

Database

A database is the place of storage of the data in the form of tables

Data means information which is very useful. A database is also collection of 1 or more tables.

Table – a table is a collection of rows and columns.

	CELL	
	CELL	

Columns

A cell is an intersection of a row and a column

A column is also called as a field / attribute

A record is also called as a row / tuple.

A table is also called as an entity / relation.

Note :-

- If we install any of the database related software(s) – we can create our own database, we can create our own tables and we can store the data inside it.
- When we install any database s/w(s) – a part of hard disk will be designated / reserved to perform database related activities
- A database can also contain other database objects like views, indexes, stored procedures, functions, triggers etc, apart from tables.

Some of the database software(s) we have are,

Oracle, SQL Server, DB2, Sybase, Informix, MySQL, MS – Access, Foxbase, FoxPro

Among the above database software – some of them are DBMS and some of them are RDBMS

The s/w which is widely used today is Oracle. The different versions of Oracle starting from the earliest to the latest are – Oracle 2, Oracle 3, Oracle 4, Oracle 5, Oracle 6, Oracle 7, Oracle 8i, Oracle 9i, Oracle

10g, and the latest to hit the market is Oracle 11g. here 'i' stands for Internet and 'g' stands for Grid / Grid computing.

RELATIONSHIPS

A relationship is the association between any two tables which preserves data integrity.

Relationships

Master (Parent)	Dept No.	Dept Name	Detail (Child)
	10	Accounting	
	20	Research	
	30	Sales	

Relationship helps to prevent the incorrect data in the child tables

Once the relationship is created, one table becomes master (or parent) and the other one becomes the child (or detail).

Whatever we insert into the child should be present in the master, else the record will be rejected from the child.

The master table contains the master data which will not change frequently.

The child table contains the transactional data which will change quite often.

DBMS & RDBMS

DBMS – stands for Database Management System

DBMS is a database s/w which allows us to store the data in the form of tables.

RDBMS – stands for Relational DBMS

RDBMS is also a database s/w which has facility to handle more data volume, good performance, enhanced security features etc when compared against DBMS.

Any DBMS to qualify as a RDBMS should support the Codd rules / Codd laws

Ex for DBMS – FoxPro, FoxBase, Dbase

Ex for RDBMS – Oracle, Sybase, DB2, Teradata, SQL Server, MySQL

CONSTRAINTS

A constraint is a condition which restricts the invalid data in the table.

A constraint can be provided for a column of a table.

Types of Constraints

- ❖ NOT NULL
- ❖ UNIQUE
- ❖ Primary Key
- ❖ Foreign Key
- ❖ Check

NULL

- NULL is nothing, it is neither zero nor blank space
- It will not occupy any space in the memory
- Two NULLS are never same in Oracle.
- NULL represents unknown value
- Any arithmetic operation we perform on NULL will result in NULL itself. **For ex,** $100000 + \text{NULL} = \text{NULL}$; $100000 * \text{NULL} = \text{NULL}$

NOT NULL

- NOT NULL will ensure atleast some value should be present in a column

UNIQUE

- It will not allow any duplicates in a column
- UNIQUE column can take multiple NULL (s)

Primary Key

- It is the combination of **NOT NULL** and **UNIQUE**
- Only one PK is allowed in a table
- PK identifies a record uniquely in a table
- Creation of PK is not mandatory, but it is highly recommended to create

Foreign Key

- FK creates relationship between any two tables
- FK is also called as referential integrity constraints
- FK is created on the child table
- FK can take both NULL and duplicate values
- To create FK, the master table should have PK defined on the common column of the master table
- We can have more than 1 FK in a given table

CHECK

It is used to provide additional validations as per the customer requirements.

- Ex -**
- 1) $\text{sal} > 0$
 - 2) empnum should start with 1
 - 3) commission should be between 1000 & 5000

Check
(sal >
0)

PK

NN

PK

NN

FK

NN

Uniqu
e

Uniq
ue

Dept No.	Dept name
10	Accounting
20	Research
30	Sales

Emp No.	Emp Name	Dept No.	Salary	Ph No.	Email
101	A	10	200000	2222	a@gmail
102	B	10	30000	-	-
103	C	20	400000	3333	-

RELATIONSHIP

NULL

SQL – Structured Query Language

SQL – it is a language to talk to the database / to access the database

SQL – it is a language, whereas SQL server is a database.

To work on SQL , a DB software (RDBMS) is required.

SQL is not case sensitive

Username - Scott

Password - Tiger

Troubleshooting Oracle

Error 1

The account is locked

Steps to rectify the error

- Login as username – ‘system’ & password – ‘manager’ or ‘password – ‘tiger’
- SQL > show user ;
User is “SYSTEM”

SQL > alter user scott account unlock ;
User altered

SQL > exit ;

Error 2

TNS : protocol adapter error

How to troubleshoot this

Cause is “oracle service has not started”

How to go here,

Settings – Control Panel – Administrative Tools – Services

Sort the list

There is an “Oracle Service ORCL” & “start the service”

```
SQL> select * from tab;
```

TNAME	TABTYPE	CLUSTERID
DEPT	TABLE	
EMP	TABLE	
BONUS	TABLE	
SALGRADE	TABLE	

This query gives the list of tables.

* - selects all

```
SQL> desc dept ;
```

Name	Null?	Type
DEPTNO	NOT NULL	NUMBER(2)
DNAME		VARCHAR2(14)
LOC		VARCHAR2(13)

This query gives the description of the table "department".

The description of the table has **column names, constraints, datatypes**

```
SQL> select * from dept;
```

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

This query gives the description of the table "department"

```
SQL> select * from emp ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM
7369	SMITH	CLERK	7902	17-DEC-80	800	
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500
7566	JONES	MANAGER	7839	02-APR-81	2975	

The above query gives the description of the “employee” table. But we see that all the data is in different lines which makes it very difficult to analyse.

So we use the following command to see the data in a more orderly fashion,

```
SQL> set linesize 120 ;
SQL> select * from emp ;
```

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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

14 rows selected.

The “set linesize” command helps in increasing the line size , thus the data is arranged in a orderly fashion.

```
SQL> set pagesize 20 ;
SQL> select * from emp ;
```

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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

14 rows selected.

The above command “set pagesize 20” increases the page size, thus accommodating more number of rows in a single page.

```
SQL> select ename, job, sal
2 from emp ;
```

ENAME	JOB	SAL
SMITH	CLERK	800
ALLEN	SALESMAN	1600
WARD	SALESMAN	1250
JONES	MANAGER	2975
MARTIN	SALESMAN	1250
BLAKE	MANAGER	2850
CLARK	MANAGER	2450
SCOTT	ANALYST	3000
KING	PRESIDENT	5000
TURNER	SALESMAN	1500
ADAMS	CLERK	1100
JAMES	CLERK	950
FORD	ANALYST	3000
MILLER	CLERK	1300

14 rows selected.

The above query gives the value of only these 3 columns from the table "employee".

```
SQL> select * from emp where sal = 3000 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

'where' clause is used to restrict the number of records displayed. It gives only the records of the specified condition.

```
SQL> select * from emp where job='MANAGER' ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10

Any string data should be enclosed within single quotes (' ') and the same becomes case sensitive.

Assignment

1) List the employees in dept 20

```
SQL> select * from emp where deptno = 20 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

2) List the employees earning more than Rs 2500.

SQL> select * from emp where sal > 2500 ;

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

3) Display all salesmen

SQL> select * from emp where job= 'SALESMAN' ;

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30

Operators are classified into,

- **Arithmetic Operators** (+, -, *, /)
- **Relational Operators** (>, <, >=, <=, =, < > or != - not equals to)
- **Logical Operators** (NOT, AND, OR)
- **Special Operators** (IN, LIKE, BETWEEN, IS)

SPECIAL OPERATORS

1) **IN** – it is used for evaluating multiple values.

Ex - 1) List the employees in dept 10 & 20

```
SQL> select * from emp where deptno in (10 , 20 ) ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

8 rows selected.

2) List all the clerks and analysts

```
SQL> select * from emp where job in ('CLERK', 'ANALYST' ) ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

6 rows selected.

We can provide upto 1000 values at the max

2) **LIKE** – used for pattern matching

% (percentage) - matches 0 or 'n' characters
_ (underscore) - matches exactly one character

Ex - 1) List all the employees whose name starts with 'S'

```
SQL> select * from emp where ename like 'S%' ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20

Whenever we use % or _ , always ensure that it is preceded by the word 'like'

2) List the employees whose name is having letter 'L' as 2nd character

```
SQL> select * from emp where ename like '_L%' ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10

ASSIGNMENT

1) List the employees whose name is having atleast 2 L's

```
SQL> select * from emp where ename like '%_LL_%';
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

2) List the employees whose name is having letter 'E' as the last but one character

```
SQL> select * from emp where ename like '%_E_';
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

3) List all the employees whose name is having letter 'R' in the 3rd position

```
SQL> select * from emp where ename like '__R%';
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

In the above query, we give 2 underscores before R%.

4) List all the employees who are having exactly 5 characters in their jobs

```
SQL> select ename, job from emp where job like '_____';
```

ENAME	JOB
SMITH	CLERK
ADAMS	CLERK
JAMES	CLERK
MILLER	CLERK

Here, in single quotes – we give 5 underscores.

5) List the employees whose name is having atleast 5 characters

```
SQL> select ename from emp where ename like '_____';
```

ENAME
SMITH
ALLEN
JONES
BLAKE
CLARK
SCOTT
ADAMS
JAMES

8 rows selected.

Here, also in single quotes – we give 5 underscores (_____)

3) BETWEEN operator – used for searching based on range of values.

Ex - 1) List the employees whose salary is between 200 and 300

```
SQL> select * from emp where  
2 sal between 2000 and 3000 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

4) IS operator – it is used to compare nulls

Ex - 1) List all the employees whose commission is null

```
SQL> select * from emp where comm is null ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

10 rows selected.

ASSIGNMENT

1) List all the employees who don't have a reporting manager

```
SQL> select * from emp where mgr is null ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7839	KING	PRESIDENT		17-NOV-81	5000		10

LOGICAL OPERATORS

1) List all the salesmen in dept 30

```
SQL> select * from emp where job = 'SALESMAN' and deptno = 30 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30

2) List all the salesmen in dept number 30 and having salary greater than 1500

```
SQL> select * from emp
2 where job = 'SALESMAN'
3 and deptno = 30
4 and sal > 1500 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30

3) List all the employees whose name starts with 's' or 'a'

```
SQL> select * from emp
2 where ename like 'S%' or ename like 'A%' ;
```

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
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20

4) List all the employees except those who are working in dept 10 & 20.

```
SQL> select * from emp
2 where deptno not in (10,20) ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7900	JAMES	CLERK	7698	03-DEC-81	950		30

6 rows selected.

5) List the employees whose name does not start with 'S'

```
SQL> select * from emp
2 where ename not like 'S%' ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

12 rows selected.

