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LONAVALA

Lab Manual

Database Management System Lab

(310247)

Class:-TE Computer YEAR:-2018-2019

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Marking Scheme

50 marks-Practical Exam

25 marks-Term Work

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CERTIFICATE

This is to certify that

Mr./ Miss _____,

Of Class TE – Computer Roll No.___ Has completed all the practical work in the subject Database Management System Lab satisfactorily in the Department of COMPUTER ENGINEERING as prescribed by Savitribai Phule Pune University, in the academic year 2018 – 2019

Staff In-charge Head of the Department Principal

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Sr. No.	Name of Assignment	Page No.	Date	Remark
	Group A - Database Programming Languages – SQL, PL/SQL			
1	Study of Open Source Relational Databases :			
2	Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as **Table, View, Index, Sequence, Synonym**			
3	Design at least 10 SQL queries for suitable database application using SQL DML statements: **Insert, Select, Update, Delete with operators, functions and set operator**.			
4	Design at least 10 SQL queries for suitable database application using SQL DML statements: all types **of Join, Sub-Query and View.**			
5	**Unnamed PL/SQL code block:** Use of Control structure and Exception handling is mandatory. Write a PL/SQL block of code for the following requirements:- Schema: 1. **Borrower**(Roll,Name,DateofIssue, NameofBook, Status) 2. **Fine** (Roll, Date, Amt) • Accept Roll & N ame of book from user. • Check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5per day. • If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day. • After submitting the book, status will change from I to R. • If condition of fine is true, then details will be stored into fine table. **Frame the problem statement for writing PL/SQL block inline with above statement.**			
6	**Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor)** Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table **Cust_New** with the data available in the table **Cust_Old**. If the data in the first table already exist in the second table then that data should be skipped. **Frame the separate problem statement for writing PL/SQL block to implement all types**			
7	**PL/SQL Stored Procedure and Stored Function.** Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class. Write a PL/SQL block for using procedure created with above requirement.			

	Stud_Marks(name, total_marks) **Result**(Roll,Name, Class) **Frame the separate problem statement for writing PL/SQL Stored Procedure and function, inline with above statement. The problem statement should clearly state the requirements.**			
8	**Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers).** Write a database trigger on **Library** table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in **Library_Audit** table. **Frame problem statement for writing Database Triggers of all types, inline with above statement. The problem statement should clearly state the requirements.**			
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9	**Study of Open Source NOSQL Database**: MongoDB (Installation, Basic CRUD operations, Execution)			
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16	Write a program to implement MogoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC.			
17	Implement /Oracle database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit.) using ODBC/JDBC.			

Assignment No.	**1**
Title	Study of Open Source Databases:
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 1

Title : Study of Open Source Databases:

Objectives : To develop basic, intermediate and advanced Database programming skills

Theory :

Introduction A database is a separate application that stores a collection of data. Each database has one or more distinct APIs for creating, accessing, managing, searching and replicating the data it holds.

So now days, we use relational database management systems (RDBMS) to store and manage huge volume of data. This is called relational database because all the data is stored in to different tables and relations are established using primary keys or other keys known as foreign keys.

A Relational DataBase Management System(RDBMS) is a software that:

- Enables you to implement a database with tables, columns and indexes.
- Guarantees the Referential Integrity between rows of various tables.
- Updates the indexes automatically.
- Interprets an SQL query and combines information from various tables

RDBMS Terminology:

Before we proceed to explain database system, let's revise few definitions related to database.

Database: A database is a collection of tables, with related data.

Table: A table is a matrix with data. A table in a database looks like a simple spreadsheet.

Column: One column (data element) contains data of one and the same kind, for example the Column postcode.

Row: A row (tuple, entry or record) is a group of related data, for example the data of one subscription.

Redundancy: Storing data twice, redundantly to make the system faster.

Primary Key: A primary key is unique. A key value cannot occur twice in one table. With a key, you can find at most one row.

Foreign Key: A foreign key is the linking pin between two tables.

Compound Key: A compound key(composite key) is a key that consists of multiple columns, Because one column is not sufficiently unique.

Index: An index in a database resembles an index at the back of a book.

