Database Testing:

Database testing mainly concentrates on the following

- data integrity test(update,delete,insertion) should verify the db for the changes
- stored procedure test
- type test (data type test)
- data size test
- Event driven item test (triggers)
- Input item verification

ORACLE/SQL

SQL is a standard language for accessing and manipulating databases.

- SQL is not case sensitive

What Can SQL do?

- SQL can execute queries against a database
- SQL can retrieve data from a database
- SQL can insert records in a database
- SQL can update records in a database
- SQL can delete records from a database
- SQL can create new tables in a database
- SQL can create stored procedures in a database
- SQL can create views in a database
- SQL can set permissions on tables, procedures, and views

SQL DDL,DML & DCL

SQL can be divided into three parts:

The DDL part of SQL permits database tables to be created or deleted.

- **CREATE TABLE** - creates a new table
- **ALTER TABLE** - modifies a table
- **DROP TABLE** - deletes a table

The query and update commands form the DML part of SQL:

- **SELECT** - extracts data from a database
- **UPDATE** - updates data in a database
- **DELETE** - deletes data from a database
- **INSERT INTO** - inserts new data into a database

DCL is used to create database users & permissions to control the DB securing it

- **Grant**
- **Rollback**

The ALTER TABLE Statement

The ALTER TABLE statement is used to add, delete, or modify columns in an existing table.

SQL ALTER TABLE Syntax

To add a column in a table, use the following syntax:ALTER TABLE table_name

ADD column_name datatype

To delete a column in a table, use the following syntax (notice that some database systems don't allow deleting a column):ALTER TABLE table_name

DROP COLUMN column_name

The INSERT INTO Statement

The INSERT INTO statement is used to insert a new row in a table.

SQL INSERT INTO Syntax

It is possible to write the INSERT INTO statement in two forms.

The first form doesn't specify the column names where the data will be inserted, only their values:

```
INSERT INTO table_name
VALUES (value1, value2, value3,...)
```

The second form specifies both the column names and the values to be inserted:

```
INSERT INTO table_name (column1, column2, column3,...)
VALUES (value1, value2, value3,...)
```

SQL INSERT INTO Example

We have the following "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes

2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

Now we want to insert a new row in the "Persons" table.

We use the following SQL statement:

```
INSERT INTO Persons
VALUES (4,'Nilsen', 'Johan', 'Bakken 2', 'Stavanger')
```

The "Persons" table will now look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger
4	Nilsen	Johan	Bakken 2	Stavanger

Insert Data Only in Specified Columns

It is also possible to only add data in specific columns.

The following SQL statement will add a new row, but only add data in the "P_Id", "LastName" and the "FirstName" columns:

```
INSERT INTO Persons (P_Id, LastName, FirstName)
VALUES (5, 'Tjessem', 'Jakob')
```

The "Persons" table will now look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger
4	Nilsen	Johan	Bakken 2	Stavanger
5	Tjessem	Jakob		

Update Command

The UPDATE statement is used to update records in a table.

The UPDATE Statement

The UPDATE statement is used to update existing records in a table.

SQL UPDATE Syntax

```
UPDATE table_name
SET column1=value, column2=value2,...
WHERE some_column=some_value
```

Note: Notice the WHERE clause in the UPDATE syntax. The WHERE clause specifies which record or records that should be updated. If you omit the WHERE clause, all records will be updated!

SQL UPDATE Example

The "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger
4	Nilsen	Johan	Bakken 2	Stavanger
5	Tjessem	Jakob		

Now we want to update the person "Tjessem, Jakob" in the "Persons" table.

We use the following SQL statement:

```
UPDATE Persons
SET Address='Nissestien 67', City='Sandnes'
WHERE LastName='Tjessem' AND FirstName='Jakob'
```

The "Persons" table will now look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger
4	Nilsen	Johan	Bakken 2	Stavanger
5	Tjessem	Jakob	Nissestien 67	Sandnes

SQL UPDATE Warning

Be careful when updating records. If we had omitted the WHERE clause in the example above, like this:

```
UPDATE Persons
SET Address='Nissestien 67', City='Sandnes'
```

The "Persons" table would have looked like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Nissestien 67	Sandnes
2	Svendson	Tove	Nissestien 67	Sandnes
3	Pettersen	Kari	Nissestien 67	Sandnes
4	Nilsen	Johan	Nissestien 67	Sandnes
5	Tjessem	Jakob	Nissestien 67	Sandnes

Select Command:

SELECT * FROM customers ---will retrieve all the data in customers table

SELECT CompanyName, ContactName FROM customers - will retreive the data only for the columns companyname and contact name

The WHERE Clause

The WHERE clause is used to extract only those records that fulfill a specified criterion.