6) List all the employees who are having reporting managers in dept 10

```
SQL> select * from emp
2 where mgr is not null
3 and deptno = 10 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

ASSIGNMENT

1) List the employees who are not working as managers and clerks in dept 10 and 20 with a salary in the range of 1000 to 3000

```
SQL> select * from emp
2 where job not in ('MANAGER','CLERK')
3 and deptno in (10,20)
4 and sal between 1000 and 3000;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

2) List the employees whose salary not in the range of 1000 to 2000 in dept 10,20,30 except all salesmen

```
SQL> select * from emp where
2 sal not between 1000 and 2000
3 and deptno in (10,20,30)
4 and job <>'SALESMAN';
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

8 rows selected.

3) List the department names which are having letter 'O' in their locations as well as their department names

```
SQL> select * from dept
2 where loc like '%_O_%' and
3 dname like '%_O_%';
```

DEPTNO	DNAME	LOC
10	ACCOUNTING	NEW YORK
40	OPERATIONS	BOSTON

SORTING

It arranges the data either in ascending / descending order

Ascending - ASC / Descending - DESC

We can sort the data using **ORDER BY**

By default, the data is always arranged in ASC order

For ex - 1) Arrange all the employees by their salary

```
SQL> select * from emp
2 order by sal;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7934	MILLER	CLERK	7782	23-JAN-82	1300		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30

7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10

14 rows selected.

2) Arrange all the employees by their salary in the descending order

```
SQL> select * from emp
2 order by sal desc;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7839	KING	PRESIDENT		17-NOV-81	5000		10
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7934	MILLER	CLERK	7782	23-JAN-82	1300		10
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7369	SMITH	CLERK	7902	17-DEC-80	800		20

14 rows selected.

3) Arrange ename, sal, job, empno and sort by descending order of salary

```
SQL> select ename, sal, job, empno
2 from emp
3 order by 2 desc ;
```

ENAME	SAL	JOB	EMPNO
KING	5000	PRESIDENT	7839
FORD	3000	ANALYST	7902
SCOTT	3000	ANALYST	7788
JONES	2975	MANAGER	7566
BLAKE	2850	MANAGER	7698
CLARK	2450	MANAGER	7782
ALLEN	1600	SALESMAN	7499
TURNER	1500	SALESMAN	7844
MILLER	1300	CLERK	7934
WARD	1250	SALESMAN	7521
MARTIN	1250	SALESMAN	7654
ADAMS	1100	CLERK	7876
JAMES	950	CLERK	7900
SMITH	800	CLERK	7369

14 rows selected.

In the above query we have – **order by 2** – thus it arranges only the 2nd column ‘salary’ in the descending order.

Thus to arrange the specific columns in order – we must have to specify the column number.

NOTE :- ORDER BY should be used always as the last statement in the SQL query.

Selecting DISTINCT VALUES

```
SQL> select distinct deptno  
2 from emp ;
```

```
DEPTNO  
-----  
30  
20  
10
```

The above query arranges all the distinct values of department number.

We have 5 GROUP functions,

- 1) Sum
- 2) Max
- 3) Min
- 4) Avg
- 5) Count

Sum - returns total value

Max - returns maximum value

Min - returns minimum value

Avg - returns average value

Count - returns number of records

Ex - 1) display the maximum salary, minimum salary and total salary from employee

```
SQL> select max(sal), min(sal), sum(sal) from emp;
```

MAX(SAL)	MIN(SAL)	SUM(SAL)
5000	800	29025

To give aliases for the columns :-

```
SQL> select max(sal) "high",  
2 min(sal) "low",  
3 sum(sal) "total"  
4 from emp ;
```

high	low	total
5000	800	29025

3) The below query gives the total number of employees

```
SQL> select count(*), count(empno)  
2 from emp ;
```

COUNT(*)	COUNT(EMPNO)
14	14

4) The below query gives the number of employees who have commission

```
SQL> select count(*), count(comm)  
2 from emp ;
```

COUNT(*)	COUNT(COMM)
14	4

5) List the number of employees in department 30

```
SQL> select count(*) from emp
2  where deptno = 30 ;
```

```
COUNT(*)
-----
        6
```

ASSIGMENT

1) Display the total salary in department 30

```
SQL> select sum(sal) "total" from emp
2  where deptno = 30;
```

```
total
-----
 9400
```

2) List the number of clerks in department 20

```
SQL> select count(*) from emp
2  where deptno = 20
3  and job = 'CLERK' ;
```

```
COUNT(*)
-----
        2
```

3) List the highest and lowest salary earned by salesmen

```
SQL> select max(sal), min(sal) from emp
2  where job = 'SALESMAN';
```

```
MAX(SAL)  MIN(SAL)
-----  -----
 1600      1250
```

GROUPING

It is the process of computing the aggregates by segregating based on one or more columns. Grouping is done by using 'group by' clause.

For ex - 1) Display the total salary of all departments

```
SQL> select deptno, sum(sal)
2   from emp
3   group by deptno ;
```

DEPTNO	SUM(SAL)
30	9400
20	10875
10	8750

2) Display the maximum of each job

```
SQL> select job, max(sal)
2   from emp
3   group by job ;
```

JOB	MAX(SAL)
CLERK	1300
SALESMAN	1600
PRESIDENT	5000
MANAGER	2975
ANALYST	3000

HAVING

'Having' is used to filter the grouped data.

'Where' is used to filter the non grouped data.

'Having' should be used after group by clause

'Where' should be used before group by clause

For ex - 1) Display job-wise highest salary only if the highest salary is more than Rs1500

```
SQL> select job, max(sal)
2   from emp
3   group by job
4   having max(sal) > 1500 ;
```

JOB	MAX(SAL)
SALESMAN	1600
PRESIDENT	5000
MANAGER	2975
ANALYST	3000

2) Display job-wise highest salary only if the highest salary is more than 1500 excluding department 30. Sort the data based on highest salary in the ascending order.

```
SQL> select job, max(sal)
  2   from emp
  3  where deptno <>30
  4  group by job
  5  having max(sal) >1500
  6  order by 2 ;
```

JOB	MAX(SAL)
MANAGER	2975
ANALYST	3000
PRESIDENT	5000

RESTRICTIONS ON GROUPING

- we can select only the columns that are part of 'group by' statement
If we try selecting other columns, we will get an error as shown below,

```
SQL> select deptno, job, sum(sal), sum(comm)
  2   from emp
  3  group by deptno ;
select deptno, job, sum(sal), sum(comm)
      *
```

ERROR at line 1:
ORA-00979: not a GROUP BY expression

The above query is an error because 'job' is there in the **select** query but not in the **group by** query.
If it is enclosed in any of the **group functions like sum(sal)** etc – then it is not an error. But whatever table is included in the **select** query must also be included in the **group by** query.

The above problem can be overcome with the following query as shown below,

```
SQL> select deptno, job, sum(sal), sum(comm)
  2   from emp
  3  group by deptno, job ;
```

DEPTNO	JOB	SUM(SAL)	SUM(COMM)
20	CLERK	1900	
30	SALESMAN	5600	2200
20	MANAGER	2975	
30	CLERK	950	
10	PRESIDENT	5000	
30	MANAGER	2850	
10	CLERK	1300	
10	MANAGER	2450	
20	ANALYST	6000	

9 rows selected.

The below query is also correct to rectify the above error,

```
1 select deptno, sum(sal), sum(comm)
2 from emp
3 group by deptno, job
4* order by deptno
SQL> /
```

DEPTNO	SUM(SAL)	SUM(COMM)
10	1300	
10	2450	
10	5000	
20	6000	
20	1900	
20	2975	
30	950	
30	2850	
30	5600	2200

9 rows selected.

Whatever is there in the **select** statement must be there in the **group by** statement. But, whatever is there in the **group by** statement need not be present in the **select** statement. This is shown in the above two corrected queries.

ASSIGNMENT

1) Display the department numbers along with the number of employees in it

```
SQL> select deptno, count(*)
2 from emp
3 group by deptno
4 order by deptno ;
```

DEPTNO	COUNT(*)
10	3
20	5
30	6

2) Display the department numbers which are having more than 4 employees in them

