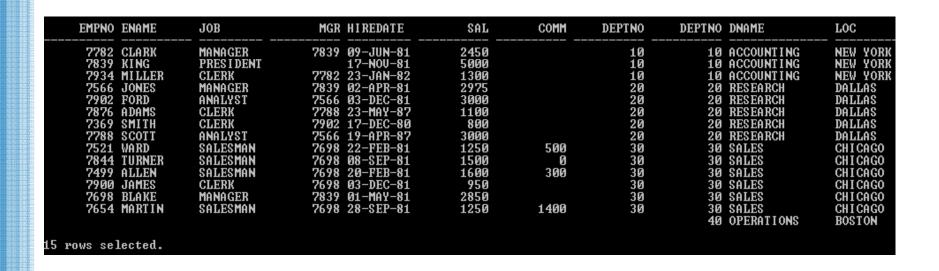
EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	DEPTNO	DNAME	LOC
	CLARK	MANAGER	7839	09-JUN-81	2450		10		ACCOUNTING	NEW YORK
	KING MILLER	PRES I DENT CLERK	7782	17-NOV-81 23-JAN-82	5000 1300		10 10		ACCOUNTING ACCOUNTING	NEW YORK NEW YORK
7566	JONES	MANAGER	7839	02-APR-81	2975		20	$\bar{2}\bar{0}$	RESEARCH	DALLAS
	FORD ADAMS	ANALYST CLERK		03-DEC-81 23-MAY-87	3000 1100		20 20		RESEARCH RESEARCH	DALLAS DALLAS
	SMITH	CLERK		17-DEC-80	800		20		RESEARCH	DALLAS
	SCOTT WARD	ANALYST SALESMAN		19-APR-87 22-FEB-81	3000 1250	500	20 30		RESEARCH SALES	DALLAS CHICAGO
	TURNER	SALESMAN		08-SEP-81	1500	200 0	30		SALES	CHICAGO
	ALLEN	SALESMAN		20-FEB-81	1600	300	30		SALES	CHICAGO
	JAMES BLAKE	CLERK MANAGER		03-DEC-81 01-MAY-81	950 2850		30 30		SALES SALES	CHICAGO CHICAGO
	MARTIN	SALESMAN		28-SEP-81	1250	1400	30	30	SALES OPERATIONS	CHICAGO BOSTON
15 rows se	lected.									

As All rows of Department table was not matching with departments in Employee table so its deptno = 40 was not retrieving by simple inner join.

b) Right Outer Join(cont.)

Alternate Syntax

SELECT E.ENAME, D.DEPTNO, D.DNAME FROM EMP E, DEPT D WHERE E.DEPTNO(+) = D.DEPTNO; Plus is on left side show this is a Right Outer join and can be Convent that we are showing unmatched rows as blank in Employee table



c) Full Outer Join

The FULL OUTER JOIN keyword combines the result of both LEFT and RIGHT joins.

Example:



Suppose my inserted row of Employee *Ali* is still present in a table then output of full outer join be

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO	DEPTNO	DNAME	LOC
7369	SMITH	CLERK	7902	17-DEC-80	 800		20	20	RESEARCH	DALLAS
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30	30	SALES	CHICAGO
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30	30	SALES	CHICAGO
7566	JONES	MANAGER	7839	02-APR-81	2975		20	20	RESEARCH	DALLAS
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30	30	SALES	CHICAGO
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30	30	SALES	CHICAGO
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10	10	ACCOUNTING	NEW YORK
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20	20	RESEARCH	DALLAS
7839	KING	PRES I DENT		17-NOU-81	5000		10	10	ACCOUNTING	NEW YORK
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30	30	SALES	CHICAGO
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20	20	RESEARCH	DALLAS
7900	JAMES	CLERK	7698	03-DEC-81	950		30	30	SALES	CHICAGO
7902	FORD	ANALYST	7566	03-DEC-81	3000		20	20	RESEARCH	DALLAS
7934	MILLER	CLERK	7782	23-JAN-82	1300		10	10	ACCOUNTING	NEW YORK
								40	OPERATIONS	BOSTON
7999	ALI	ANALYST	7566	20-FEB-81	1100		04			
16 rows sel	lected.									

3. Non-Equijoin

If the join contains inequality condition(i.e: <>, >, <, BETWEEN, etc.) it is called non-equijoin.

Example:

Display employee name, salary and Grades of Employee. <u>Hint: Every grade have a specific Salary Range</u>

SELECT E.ENAME, E.SAL, S.GRADE FROM EMP E, SALGRADE S WHERE E.SAL BETWEEN S.LOSAL AND S.HISAL;

No Equality Condition in the Join of 2 tables

4. Self join

A **self-join** is a query in which a table is joined (compared) to itself.

Example:

We have already verbally discuss this example in lab 01 Print Employee name & employee's manager name. For this we need to join the EMP table to itself(perform a *self join*)

SELECT WORKER.ENAME MANAGER.ENAME as "Manager" FROM EMP WORKER, EMP MANAGER
WHERE WORKER.MGR = MANAGER.EMPNO;

To Print Name of Manager we used Self Join