SQL WHERE Syntax

```
SELECT column_name(s)
FROM table_name
WHERE column_name operator value
```

WHERE Clause Example

The "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

Now we want to select only the persons living in the city "Sandnes" from the table above.

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE City='Sandnes'
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes

Quotes Around Text Fields

SQL uses single quotes around text values (most database systems will also accept double quotes).

Although, numeric values should not be enclosed in quotes.

For text values:

```
This is correct:

SELECT * FROM Persons WHERE FirstName='Tove'

This is wrong:

SELECT * FROM Persons WHERE FirstName=Tove
```

For numeric values:

```
This is correct:

SELECT * FROM Persons WHERE Year=1965

This is wrong:

SELECT * FROM Persons WHERE Year='1965'
```

Operators Allowed in the WHERE Clause

With the WHERE clause, the following operators can be used:

Operator	Description

=	Equal
<>	Not equal
>	Greater than
<	Less than
>=	Greater than or equal
<=	Less than or equal
BETWEEN	Between an inclusive range
LIKE	Search for a pattern
IN	If you know the exact value you want to return for at least one of the columns

Note: In some versions of SQL the <> operator may be written as !=

The AND & OR Operators

The AND operator displays a record if both the first condition and the second condition is true.

The OR operator displays a record if either the first condition or the second condition is true.

AND Operator Example

The "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

Now we want to select only the persons with the first name equal to "Tove" AND the last name equal to "Svendson":

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE FirstName='Tove'
AND LastName='Svendson'
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
2	Svendson	Tove	Borgvn 23	Sandnes

OR Operator Example

Now we want to select only the persons with the first name equal to "Tove" OR the first name equal to "Ola":

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE FirstName='Tove'
OR FirstName='Ola'
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes

Combining AND & OR

You can also combine AND and OR (use parenthesis to form complex expressions).

Now we want to select only the persons with the last name equal to "Svendson" AND the first name equal to "Tove" OR to "Ola":

We use the following SELECT statement:

```
SELECT * FROM Persons WHERE
LastName='Svendson'
AND (FirstName='Tove' OR FirstName='Ola')
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
2	Svendson	Tove	Borgvn 23	Sandnes

Distinct

In a table, some of the columns may contain duplicate values.

The DISTINCT keyword can be used to return only distinct (different) values.

SQL SELECT DISTINCT Syntax

SELECT DISTINCT column_name(s) FROM table_name

table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

Now we want to select only the distinct values from the column named "City" from the table above.

We use the following SELECT statement:

```
SELECT DISTINCT City FROM Persons
```

The result-set will look like this:

City
Sandnes
Stavanger

The ORDER BY Keyword

The ORDER BY keyword is used to sort the result-set by a specified column.

The ORDER BY keyword sort the records in ascending order by default.

If you want to sort the records in a descending order, you can use the DESC keyword.

SQL ORDER BY Syntax

```
SELECT column_name(s)
FROM table_name
ORDER BY column_name(s) ASC|DESC
```

ORDER BY Example

The "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger
4	Nilsen	Tom	Vingvn 23	Stavanger

Now we want to select all the persons from the table above, however, we want to sort the persons by their last name.

We use the following SELECT statement:

```
SELECT * FROM Persons
ORDER BY LastName
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
4	Nilsen	Tom	Vingvn 23	Stavanger
3	Pettersen	Kari	Storgt 20	Stavanger
2	Svendson	Tove	Borgvn 23	Sandnes

ORDER BY DESC Example

Now we want to select all the persons from the table above, however, we want to sort the persons descending by their last name.

We use the following SELECT statement:

```
SELECT * FROM Persons
ORDER BY LastName DESC
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger
4	Nilsen	Tom	Vingvn 23	Stavanger
1	Hansen	Ola	Timoteivn 10	Sandnes

SQL LIKE Operator

The LIKE operator is used in a WHERE clause to search for a specified pattern in a column.

The LIKE Operator

The LIKE operator is used to search for a specified pattern in a column.

SQL LIKE Syntax

```
SELECT column_name(s)
FROM table_name
WHERE column_name LIKE pattern
```

LIKE Operator Example

The "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

Now we want to select the persons living in a city that starts with "s" from the table above.

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE City LIKE 's%'
```

The "%" sign can be used to define wildcards (missing letters in the pattern) both before and after the pattern.

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

Next, we want to select the persons living in a city that ends with an "s" from the "Persons" table.

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE City LIKE '%s'
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes

Next, we want to select the persons living in a city that contains the pattern "tav" from the "Persons" table.

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE City LIKE '%tav%'
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
3	Pettersen	Kari	Storgt 20	Stavanger

It is also possible to select the persons living in a city that NOT contains the pattern "tav" from the "Persons" table, by using the NOT keyword.

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE City NOT LIKE '%tav%'
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes

The IN Operator

The IN operator allows you to specify multiple values in a WHERE clause.