```
SQL> select deptno from emp
2 group by deptno
3 having count(*) >4
4 order by deptno ;
```

DEPTNO
20
30

3) Display the maximum salary for each of the job excluding all the employees whose name ends with 'S'

```
SQL> select ename, job, min(sal)
2   from emp
3   where ename not like '%S'
4   group by ename, job
5   order by 3 ;
```

ENAME	JOB	MIN(SAL)
SMITH	CLERK	800
MARTIN	SALESMAN	1250
WARD	SALESMAN	1250
MILLER	CLERK	1300
TURNER	SALESMAN	1500
ALLEN	SALESMAN	1600
CLARK	MANAGER	2450
BLAKE	MANAGER	2850
FORD	ANALYST	3000
SCOTT	ANALYST	3000
KING	PRESIDENT	5000

11 rows selected.

4) Display the department numbers which are having more than 9000 as their departmental total salary

```
SQL> select deptno, sum(sal)
2   from emp
3   group by deptno
4   having sum(sal) >9000
5   order by 1 ;
```

DEPTNO	SUM(SAL)
20	10875
30	9400

Statements – they help us to create the table and insert the data.

There are 3 types of statements,

- ❖ **DDL** – Data Definition Language – the various commands in DDL are :- Create, Drop, Truncate, Alter, Rename
- ❖ **DML** – Data Manipulation Language – the various commands in DML are :- Insert, Update, Delete
- ❖ **TCL** – Transaction Control Language – the various commands in TCL are :- Rollback, Commit, Savepoint

CREATE – It creates the table.

Before we study the **Create** command, let us first study the some of the basic **datatypes** we use in SQL.

1) **CHAR** :-

It stores the fixed length character data.

It can store the alphanumeric data (i.e, numbers and characters).

2) **VARCHAR**

It stores the variable length character data

It can store alphanumeric data.

Difference between CHAR & VARCHAR

Let us consider an example as shown below to explain the difference.

Name char (6) ;

Here we are defining **name** which is of 6characters in length.

Now, let us store '*Tom*' in the name field. Let us understand how the memory is allocated for this,

Blank Space

Reserved / Non-reusable memory

When we declare anything of type **char**, the memory is allocated as of the size given and its fixed length – hence it cannot be altered.

Now, when we give *tom*, it allocates 6 bytes for **name char** – only the 1st 3bytes are used to store **Tom** – the rest becomes waste as it is a blank space and it is reserved memory.
The **length(name) = 6**.

Name varchar (6) ;

Here we are defining **name** which is of 6characters in length.

Now, let us store '*Tom*' in the name field. Let us understand how the memory is allocated for this,

Null

Re-usable memory

When we declare anything of type **varchar**, the memory is allocated as shown above and it is variable length

When we give *tom*, it allocates 6bytes for **name varchar** – only the 1st 3bytes are used to store **tom** – the remaining 3 fields becomes **null**. As we know the property of **null** – null does not occupy any memory space – **thus the memory is not wasted here**.

The **length(name) = 3**.

Another difference is : -

In **char**, maximum value we can store is 2000 characters

In **varchar**, maximum value we can store is 4000 characters.

3) NUMBER

- it stores numeric data.

For ex – 1) sal number(4) ;

Here the maximum possible value is 9999.

2) sal number (6, 2) ;

Here, 2 – scale (total number of decimal places)

6 – precision (total number of digits including decimal places)

Maximum value is 9999.99

sal number (4, 3) ;

maximum value is 9.999

sal number (2, 2)

maximum value is .99

4) DATE

- it stores date and time

- no need to specify any length for this type.

For ex, SQL > order_dt DATE ;

Date is always displayed in the default format :- **dd - month - yy**

5) BLOB

Stands for – Binary Large Object

It stores binary data (images, movies, music files) within the database. It stores upto 4GB.

6) CLOB

Stands for – Character Large Object

It stores plain character data like **varchar** field upto 4GB.

Create the following tables

PRODUCTS
ProdID (PK)
ProdName (Not Null)
Qty (Chk > 0)
Description

ORDERS
ProdID (FK from products)
OrderID (PK)
Qty_sold (chk > 0)
Price
Order_Date

```
SQL> CREATE TABLE products
2 (
3   prodid  NUMBER(4) PRIMARY KEY ,
4   prodname VARCHAR(10) NOT NULL ,
5   qty     NUMBER(3) CHECK (qty > 0) ,
6   description VARCHAR(20)
7 ) ;
```

Table created.

We can see that the table has been created.

Now, let us verify if the table has really been created and also the description of the table,

```
SQL> select * from tab ;
```

TNAME	TABTYPE	CLUSTERID
DEPT	TABLE	
EMP	TABLE	
BONUS	TABLE	
SALGRADE	TABLE	
PRODUCTS	TABLE	

The new table **products** has been added to the database.

```
SQL> desc products ;
```

Name	Null?	Type
PROID	NOT NULL	NUMBER(4)
PRODNAME	NOT NULL	VARCHAR2(10)
QTY		NUMBER(3)
DESCRIPTION		VARCHAR2(20)

Thus, we get the description of the table **products**.

```
SQL> CREATE TABLE orders
2 (
3   prodid  NUMBER(4) REFERENCES products (prodid) ,
4   orderid  NUMBER(4) PRIMARY KEY ,
5   qty_sold NUMBER(3) CHECK (qty_sold > 0),
6   price    NUMBER(8, 2) ,
7   order_dt DATE
8 ) ;
```

Table created.

The new table **orders** has been created. We can see from the above query how to reference a child table to the parent table using the **references** keyword.

```
SQL> select * from tab ;
```

TNAME	TABTYPE	CLUSTERID
DEPT	TABLE	
EMP	TABLE	
BONUS	TABLE	
SALGRADE	TABLE	
PRODUCTS	TABLE	
ORDERS	TABLE	

```
6 rows selected.
```

Thus we can verify that **orders** table has been created and added to the database.

```
SQL> desc orders ;
```

Name	Null?	Type
PROID		NUMBER(4)
ORDERID	NOT NULL	NUMBER(4)
QTY_SOLD		NUMBER(3)
PRICE		NUMBER(8,2)
ORDER_DT		DATE

Thus, we get the description of the **orders** table.

Creating a table from another table :-

Now, we will see how to create a table from another table – i.e, it duplicates all the records and the characteristics of another table.

The SQL query for it is as follows,

```
SQL> CREATE TABLE temp
2 AS
3 select * from dept ;
```

```
Table created.
```

Thus we can see that we have created another table **temp** from the table **dept**.

We can verify it as shown below,

```
SQL> select * from tab ;
```

TNAME	TABTYPE	CLUSTERID
DEPT	TABLE	
EMP	TABLE	
BONUS	TABLE	
SALGRADE	TABLE	
PRODUCTS	TABLE	
ORDERS	TABLE	
TEMP	TABLE	

```
7 rows selected.
```

Thus, we can see that the **table temp** has been created.

```
SQL> desc temp ;
```

Name	Null?	Type
DEPTNO		NUMBER(2)
DNAME		VARCHAR2(14)
LOC		VARCHAR2(13)

Thus, we can see that the table **temp** has copied the structure of the table **dept**. Here, we must observe that **temp** copies all the columns, rows and NOT NULL constraints only from the table **dept**. It never copies PK, FK, Check constraints.

Thus, when in the interview somebody asks you "I have a table which has about 1million records. How do I duplicate it into another table without using Insert keyword and without inserting it individually all the records into the duplicated table ?

Answer is - Use the above query of creating a table from another table and explain it.

```
SQL> select * from temp ;
```

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

Thus, from the above query - we can see that all the records of the table **dept** has been copied into the table **temp**.

TRUNCATE

It removes all the data permanently, but the structure of the table remains as it is.

Ex - SQL > TRUNCATE TABLE test ;

DROP

It removes both data and the structure of the table permanently from the database.

Ex - SQL > DROP TABLE test ;

Let us understand the difference between **drop & truncate** using the below shown example,

SQL> CREATE TABLE test1	SQL> CREATE TABLE test2
2 AS	2 AS
3 select * from dept ;	3 select * from dept ;
Table created.	Table created.

Let us create 2 tables Test1 and Test2 as shown above.

```
SQL> desc test1 ;
```

Name	Null?	Type
DEPTNO		NUMBER(2)
DNAME		VARCHAR2(14)
LOC		VARCHAR2(13)

```
SQL> select * from test1 ;
```

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

The above shows the description of the table test1.

```
SQL> desc test2 ;
```

Name	Null?	Type
DEPTNO		NUMBER(2)
DNAME		VARCHAR2(14)
LOC		VARCHAR2(13)

```
SQL> select * from test2 ;
```

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

The above gives the description of the table Test2.

Now, let us use the **Truncate query on Test1** and **Drop query on Test2** and see the difference.

```
SQL> truncate table test1 ;
```

```
Table truncated.
```

```
SQL> select * from test1 ;
```

```
no rows selected
```

```
SQL> desc test1 ;
```

Name	Null?	Type
DEPTNO		NUMBER(2)
DNAME		VARCHAR2(14)
LOC		VARCHAR2(13)

The above 3 queries show that – 1st query has the table test1 truncated.

2nd query – it shows **no rows selected** – thus only the records from the table has been removed. 3rd query – it shows that the structure of the table is still present. Only the records will be removed. Thus, this **explains the truncate query**.

```
SQL> drop table test2 ;
```

```
Table dropped.
```

```
SQL> select * from test2 ;
```

```
select * from test2
```

```
*
```

```
ERROR at line 1:
```

```
ORA-00942: table or view does not exist
```

```
SQL> desc test2 ;
```

```
ERROR:
```

```
ORA-04043: object test2 does not exist
```

Thus from the above queries we can explain how **drop** works. 1st query – it drops the table. Thus – the entire structure and records of the table are dropped.

2nd and 3rd query – since, there is no table – **select & desc** query for **test2** will throw an error.

Thus, this **explains the drop query**.

Hence, we have seen the difference between **drop & truncate** query.

10g Recycle Bin

DROP

FLASHBACK

PURGE

The functionality of Recycle Bin was introduced in Oracle 10G version only. Thus even though the table has been dropped, we can still restore it using **flashback command** or we can permanently remove it using the **purge** command.

This concept of Recycle bin was not there in the earlier versions of Oracle.

RENAME

It renames a table.

For ex, let us see the query of how we do this renaming a table.

```
SQL> CREATE TABLE temp
  2 AS
  3 select * from dept ;
```

Table created.

```
SQL> select * from temp ;
```

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

```
SQL> select * from tab ;
```

TNAME	TABTYPE	CLUSTERID
DEPT	TABLE	
EMP	TABLE	
BONUS	TABLE	
SALGRADE	TABLE	
PRODUCTS	TABLE	
ORDERS	TABLE	
TEMP	TABLE	

7 rows selected.

In the above 3queries – we have created a table **temp** which copies table **dept** – we see the records of the table temp – and also check if the table has really been created.

Now let us **rename temp to temp23** as shown below,

```
SQL> RENAME temp TO temp23 ;
```

Table renamed.

The above query is used to rename a table.

Now let us verify the contents of the table and check if it has really been modified,

See next page,

```
SQL> select * from tab ;
```

TNAME	TABTYPE	CLUSTERID
DEPT	TABLE	
EMP	TABLE	
BONUS	TABLE	
SALGRADE	TABLE	
PRODUCTS	TABLE	
ORDERS	TABLE	
TEMP23	TABLE	

7 rows selected.

```
SQL> select * from temp23 ;
```

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

Thus the table has been renamed and its contents are verified.

ALTER

- this query alters / changes the structure of the table (i.e, - adding columns, removing columns, renaming columns etc).

Now let us **alter** the table **products** (which we have created earlier).

1) Let us add a new column '*model_no*' to the table.

```
SQL> ALTER TABLE products  
2 ADD model_no VARCHAR(10) NOT NULL ;
```

Table altered.

Thus, a new column has been added. Lets verify it with the query shown below,

```
SQL> desc products ;
```

Name	Null?	Type
PRODID	NOT NULL	NUMBER(4)
PRODNAME	NOT NULL	VARCHAR2(10)
QTY		NUMBER(3)
DESCRIPTION		VARCHAR2(20)
MODEL_NO	NOT NULL	VARCHAR2(10)

2) Now let us drop the column `model_no` from `products`.

```
SQL> ALTER TABLE products
2 DROP COLUMN model_no ;
```

Table altered.

Thus, the column has been dropped.

```
SQL> desc products ;
```

Name	Null?	Type
PRODID	NOT NULL	NUMBER(4)
PRODNAME	NOT NULL	VARCHAR2(10)
QTY		NUMBER(3)
DESCRIPTION		VARCHAR2(20)

Thus, we can see from the description of the table – the column `model_no` has been dropped.

3) Let us rename the column `qty` to `qty_available`.

```
SQL> ALTER TABLE products
2 RENAME column qty to qty_available ;
```

Table altered.

Let us verify if it has been renamed,

```
SQL> desc products ;
```

Name	Null?	Type
PRODID	NOT NULL	NUMBER(4)
PRODNAME	NOT NULL	VARCHAR2(10)
QTY_AVAILABLE		NUMBER(3)
DESCRIPTION		VARCHAR2(20)

NOTE : `SELECT` is neither DML nor DDL. It does not belong to any group because it does not alter anything, it just displays the data as required by the user.

DML

INSERT

It inserts a record to a table.
Let us observe how it is done,

```
SQL> INSERT INTO products
      2 values (1001, 'CAMERA' , 10, 'Digital') ;
```

1 row created.

```
SQL> INSERT INTO products
      2 values (1002, 'Laptop', 23, 'Dell') ;
```

1 row created.

This is how we insert values into a table. All characters and alpha-numeric characters(ex - 10023sdf78) must be enclosed in single quotes (' ') and each value must be separated by comma. Also we must be careful in entering the data without violating the primary key, foreign key , unique constraints.

Now let us see the table in which the data in has been inserted,

```
SQL> select * from products ;
```

PRODID	PRODNAME	QTY_AVAILABLE	DESCRIPTION
1001	CAMERA	10	Digital
1002	Laptop	23	Dell

Now, let us insert data into the table **orders** in which a foreign key is referencing primary key,

```
SQL> INSERT INTO orders
      2 values (1001, 9001, 2, 9867.1, sysdate ) ;
```

1 row created.

Here, we see that 1001 is the same prodid as of the earlier table. Sysdate - it displays the current date set in the system .

```
SQL> INSERT INTO orders
      2 values (1002, 9023, 2, 98756.23, ' 02 - Oct - 2010 ' ) ;
```

1 row created.

Now, let us see the table,

```
SQL> select * from orders ;
```

PRODID	ORDERID	QTY_SOLD	PRICE	ORDER_DT
1001	9001	2	9867.1	06-APR-11
1002	9023	2	98756.23	02-OCT-10

Another way of inserting data into the table is shown below,

```
SQL> INSERT INTO orders (prodid, orderid, qty_sold, price, order_dt)
2 values (1002, 99, 7, 23678.9, '02 - Oct - 1987' ) ;
```

1 row created.

Now, let us see the table,

```
SQL> select * from orders ;
```

PRODID	ORDERID	QTY_SOLD	PRICE	ORDER_DT
1001	9001	2	9867.1	06-APR-11
1002	9023	2	98756.23	02-OCT-10
1002	99	7	23678.9	02-OCT-87

UPDATE :-

It updates one or more records.

For ex - 1) Let us update salary by increasing it by Rs200 and also give commission of Rs100 where empno = 7369.

```
SQL> select * from emp ;
```

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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

14 rows selected.

Now, let us **update** the said record as shown below,

```
SQL> update emp set sal = sal + 200, comm = 100 where empno = 7369 ;
```

1 row updated.

Let us verify if the record has been updated,

```
SQL> select * from emp ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	1000	100	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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

14 rows selected.

Thus, the record(empno – 7369) has been updated.

2) Increase all salary by 10%

```
SQL> update emp set sal = sal + sal * 0.1 ;
```

14 rows updated.

Let us verify it,

```
SQL> select * from emp ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	1100	100	20
7499	ALLEN	SALESMAN	7698	20-FEB-81	1760	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1375	500	30
7566	JONES	MANAGER	7839	02-APR-81	3272.5		20
7654	MARTIN	SALESMAN	7698	28-SEP-81	1375	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	3135		30
7782	CLARK	MANAGER	7839	09-JUN-81	2695		10
7788	SCOTT	ANALYST	7566	19-APR-87	3300		20
7839	KING	PRESIDENT		17-NOV-81	5500		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1650	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1210		20
7900	JAMES	CLERK	7698	03-DEC-81	1045		30
7902	FORD	ANALYST	7566	03-DEC-81	3300		20
7934	MILLER	CLERK	7782	23-JAN-82	1430		10

14 rows selected.

DELETE

It deletes one / some / all the records.

Let us create a table test from table emp – and see how to delete 1 record and how to delete all records from it,

```
SQL> select * from test ;
```

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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

14 rows selected.

Thus, we have created the table test.

```
SQL> delete from test where empno = 7934 ;
```

1 row deleted.

Thus 1 row, 'miller' has been deleted.

```
SQL> select * from test ;
```

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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

13 rows selected.

Thus, the deletion has been confirmed.

TCL

Any DML change on a table is not a permanent one.
We need to save the DML changes in order to make it permanent
We can also undo (ignore) the same DML changes on a table.

The DDL changes cannot be undone as they are implicitly saved.

ROLLBACK

It undoes the DML changes performed on a table.
Let us see in the below example how **rollback** works,

```
SQL> delete from emp ;  
  
14 rows deleted.  
  
SQL> select * from emp ;  
  
no rows selected
```

Let us delete the employee table. When we perform **select** operation on emp, we can see that all the rows have been deleted.

We now perform the **rollback** operation,

```
SQL> rollback ;  
  
Rollback complete.
```

Now let us perform the **select** operation,

```
SQL> select * from emp ;
```

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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

```
14 rows selected.
```

Thus performing the **rollback** operation, we can retrieve all the records which had been deleted.

COMMIT

It saves the DML changes permanently to the database.

Committing after rollback & vice versa will not have any effect

Let us explain the above statement with an example,

```
SQL> select * from test ;
```

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

```
SQL> delete from test ;
```

4 rows deleted.

```
SQL> select * from test ;
```

no rows selected

```
SQL> rollback ;
```

Rollback complete.

```
SQL> commit ;
```

Commit complete.

```
SQL> select * from test ;
```

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

We can see that **commit** has no effect after **rollback** operation.

```
SQL> select * from test ;
```

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

```
SQL> delete from test ;
```

4 rows deleted.

```
SQL> commit ;
```

Commit complete.

```
SQL> rollback ;
```

Rollback complete.