SQL IN Syntax

```
SELECT column_name(s)
FROM table_name
WHERE column_name IN (value1,value2,...)
```

IN Operator Example

The "Persons" table:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
2	Svendson	Tove	Borgvn 23	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

Now we want to select the persons with a last name equal to "Hansen" or "Pettersen" from the table above.

We use the following SELECT statement:

```
SELECT * FROM Persons
WHERE LastName IN ('Hansen','Pettersen')
```

The result-set will look like this:

P_Id	LastName	FirstName	Address	City
1	Hansen	Ola	Timoteivn 10	Sandnes
3	Pettersen	Kari	Storgt 20	Stavanger

The BETWEEN Operator

The BETWEEN operator selects a range of data between two values. The values can be numbers, text, or dates.

SQL BETWEEN Syntax

```
SELECT column_name(s)
FROM table_name
```

```
WHERE column_name
BETWEEN value1 AND value2
```

SQL Alias

You can give a table or a column another name by using an alias. This can be a good thing to do if you have very long or complex table names or column names.

SQL Constraints

Constraints are used to limit the type of data that can go into a table.

Constraints can be specified when a table is created (with the CREATE TABLE statement) or after the table is created (with the ALTER TABLE statement).

We will focus on the following constraints:

- NOT NULL
- UNIQUE
- PRIMARY KEY
- FOREIGN KEY
- CHECK

The next chapters will describe each constraint in details.

SQL NOT NULL Constraint

The NOT NULL constraint enforces a column to NOT accept NULL values.

The NOT NULL constraint enforces a field to always contain a value. This means that you cannot insert a new record, or update a record without adding a value to this field.

The following SQL enforces the "P_Id" column and the "LastName" column to not accept NULL values:

EX:

CREATE TABLE Persons

(

P_Id int NOT NULL,

LastName varchar(255) NOT NULL,

FirstName varchar(255),

Address varchar(255),

City varchar(255)

)

SQL UNIQUE Constraint

The UNIQUE constraint uniquely identifies each record in a database table.

The UNIQUE and PRIMARY KEY constraints both provide a guarantee for uniqueness for a column or set of columns.

A PRIMARY KEY constraint automatically has a UNIQUE constraint defined on it.

Note that you can have many UNIQUE constraints per table, but only one PRIMARY KEY constraint per table.

SQL UNIQUE Constraint on CREATE TABLE

The following SQL creates a UNIQUE constraint on the "P_Id" column when the "Persons" table is created:

Ex : CREATE TABLE Persons

(

P_Id int NOT NULL,

LastName varchar(255) NOT NULL,

FirstName varchar(255),

Address varchar(255),

City varchar(255),

UNIQUE (P_Id)

)

PRIMARY KEY:

SQL PRIMARY KEY Constraint

The PRIMARY KEY constraint uniquely identifies each record in a database table.

Primary keys must contain unique values.

A primary key column cannot contain NULL values.

Each table should have a primary key, and each table can have only ONE primary key.

SQL PRIMARY KEY Constraint on CREATE TABLE

The following SQL creates a PRIMARY KEY on the "P_Id" column when the "Persons" table is created:

Ex:

```
CREATE TABLE Persons
(
P_Id int NOT NULL,
LastName varchar(255) NOT NULL,
FirstName varchar(255),
Address varchar(255),
City varchar(255),
PRIMARY KEY (P_Id)
)
```

FOREIGN KEY

The FOREIGN KEY constraint also prevents that invalid data form being inserted into the foreign key column, because it has to be one of the values contained in the table it points to.

create table emp (empno int,deptno int,constraint fk_emp FOREIGN KEY (empno) REFERENCES suni(empno))

SQL CHECK Constraint

The CHECK constraint is used to limit the value range that can be placed in a column.

If you define a CHECK constraint on a single column it allows only certain values for this column.

If you define a CHECK constraint on a table it can limit the values in certain columns based on values in other columns in the row.

SQL CHECK Constraint on CREATE TABLE

The following SQL creates a CHECK constraint on the "P_Id" column when the "Persons" table is created. The CHECK constraint specifies that the column "P_Id" must only include integers greater than 0.

My SQL:CREATE TABLE Persons

(

P_Id int NOT NULL,

LastName varchar(255) NOT NULL,

FirstName varchar(255),

Address varchar(255),

City varchar(255),

CHECK (P_Id>0)

)

Joins

Self Join:

A self-join is a query in which a table is joined (compared) to itself. Self-joins are used to compare values in a column with other values in the *same column in the same table*. One practical use for self-joins:

Ex:

select sal from emp e1 where 2=(select count(distinct(sal)) from emp e2 where e1.sal<=e2.sal);

Inner Join

The **SQL INNER JOIN** clause tells the database to only return rows where there is a match found between table1 and table2. An INNER JOIN is most often (but not always) created between the primary key column of one table and the foreign key column of another table.