```
SQL> select * from test ;
```

no rows selected

Thus, from above – we can see that **rollback** has no effect after **commit** operation.

During an abnormal exit – i.e, shutdown or if the SQL window is closed by mouse click – then all the DML's will be rolled back automatically.

During a normal exit – **exit** ; - all the DML's will be auto-committed – and there will be no rollback.

Ex - 1) INSERT
UPDATE
ALTER
DELETE
ROLLBACK

When we perform the following operations in the same order for a table – then INSERT, UPDATE will be committed – because ALTER is a DDL – and thus all the DML's above it will also be committed – because DDL operations cannot be undone.

Here – only DELETE will be rolled back because it's a DML.

2) INSERT
UPDATE
DELETE
ROLLBACK

Here, all are rolled back.

SAVEPOINT :

It is like a pointer (break-point) till where a DML will be rolled back.

Ex :-

Insert ...

Save point x ;

Update ...

Delete ..

Rollback to x ;

...

...

Here, only DELETE & UPDATE are rolled back.

INSERT is neither rolled back nor committed.

Assignments

1) Create the following tables

a) Table name :- STUDENTS

regno (PK)

name (NN)

semester

DOB

Phone

b) Table name :- BOOKS

bookno (PK)

bname

author

c) Table name :- LIBRARY

regno (FK from students)

bookno (FK from books)

DOI -date of issue

DOR - date of return

2) Insert 5 records to each of these tables

3) Differentiate between,

a) Delete and Truncate

b) Truncate and Drop

c) Char and Varchar

d) Drop and Delete

Delete and Truncate

a) Delete - deletes whichever records we want to delete from the table

Truncate - deletes all the records whether we want it or not

b) Delete - can be undone

Truncate - cannot be undone.

NOTE - The Primary Key created using more than 1 column is called as *composite primary key*.

Ex - **alter table lib**

Add primary key (regno, bookno, DOI) ;

A sub-query is also called as a nested query.

Syntax of a sub-query

```
Select ...  
From ...  
Where ... ( select ...  
           From ...  
           Where ...  
         )
```

OUTER QUERY

INNER QUERY

Here, the **inner query** will be executed first.

The output of **inner query** is passed as input to the **outer query**.

To write a sub-query, atleast 1 common column should be existing between the tables.

For ex :-

1) List the employees working in 'Research' department.

```
SQL> select * from emp  
2  where deptno = (select deptno  
3                  from dept  
4                  where dname = 'RESEARCH'  
5                  ) ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

2) List the department names that are having analysts

```
SQL> select * from dept  
2  where deptno IN (select deptno  
3                  from emp  
4                  where job = 'ANALYST'  
5                  ) ;
```

DEPTNO	DNAME	LOC
20	RESEARCH	DALLAS

3) List the employees in Research and Sales department

```
SQL> select * from emp
2   where deptno IN (select deptno
3                     from dept
4                     where dname IN ('RESEARCH','SALES'))
5
6   order by deptno ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7902	FORD	ANALYST	7566	03-DEC-81	3000		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30

11 rows selected.

Assignment

1) List the department names which are having salesmen in it.

```
SQL> select * from dept
2   where deptno in (select deptno from emp
3                     where job = 'SALESMAN'
4                     ) ;
```

DEPTNO	DNAME	LOC
30	SALES	CHICAGO

2) Display the employees whose location is having atleast one 'O' in it.

```
SQL> select * from emp
2   where deptno in (select deptno from
3                     dept where loc like '%O%')
4   order by deptno ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7839	KING	PRESIDENT		17-NOV-81	5000		10
7934	MILLER	CLERK	7782	23-JAN-82	1300		10
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30

9 rows selected.

3) List the department names that are having atleast 1 employee in it.

```
SQL> select dname from dept
2   where deptno IN (select deptno from emp
3                      group by deptno
4                      having count(*) >0 ) ;
```

DNAME

```
-----
SALES
RESEARCH
ACCOUNTING
```

4) List the department names that are having atleast 4 employees in it

```
SQL> select dname from dept
2   where deptno in (select deptno from emp
3                      group by deptno
4                      having count(*) >=4);
```

DNAME

```
-----
SALES
RESEARCH
```

5) Display the department names which are having atleast 2clerks in it

```
SQL> select dname from dept
2   where deptno in (select deptno from emp
3                      where job = 'CLERK'
4                      group by deptno
5                      having count('CLERK') =2 ) ;
```

DNAME

```
-----
RESEARCH
```

6) Display the 2nd maximum salary

```
SQL> select max(sal) from emp
2   where sal < (select max(sal) from emp) ;
```

MAX(SAL)

```
-----
3000
```

7) Display the 3rd maximum salary

```
SQL> select max(sal) from emp
2   where sal < (select max(sal) from emp
3   where sal < (select max(sal) from emp) ) ;
```

MAX(SAL)

```
-----
2975
```

8) Display the 4th least salary

```
SQL> select min(sal) from emp
2  where sal > (select min(sal) from emp
3  where sal > (select min(sal) from emp
4  where sal > (select min(sal) from emp ) ) ) ;
```

```
MIN(SAL)
-----
1250
```

This method is not efficient to find the maximum and minimum salary. The limit is 32. This is not efficient if you want to find the 100th maximum salary.

We can have upto 32 levels of sub-queries only.

9) List the department names that are having no employees at all

```
SQL> select * from dept
2  where deptno not in (select deptno from emp) ;
```

DEPTNO	DNAME	LOC
40	OPERATIONS	BOSTON

Joins are used when we need to fetch the data from multiple tables

Types of JOIN(s)

- Cartesian Join (product)
- Inner (Equi) Join
- Outer Join - Left Outer Join, Right Outer Join, Full Outer Join
- Self Join

CARTESIAN JOIN

- It is based on Cartesian product theory.

Here, each and every record of the 1st table will combine with each and every record of the 2nd table.
If a table A is having 10 records & B is having 4 records – the Cartesian join will return $10 \times 4 = 40$ records.

For ex, let us consider the following query

Display employee name along with the department name

```
SQL> select A.ename, A.sal, B.dname  
2 from emp A, dept B ;
```

ENAME	SAL	DNAME	ENAME	SAL	DNAME
SMITH	800	ACCOUNTING	JONES	2975	RESEARCH
ALLEN	1600	ACCOUNTING	MARTIN	1250	RESEARCH
WARD	1250	ACCOUNTING	BLAKE	2850	RESEARCH
JONES	2975	ACCOUNTING	CLARK	2450	RESEARCH
MARTIN	1250	ACCOUNTING	SCOTT	3000	RESEARCH
BLAKE	2850	ACCOUNTING	KING	5000	RESEARCH
CLARK	2450	ACCOUNTING	TURNER	1500	RESEARCH
SCOTT	3000	ACCOUNTING	ADAMS	1100	RESEARCH
KING	5000	ACCOUNTING	JAMES	950	RESEARCH
TURNER	1500	ACCOUNTING	FORD	3000	RESEARCH
ADAMS	1100	ACCOUNTING	MILLER	1300	RESEARCH
JAMES	950	ACCOUNTING	SMITH	800	SALES
FORD	3000	ACCOUNTING	ALLEN	1600	SALES
MILLER	1300	ACCOUNTING	WARD	1250	SALES
SMITH	800	RESEARCH	JONES	2975	SALES
ALLEN	1600	RESEARCH	MARTIN	1250	SALES
WARD	1250	RESEARCH	BLAKE	2850	SALES

	ENAME	SAL	DNAME
	CLARK	2450	SALES
	SCOTT	3000	SALES
	KING	5000	SALES
	TURNER	1500	SALES
	ADAMS	1100	SALES
	JAMES	950	SALES
	FORD	3000	SALES
	MILLER	1300	SALES
	SMITH	800	OPERATIONS
	ALLEN	1600	OPERATIONS
	WARD	1250	OPERATIONS
	JONES	2975	OPERATIONS
	MARTIN	1250	OPERATIONS
	BLAKE	2850	OPERATIONS
SCOTT	3000	RESEARCH	
KING	5000	RESEARCH	
TURNER	1500	RESEARCH	
ADAMS	1100	RESEARCH	
JAMES	950	RESEARCH	
FORD	3000	RESEARCH	
MILLER	1300	RESEARCH	
SMITH	800	SALES	
ALLEN	1600	SALES	
WARD	1250	SALES	
JONES	2975	SALES	
MARTIN	1250	SALES	
BLAKE	2850	SALES	

ENAME	SAL	DNAME
TURNER	1500	OPERATIONS
ADAMS	1100	OPERATIONS
JAMES	950	OPERATIONS
FORD	3000	OPERATIONS
MILLER	1300	OPERATIONS

56 rows selected.

From above – we can see that the above query returns 56 records – but we are expecting 14 records. This is because each and every record of employee table will be combined with each & every record of department table.

Thus, Cartesian join should not be used in real time scenarios.

The Cartesian join contains both correct and incorrect sets of data. We have to retain the correct ones & eliminate the incorrect ones by using the **inner join**.

INNER JOIN

Inner join are also called as **equijoins**.

They return the matching records between the tables.

In the real time scenarios, this is the most frequently used Join.

For ex, consider the query shown below,

Select A.ename, A.sal, B.dname

From emp A, dept B

Where A.deptno = B.deptno

And A.sal > 2000

Order by A.sal ;

- JOIN condition

- FILTER condition

Let us see the output shown below,

```
SQL> Select A.ename, A.sal, B.dname
2 From emp A, dept B
3 Where A.deptno = B.deptno
4 And A.sal > 2000
5 Order by A.sal ;
```

ENAME	SAL	DNAME
CLARK	2450	ACCOUNTING
BLAKE	2850	SALES
JONES	2975	RESEARCH
FORD	3000	RESEARCH
SCOTT	3000	RESEARCH
KING	5000	ACCOUNTING

6 rows selected.

JOIN condition is mandatory for removing the Cartesian output.

Let us consider the following 2 scenarios shown below,

Scenario 1

A		
P	Q	R

B		
P	S	T

C		
P	X	Y

We want			
P	Q	S	X

The SQL query will be,

Select A.P, A.Q, B.S, C.X

From A, B, C

Where A.P = B.P Number of joins = 2

And A.P = C.P

Scenario 2

A		
P	Q	R

B			
P	Q	S	T

C		
P	X	Y

We want				
P	Q	R	S	X

The SQL query is ,

Select A.P, A.Q, A.R, B.S, C.X

From A, B, C

Where A.P = B.P

And A.Q = B.Q

And A.P = C.P ;

Number of Joins = 3

If there are no common columns, then reject it saying that the two tables can be joined.

But there are some cases – where the 2 columns will be same but having different column names.

For ex – customerid & cid

Display employee name, his job, his dname and his location for all the managers living in New York or Chicago

```
SQL> select A.ename, A.job, B.dname, B.loc
2  from emp A, dept B
3  where A.deptno = B.deptno
4  and A.job = 'MANAGER'
5  and B.loc in ('NEW YORK', 'CHICAGO') ;
```

ENAME	JOB	DNAME	LOC
BLAKE	MANAGER	SALES	CHICAGO
CLARK	MANAGER	ACCOUNTING	NEW YORK

ANSI style JOINS

This was introduced from Oracle 9i.

It is another way of writing inner joins with a few modifications.

```
SQL> select A.ename, A.job, B.dname, B.loc
2   from emp A join dept B
3   on A.deptno = B.deptno
4   and A.job = 'MANAGER'
5   and B.loc in ('NEW YORK', 'CHICAGO') ;
```

ENAME	JOB	DNAME	LOC
BLAKE	MANAGER	SALES	CHICAGO
CLARK	MANAGER	ACCOUNTING	NEW YORK

Thus we, can see the changes ,

- In the 2nd line - ,(comma) has been replaced by the word 'join'
- In the 3rd line - 'where' has been replaced with 'on'

Assignment

1) Display employee name and his department name for the employees whose name starts with 'S'

```
SQL> select A.ename, B.dname
2   from emp A, dept B
3   where A.deptno = B.deptno
4   and A.ename not like 'S%' ;
```

ENAME	DNAME
ALLEN	SALES
WARD	SALES
JONES	RESEARCH
MARTIN	SALES
BLAKE	SALES
CLARK	ACCOUNTING
KING	ACCOUNTING
TURNER	SALES
ADAMS	RESEARCH
JAMES	SALES
FORD	RESEARCH
MILLER	ACCOUNTING

12 rows selected.

OUTER JOIN

It returns both matching and non-matching records

Outer join = inner join + non-matching records

Non-matching records means data present in one table, but absent in another table w.r.to common columns.

For ex, 40 is there in deptno of dept table, but not there in deptno of emp table.

Display all the department names irrespective of any employee working in it or not. If an employee is working – display his name.

Using right join

```
SQL> select A.ename, A.job, B.dname, B.loc
  2  from emp A right join dept B
  3  on A.deptno = B.deptno ;
```

ENAME	JOB	DNAME	LOC
CLARK	MANAGER	ACCOUNTING	NEW YORK
KING	PRESIDENT	ACCOUNTING	NEW YORK
MILLER	CLERK	ACCOUNTING	NEW YORK
JONES	MANAGER	RESEARCH	DALLAS
FORD	ANALYST	RESEARCH	DALLAS
ADAMS	CLERK	RESEARCH	DALLAS
SMITH	CLERK	RESEARCH	DALLAS
SCOTT	ANALYST	RESEARCH	DALLAS
WARD	SALESMAN	SALES	CHICAGO
TURNER	SALESMAN	SALES	CHICAGO
ALLEN	SALESMAN	SALES	CHICAGO
JAMES	CLERK	SALES	CHICAGO
BLAKE	MANAGER	SALES	CHICAGO
MARTIN	SALESMAN	SALES	CHICAGO
		OPERATIONS	BOSTON

15 rows selected.

Using left join

```
SQL> select A.ename, A.job, B.dname, B.loc
  2  from dept B left join emp A
  3  on A.deptno = B.deptno ;
```

Using full join

```
SQL> select A.ename, A.job, B.dname, B.loc
  2  from dept B full join emp A
  3  on A.deptno = B.deptno ;
```

A	B
10	6
3	3
7	
	3

A CJ B = 60records A IJ B = 3records(3 matching)

A LJ B = 10records (3matching + 7non matching of A)

A RJ B = 6records (3matching + 3non matching of B)

A FJ B = 13records (3matching of A & B + 7nonmatching of A + 3nonmatching of B)

Assignment

1) Display employee name and his department name for the employees whose name starts with 'S'

```
SQL> select A.ename, B.deptno
  2   from emp A, dept B
  3   where A.deptno = B.deptno
  4   and A.ename like 'S%' ;
```

ENAME	DEPTNO
SMITH	20
SCOTT	20

2) Display employee name and his department name who is earning 1st maximum salary

```
SQL> select A.ename, B.dname
  2   from emp A, dept B
  3   where A.deptno = B.deptno
  4   and A.sal = (select max(sal) from emp) ;
```

ENAME	DNAME
KING	ACCOUNTING

SELF JOIN

Joining a table to itself is called self join

The **FROM** clause looks like this,
FROM emp A, emp B

Or

FROM emp A join emp B - ANSI style

For ex, - Display employee name along with their manager name

```
SQL> select A.ename "EMP",
  2         B.ename "MANAGER"
  3   from emp A, emp B
  4   where A.mgr = B.empno ;
```

EMP	MANAGER
SMITH	FORD
ALLEN	BLAKE
WARD	BLAKE
JONES	KING
MARTIN	BLAKE
BLAKE	KING
CLARK	KING
SCOTT	JONES
TURNER	BLAKE
ADAMS	SCOTT
JAMES	BLAKE
FORD	JONES
MILLER	CLARK

13 rows selected.

Now, let us see how this i.e the logic (the above query) works,

Emp (A)		
EmpNo	Ename	Mgr
101	Scott	102
102	Blake	103
103	King	-
104	Smith	103
105	Jones	104
Emp (B)		
EmpNo	Ename	Mgr
101	Scott	102
102	Blake	103
103	King	-
104	Smith	103
105	Jones	104

Now, when we give the above query – in Oracle – it starts matching the ‘mgr’ column of **emp A** with the ‘empno’ of **emp b** – we get two tables because in **self join** – a duplicate of the table required is created.

Now let us consider the **first employee Scott** – it starts the **mgrid** of **Scott** with the **empno** of all the records in **emp B** – when two **ids** match, then the **empno** in **emp B** becomes the **mgr** of the **empno** in **emp A**. Thus, we can see that – **mgr id 102** is matching with **empno 102 Blake** in **emp B**. Therefore, Blake is the manager of Scott.

Similarly we do the same for all the other records of **emp A** and thus find the employees and their respective managers.

Display the employees who are getting the same salary

```
SQL> select A.ename, A.sal
 2  from emp A join emp B
 3  on A.sal = B.sal
 4  and A.empno <> B.empno ;
```

ENAME	SAL
MARTIN	1250
WARD	1250
FORD	3000
SCOTT	3000

Co - related Queries :

- They are special type of sub - queries
- Here, both outer & inner queries are inter-dependent
- For each & every record of outer query, the entire inner query will be executed
- They work on the principles of both **sub - queries & JOIN(s)**.

For ex, Display the employee who is earning the highest salary

```
SQL> select * from emp A
2  where 0 = (select count(distinct(B.sal)) from emp B
3  where A.sal < B.sal ) ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7839	KING	PRESIDENT		17-NOV-81	5000		10

Thus, if an outer query column is being accessed inside the inner query, then that query is said to be co-related.

Let us see the logic i.e, how we get the 1st max salary :-

Emp (A)		
EmpNo	Ename	Sal
101	Scott	3000
102	Blake	4000
103	King	5000
104	Smith	2000
105	Jones	1000
Emp (B)		
EmpNo	Ename	Sal
101	Scott	3000
102	Blake	4000
103	King	5000
104	Smith	2000
105	Jones	1000

Since co-related queries are a combination of Joins and sub-queries.

It follows the concept of Joins and creates multiple copies of the same table.

Then it takes 1st record i.e, - Blake - sal is 3000. It starts comparing with the sal in the emp table,

3000 = 3000 - count starts from 0 - thus, 0 = 0

3000 < 4000 - thus, 0 != 1

3000 < 5000 - thus, 0 != 2

3000 > 2000 - thus, 0 != 2

3000 > 1000 - thus, 0 != 2 if the condition becomes false, then the count increments by 1. Here 3000 is less than 4000 & 5000, thus 0 != 2. Thus, Blake does not have the highest salary.

Similarly, it does for the next records,

Blake – salary of 4000 – but $4000 < 5000$ – thus, $0 \neq 1$. This is also false.

King – salary of 5000 – it is greater than everything – thus, $0 = 0$. Thus, King has the highest salary.

But the query doesn't stop here, it checks for Smith & Jones as well.

Similarly, if we want to find the 2nd maximum salary,

Then in the query, change '0' to '1' & here, the logic is – it compares until it gets $1 = 1$.

For 3rd maximum salary – change 0 to 2 and so on – here, the logic is – it compares until it gets $2 = 2$.

For any highest, always put it as '0' in the query.

If you want n(th) salary, pass (n-1).

In interview – this is a definite question. They will ask you what is co-related queries. And then they'll ask you find, 1st or max or 3rd maximum salary – after you write the query – they will ask you to explain the logic as to how it gets the same – draw the table and explain it to them just as shown above.

Assignment

1) Display the least salary from the employee table.