Employee

EmployeeID	Name	Telephone	StartedEmployment
1	Bob Marley	0222 00000	10/01/2005
2	John Lennon	0222 00050	02/05/2003
3	Ralph Kimball	0222 03307	01/04/2004
4	Bill Gates	0222 03307	01/04/2004

TrainingTaken

TrainingTakenID	EmployeeID	TrainingTitle	TrainingDate
1	2	Sales Training	10/01/07
2	1	Risk Management	05/02/07
3	2	First Aid	01/03/07
4	3	Sales Training	10/01/07

The Employee table has a primary key column called *EmployeeID* which relates to the foreign key column in the TrainingTaken table called *EmployeeID*.

Now that we know how these two tables relate to each other we can write a query that correctly 'joins' or 'matches' related data from these two tables. To do this we must specify in our INNER JOIN clause, the relationship between the *EmployeeID* column in the Employee table and the *EmployeeID* column in the TrainingTakentable.

Lets write a query that returns a list of employee names along with the title and date of any training they have been on.

```
SELECT Employee.Name, TrainingTaken.TrainingTitle, TrainingTaken.TrainingDate
FROM Employee
        INNER JOIN TrainingTaken ON Employee.EmployeeID =
TrainingTaken.EmployeeID
```

Returns:

Name	TrainingTaken	TrainingDate
Bob Marley	Risk Management	05/02/07
John Lennon	Sales Training	10/01/07
John Lennon	First Aid	01/03/07
Ralph Kimball	Sales Training	10/01/07

The above query demonstrates the **INNER JOIN** clause which specifies the two tables that we are using and then uses the **ON** keyword to define the relationship or 'joining points' between the two tables.

We can see that columns are identified by using *TableName.ColumnName* syntax so that the query knows which table to find the column we are referencing. This is because the same column name may be present in more than one table (e.g. the column name *EmployeeID* appears in both tables in our example).

The INNER JOIN clause in the example above can be rewritten in an alternative format (a JOIN condition) by defining the relationship between the two tables in the WHERE clause.

```
SELECT Employee.Name, TrainingTaken.TrainingTitle, TrainingTaken.TrainingDate
FROM Employee JOIN TrainingTaken
WHERE Employee.EmployeeID = TrainingTaken.EmployeeID
```

Outer joins

An outer join does not require each record in the two joined tables to have a matching record. The joined table retains each record—even if no other matching record exists. Outer joins subdivide further into left outer joins, right outer joins, and full outer joins, depending on which table(s) one retains the rows from (left, right, or both).

(In this case left and right refer to the two sides of the JOIN keyword.)

No implicit join-notation for outer joins exists in standard SQL.

Left outer join

The result of a left outer join (or simply left join) for table A and B always contains all records of the "left" table (A), even if the join-condition does not find any matching record in the "right" table (B). This means that if the ON clause matches 0 (zero) records in B, the join will still return a row in the result—but with NULL in each column from B. This means that a left outer join returns all the values from the left table, plus matched values from the right table (or NULL in case of no matching join predicate).

```
SELECT *
FROM   employee  LEFT OUTER JOIN department
          ON employee.DepartmentID = department.DepartmentID;
```

Right outer joins

A right outer join (or right join) closely resembles a left outer join, except with the treatment of the tables reversed. Every row from the "right" table (B) will appear in the joined table at least once. If no matching row from the "left" table (A) exists, NULL will appear in columns from A for those records that have no match in B.

A right outer join returns all the values from the right table and matched values from the left table (NULL in case of no matching join predicate).

For example, this allows us to find each employee and his or her department, but still show departments that have no employees.

Example right outer join, with the additional result row italicized:

```
SELECT *
FROM   employee RIGHT OUTER JOIN department
       ON employee.DepartmentID = department.DepartmentID;
```

Full outer join

Conceptually, a full outer join combines the effect of applying both left and right outer joins. Where records in the FULL OUTER JOINed tables do not match, the result set will have NULL values for every column of the table that lacks a matching row. For those records that do match, a single row will be produced in the result set (containing fields populated from both tables).

For example, this allows us to see each employee who is in a department and each department that has an employee, but also see each employee who is not part of a department and each department which doesn't have an employee.

Example full outer join:

```
SELECT *
FROM   employee
       FULL OUTER JOIN department
          ON employee.DepartmentID = department.DepartmentID;
```

SQL Functions:

SQL avg()

SQL count()

SQL max()

SQL min()

SQL sum()

SQL upper()

SQL lower()

SQL len()

SQL round()

DATE FUNCTIONS:

Select sysdate from dual;

Add_months(sysdate,2)

Add_months(sysdate,-2)

Last_day(sysdate), Last_day(sysdate)+1

To copy a table with structure and data

As select *from table name;

As select *from table name where false condition like 1=2