```
SQL> select * from emp A
2  where 0 = (select count(distinct(B.sal)) from emp B
3  where A.sal > B.sal ) ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20

2) Display top 3 person's salaries from the employee table.

```
SQL> select * from emp A
2  where 2 >= (select count(distinct(B.sal)) from emp B
3  where A.sal < B.sal ) ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7839	KING	PRESIDENT		17-NOV-81	5000		10
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

3) Write a query to display bottom 3 salaries

```
SQL> select * from emp A
  2 where 2 >= (select count(distinct(B.sal)) from emp B
  3 where A.sal > B.sal )
  4 order by sal asc ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20

4) Display 1st and 4th maximum salary

```
SQL> select * from emp A
  2 where 0 = (select count(distinct(B.sal)) from emp B
  3 where A.sal < B.sal )
  4 UNION
  5 select * from emp A
  6 where 3 = (select count(distinct(B.sal)) from emp B
  7 where A.sal < B.sal )
  8 /
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7839	KING	PRESIDENT		17-NOV-81	5000		10

5) Display 1st, 4th & 6th highest salaries in a single query

```
SQL> select * from emp A
  2 where 0 = (select count(distinct(B.sal)) from emp B
  3 where A.sal < B.sal )
  4 UNION
  5 select * from emp A
  6 where 3 = (select count(distinct(B.sal)) from emp B
  7 where A.sal < B.sal )
  8 UNION
  9 select * from emp A
 10 where 5 = (select count(distinct(B.sal)) from emp B
 11 where A.sal < B.sal )
 12 /
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7839	KING	PRESIDENT		17-NOV-81	5000		10

Functions – it is a re-usable program that returns a value.

There are **2 types**,

- Pre – defined
- User defined

Pre – defined

- GROUP functions
- CHARACTER functions
- NUMERIC functions
- DATE functions
- SPECIAL functions

These are used both in SQL and PL/SQL. PL – Procedural Language (it's an extension to SQL, can contain IF statements, loops, exceptions, OOPs, etc ..)

User – defined

Used only in PL/SQL and we will not study it here.

We have already learnt about GROUP functions.

Now, let us study the various CHARACTER functions.

CHARACTER functions

- a) Upper
- b) Lower
- c) Length

For ex :-

```
SQL> select upper ('oracle'), lower ('ORaCLE')  
2 from dual ;
```

```
UPPER( LOWER(  
-----
```

```
ORACLE oracle
```

```
SQL> select ename, lower(ename) from emp ;
```

```
ENAME          LOWER(ENAM  
-----
```

```
SMITH          smith  
ALLEN          allen  
WARD           ward  
JONES          jones  
MARTIN         martin  
BLAKE          blake  
CLARK          clark  
SCOTT          scott  
KING           king  
TURNER         turner  
ADAMS          adams  
JAMES          james  
FORD           ford  
MILLER         miller
```

```
14 rows selected.
```

In the 1st query, we see something called as **dual**.

Dual - is a dummy table which is used for performing some independent operations which will not depend on any of the existing tables.

For ex,

1)

```
SQL> select sysdate from dual ;
```

```
SYSDATE  
-----
```

```
09-APR-11
```

This gives the system date.

2)

```
SQL> select 100 + 200 from dual ;
```

100+200
300

```
SQL> select 100 + 200 " ADDITION "  
2 from dual ;
```

ADDITION
300

3)

```
SQL> select ename, sal + 100 from emp ;
```

ENAME	SAL+100
SMITH	900
ALLEN	1700
WARD	1350
JONES	3075
MARTIN	1350
BLAKE	2950
CLARK	2550
SCOTT	3100
KING	5100
TURNER	1600
ADAMS	1200
JAMES	1050
FORD	3100
MILLER	1400

14 rows selected.

We use dual – when the data is not present in any of the existing tables. Then we use dual.

Length – it returns the length of a given string.

For ex,

1)

```
SQL> select length ('oracle') from dual ;
```

LENGTH('ORACLE')
6

2)

```
SQL> select ename, length(ename) from emp ;
```

ENAME	LENGTH(ENAME)
SMITH	5
ALLEN	5
WARD	4
JONES	5
MARTIN	6
BLAKE	5
CLARK	5
SCOTT	5
KING	4
TURNER	6
ADAMS	5
JAMES	5
FORD	4
MILLER	6

14 rows selected.

3) Display all the employees whose name & job is having exactly 5 characters

```
SQL> select * from emp
2   where length(ename) =5
3   and length(job) =5 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7369	SMITH	CLERK	7902	17-DEC-80	800		20
7876	ADAMS	CLERK	7788	23-MAY-87	1100		20
7900	JAMES	CLERK	7698	03-DEC-81	950		30

REPLACE

It replaces the old value with a new value in the given string.

For ex,

```
SQL> select replace ('oracle','a','p') from dual ;
```

REPLAC

orpcle

Here, **a** - is the old value to be replaced with **p** - which is the new value.

```
SQL> select ename, replace(ename, 'A', 'B')
2   from emp ;
```

This query replaces all the names which has 'A' in it with 'B'.

Let us see the output as shown below,

ENAME	REPLACE(EN
SMITH	SMITH
ALLEN	BLLN
WARD	WBRD
JONES	JONES
MARTIN	MBRTIN
BLAKE	BLBKE
CLARK	CLBRK
SCOTT	SCOTT
KING	KING
TURNER	TURNER
ADAMS	BDBMS

ENAME	REPLACE(EN
JAMES	JBMES
FORD	FORD
MILLER	MILLER

14 rows selected.

```
SQL> select ename, replace (ename, 'A', NULL)
2   from emp ;
```

ENAME	REPLACE(EN
SMITH	SMITH
ALLEN	LLEN
WARD	WRD
JONES	JONES
MARTIN	MRTIN
BLAKE	BLKE
CLARK	CLRK
SCOTT	SCOTT
KING	KING
TURNER	TURNER
ADAMS	DMS

ENAME	REPLACE(EN
JAMES	JMES
FORD	FORD
MILLER	MILLER

14 rows selected.

SUBSTR

This is called **substring**.

It extracts 'n' characters from x(th) position of a given string.

For ex,

```
SQL> select job,
  2  substr (job,1,3) "1 - 3",
  3  substr (job,2,4) "2 - 4",
  4  substr (job,3) "3 - n",
  5  substr (job, -4) "last"
  6  from emp ;
```

JOB	1 - 2 - 3 - n	last
CLERK	CLE LERK ERK	LERK
SALESMAN	SAL ALES LESMAN	SMAN
SALESMAN	SAL ALES LESMAN	SMAN
MANAGER	MAN ANAG NAGER	AGER
SALESMAN	SAL ALES LESMAN	SMAN
MANAGER	MAN ANAG NAGER	AGER
MANAGER	MAN ANAG NAGER	AGER
ANALYST	ANA NALY ALYST	LYST
PRESIDENT	PRE RESI ESIDENT	DENT
SALESMAN	SAL ALES LESMAN	SMAN
CLERK	CLE LERK ERK	LERK

JOB	1 - 2 - 3 - n	last
CLERK	CLE LERK ERK	LERK
ANALYST	ANA NALY ALYST	LYST
CLERK	CLE LERK ERK	LERK

14 rows selected.

Here , (job, '1' , '3') - means from job - extract from 1st position , 3 characters.

1) Display the employees whose job starts with 'man'

```
SQL> select * from emp
  2  where substr (job,1,3) = 'MAN';
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7566	JONES	MANAGER	7839	02-APR-81	2975		20
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10

2) Display the employees whose job ends with 'man'

```
SQL> select * from emp
  2  where substr (job,-3) = 'MAN' ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7521	WARD	SALESMAN	7698	22-FEB-81	1250	500	30
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30

INSTR

This is also called as **instr**.

It returns position of a given character in a given string.

For ex,

Select instr ('oracle', 'a', 1, 1) from dual ;

Given string

Character to be searched

Position from where the search should begin

Number of occurrences

```
SQL> select instr ('oraclea','a',1,1),
2          instr ('oraclea','a',1,2),
3          instr ('oraclea','a')
4  from dual ;
```

INSTR('ORACLEA','A',1,1)	INSTR('ORACLEA','A',1,2)	INSTR('ORACLEA','A')
3	7	3

Display all the employees whose name is having 'L'

```
SQL> select * from emp
2  where instr (ename,'L',1,1) >0 ;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600	300	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7934	MILLER	CLERK	7782	23-JAN-82	1300		10

List the employees whose job is having atleast 2 A's in it

```
SQL> select * from emp
2 where instr(job,'A',1,2) >=2;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
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
7654	MARTIN	SALESMAN	7698	28-SEP-81	1250	1400	30
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10
7788	SCOTT	ANALYST	7566	19-APR-87	3000		20
7844	TURNER	SALESMAN	7698	08-SEP-81	1500	0	30
7902	FORD	ANALYST	7566	03-DEC-81	3000		20

9 rows selected.

CONCAT

It concatenates any two values or columns.

It is represented by - ||

For ex,

```
SQL> select ename || ' Works as ' || job "statement" from emp ;
```

statement

```
-----
SMITH Works as CLERK
ALLEN Works as SALESMAN
WARD Works as SALESMAN
JONES Works as MANAGER
MARTIN Works as SALESMAN
BLAKE Works as MANAGER
CLARK Works as MANAGER
SCOTT Works as ANALYST
KING Works as PRESIDENT
TURNER Works as SALESMAN
ADAMS Works as CLERK
JAMES Works as CLERK
FORD Works as ANALYST
MILLER Works as CLERK
```

14 rows selected.

NUMERIC FUNCTIONS

1) Mod :- it returns the remainder when 1 number is divided by the other.

```
SQL> select mod(7,2) "REM", 7/2 "QUO" from dual ;
```

REM	QUO
1	3.5

Display the employees earning odd numbered salaries.

```
SQL> select * from emp
2 where mod(sal,2)<>0;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7566	JONES	MANAGER	7839	02-APR-81	2975		20

Round

It rounds off a given number to the nearest decimal place.

Trunc

It truncates the given number to the given decimal place. Truncate does not do any rounding.

For ex,

```
SQL> select round(34.76,1),
2      trunc(34.76,1)
3 from dual ;
```

ROUND(34.76,1)	TRUNC(34.76,1)
34.8	34.7

Here, '1' indicates the number of positions.

DATE FUNCTIONS

1) Sysdate

Stands for System date.

It returns both date & time, but by default – only date is displayed.

The default format is,

dd - mon - yy

```
SQL> select sysdate from dual;
```

```
SYSDATE
-----
10-APR-11
```

2) Systimestamp

Introduced from Oracle 9i

Returns date, time and timezone.

```
SQL> select systimestamp from dual
2 /
```

```
SYSTIMESTAMP
-----
10-APR-11 06.49.08.914000 AM +05:30
```

Here, .914000 – gives the fraction of millisecond which keeps changing as shown below,

```
SQL> select systimestamp from dual  
2 /
```

```
SYSTIMESTAMP
```

```
-----  
10-APR-11 06.49.08.914000 AM +05:30
```

```
SQL> /
```

```
SYSTIMESTAMP
```

```
-----  
10-APR-11 06.50.25.614000 AM +05:30
```

```
SQL> /
```

```
SYSTIMESTAMP
```

```
-----  
10-APR-11 06.50.26.726000 AM +05:30
```

```
SQL> /
```

```
SYSTIMESTAMP
```

```
-----  
10-APR-11 06.50.27.697000 AM +05:30
```

```
SQL> /
```

```
SYSTIMESTAMP
```

```
-----  
10-APR-11 06.50.29.109000 AM +05:30
```

In interview - if they ask you - "which function contains fractions of a second" OR "how to see the system time" - then answer is "SYSTIMESTAMP".

SPECIAL FUNCTIONS

1) TO - CHAR

Used for displaying the date in different formats.

For ex,

```
SQL> select to_char(sysdate, 'mm/dd/yyyy') from dual ;
```

```
TO_CHAR(SY
```

```
-----  
04/10/2011
```

```
SQL> select to_char (sysdate, 'day, dd-month')from dual ;
```

```
TO_CHAR(SYSDATE,'DAY,DD
```

```
-----  
sunday , 10-april
```

```
SQL> select ename, to_char(hiredate, 'mm/dd/yyyy') from emp;
```

ENAME	TO_CHAR(HI
SMITH	12/17/1980
ALLEN	02/20/1981
WARD	02/22/1981
JONES	04/02/1981
MARTIN	09/28/1981
BLAKE	05/01/1981
CLARK	06/09/1981
SCOTT	04/19/1987
KING	11/17/1981
TURNER	09/08/1981
ADAMS	05/23/1987
JAMES	12/03/1981
FORD	12/03/1981
MILLER	01/23/1982

14 rows selected.

```
SQL> select to_char(sysdate, 'mm-yyyy hh:mi:ss') from dual ;
```

TO_CHAR(SYSDATE,
04-2011 06:56:30

Now, let us see how to add 5 hrs to the existing time,

```
SQL> select to_char(sysdate + (5/24), 'hh:mi') from dual ;
```

TO_CH
11:59

```
SQL> select systimestamp from dual;
```

SYSTIMESTAMP
10-APR-11 06.59.44.909000 AM +05:30

We can see that 5 hrs has been added to the current time.

NVL

It substitutes a value for a null.

For ex,

```
SQL> select ename,sal,comm,sal+NVL(comm,0) "total Sal" from emp;
```

ENAME	SAL	COMM	total Sal
SMITH	800		800
ALLEN	1600	300	1900
WARD	1250	500	1750
JONES	2975		2975
MARTIN	1250	1400	2650
BLAKE	2850		2850
CLARK	2450		2450
SCOTT	3000		3000
KING	5000		5000
TURNER	1500	0	1500
ADAMS	1100		1100
JAMES	950		950
FORD	3000		3000
MILLER	1300		1300

14 rows selected.

The above query means – if the employee has commission, then add sal + comm. To get total salary – else add 0 to the sal and display total salary.

DECODE

It works like 'if - then - else' statement.

For ex,

```
SQL> select ename,job,
  2  decode (job,'CLERK','C','SALESMAN','S','O')
  3  from emp;
```

ENAME	JOB	D
SMITH	CLERK	C
ALLEN	SALESMAN	S
WARD	SALESMAN	S
JONES	MANAGER	O
MARTIN	SALESMAN	S
BLAKE	MANAGER	O
CLARK	MANAGER	O
SCOTT	ANALYST	O
KING	PRESIDENT	O
TURNER	SALESMAN	S
ADAMS	CLERK	C
JAMES	CLERK	C
FORD	ANALYST	O
MILLER	CLERK	C

14 rows selected.

The above query states that – in job, if clerk is there, replace with C – else if salesman is there, replace it with S – else replace with 'O'.

Display employee name, job, salary and commission. If the commission is NULL, then display -100

```
SQL> select ename, job, sal, NUL(comm, -100) from emp ;
```

ENAME	JOB	SAL	NUL(COMM,-100)
SMITH	CLERK	800	-100
ALLEN	SALESMAN	1600	300
WARD	SALESMAN	1250	500
JONES	MANAGER	2975	-100
MARTIN	SALESMAN	1250	1400
BLAKE	MANAGER	2850	-100
CLARK	MANAGER	2450	-100
SCOTT	ANALYST	3000	-100
KING	PRESIDENT	5000	-100
TURNER	SALESMAN	1500	0
ADAMS	CLERK	1100	-100

ENAME	JOB	SAL	NUL(COMM,-100)
JAMES	CLERK	950	-100
FORD	ANALYST	3000	-100
MILLER	CLERK	1300	-100

14 rows selected.

Display all employees whose name is having exactly 1 'L' in it

```
SQL> select * from emp
2  where instr (ename, 'L',1,1) >0
3  and instr (ename, 'L',1,2) =0;
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7698	BLAKE	MANAGER	7839	01-MAY-81	2850		30
7782	CLARK	MANAGER	7839	09-JUN-81	2450		10

Normalization is the process of splitting the bigger table into many small tables without changing its functionality.

It is generally carried out during the design phase of SDLC.

Advantages

- 1) it reduces the redundancy (unnecessary repetition of data)
- 2) avoids problem due to delete anomaly (inconsistency)

Normalization is a step-by-step process and in each step, we have to perform some activities.

STEPS IN NORMALIZATION

- 1) 1NF - 1st Normal form
- 2) 2NF - 2nd Normal form
- 3) 3NF - 3rd Normal form

1NF

- We should collect all the required attributes into 1 or more bigger entities.
- We have to assume no 2 records are same (i.e, records should not be duplicated)
- Identify the probable primary key

At the end of 1NF, our data looks like this,

<u>COLLEGE</u>
RegNo - PK
Sname
Semester
DOB
MailID
Phone
BookNo - PK
Bname
Author
DOI
DOR
Fine

2NF

To perform 2NF,

- The tables have to be in 1NF
- Here, we identify all the complete dependencies and move them separately into different tables.

At the end of 2NF, our data looks like this,

<u>STUDENTS</u>	<u>BOOKS</u>
-----------------	--------------

RegNo - PK
Sname
Semester
DOB
MailID
Phone

BookNo - PK
RegNo - FK
Bname
Author
DOI
DOR
Fine

3NF

The table will have to be in 2NF

Here, we identify all the partial dependencies and move such columns to a separate table.

<u>STUDENTS</u>
RegNo - PK
Sname
Semester
DOB
MailID
Phone

<u>BOOKS</u>
BookNo - PK
Bname
Author

<u>LIBRARY</u>
BookNo - FK
RegNo - FK
DOI
DOR
Fine

Disadvantage of Normalization

The only minor disadvantage is we may have to write complex queries as we have more number of tables to be accessed.

Denormalization is the process of combining more than 1 smaller table to form 1 bigger table is called as denormalization.

CODD rules (Differentiates between DBMS & RDBMS)

- 1) should support NULL values
- 2) should support creation of relationship between tables
- 3) should support DDL, DML, TCL
- 4) should support constraints like PK, Unique, CHK
- 5) should support query techniques like sub - queries, joins, grouping etc.

Oracle 9i Features (i means internet)

- TIMESTAMP datatype
- SYSTIMESTAMP function
- ANSI style joins
- Renaming a column

Oracle 10g features (g means grid)

- Recycle Bin

ERD - Entity Relationship Diagram

It is the pictorial representation of all the entities and their relationships (tables).

<u>STUDENTS</u>
RegNo - PK
Sname
Semester
DOB
MailID
Phone

<u>STUDENTS INTERNALS</u>
RegNo - FK
Sid
Marks
<u>BOOKS</u>
BookNo - PK
BName
Author

<u>LIBRARY</u>
BookNo - FK
RegNo - FK
DOI
DOR
Fine

******* THE END *******