Referential Integrity: Referential Integrity makes sure that a foreign key value always points to An existing row.

is a fast, easy-to-use RDBMS being used for many small and big businesses. is developed, marketed, and supported by My SQLAB, which is a Swedish company. is becoming so popular because of many good reasons:

- is released under an open-source license. So you have nothing to pay to use it.
- is a very powerful program in its own right. It handles a large subset of the functionality of the most expensive and powerful database packages.
- uses a standard form of the well-known SQL data language.
- works on many operating systems and with many languages including PHP, PERL, C, C++, JAVA, etc.
- works very quickly and works well even with large datasets.
- is very friendly to PHP, the most appreciated language for web development.
- supports large databases, upto 50 million rows or more in a table.

  The default file size limit for a table is 4GB, but you can increase this (if your operating system can handle it) to a theoretical limit of 8 million tera bytes(TB).
- is customizable. The open-source GPL license allows programmers to modify the software to fit their own specific environments.

The SQL CREATE TABLE Statement

The CREATE TABLE statement is used to create a new table in a database.

Syntax

```
CREATE TABLE table_name (
   column1 datatype,
   column2 datatype,
   column3 datatype,   ....);
```

The column parameters specify the names of the columns of the table.

The datatype parameter specifies the type of data the column can hold (e.g. varchar, integer, date, etc.).

SQL CREATE TABLE Example

The following example creates a table called "Persons" that contains five columns: PersonID, LastName, FirstName, Address, and City:

Example

```
CREATE TABLE Persons (
    PersonID int,
    LastName varchar(255),
    FirstName varchar(255),
    Address varchar(255),
    City varchar(255) );
```

Create Table Using Another Table

A copy of an existing table can be created using a combination of the CREATE TABLE statement and the SELECT statement.

The new table gets the same column definitions. All columns or specific columns can be selected.

If you create a new table using an existing table, the new table will be filled with the existing values from the old table.

Syntax

```
CREATE TABLE new_table_name AS
    SELECT column1, column2,...
    FROM existing_table_name
    WHERE ....;
```

SQL General Data Types

Each column in a database table is required to have a name and a data type.

SQL developers have to decide what types of data will be stored inside each and every table column when creating a SQL table. The data type is a label and a guideline for SQL to understand what type of data is expected inside of each column, and it also identifies how SQL will interact with the stored data.

The following table lists the general data types in SQL:

Data type	Description
CHARACTER(n)	Character string. Fixed-length n
VARCHAR(n) or CHARACTER VARYING(n)	Character string. Variable length. Maximum length n
BINARY(n)	Binary string. Fixed-length n
BOOLEAN	Stores TRUE or FALSE values
VARBINARY(n) or BINARY VARYING(n)	Binary string. Variable length. Maximum length n
INTEGER(p)	Integer numerical (no decimal). Precision p
SMALLINT	Integer numerical (no decimal). Precision 5
INTEGER	Integer numerical (no decimal). Precision 10
BIGINT	Integer numerical (no decimal). Precision 19

DECIMAL(p,s)	Exact numerical, precision p, scale s. Example: decimal(5,2) is a number that has 3 digits before the decimal and 2 digits after the decimal
NUMERIC(p,s)	Exact numerical, precision p, scale s. (Same as DECIMAL)
FLOAT(p)	Approximate numerical, mantissa precision p. A floating number in base 10 exponential notation. The size argument for this type consists of a single number specifying the minimum precision
REAL	Approximate numerical, mantissa precision 7
FLOAT	Approximate numerical, mantissa precision 16
DOUBLE PRECISION	Approximate numerical, mantissa precision 16
DATE	Stores year, month, and day values
TIME	Stores hour, minute, and second values
TIMESTAMP	Stores year, month, day, hour, minute, and second values
INTERVAL	Composed of a number of integer fields, representing a period of time, depending on the type of interval
ARRAY	A set-length and ordered collection of elements
MULTISET	A variable-length and unordered collection of elements
XML	Stores XML data

The SQL INSERT INTO Statement

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

INSERT INTO Syntax

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

The first way specifies both the column names and the values to be inserted:

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

If you are adding values for all the columns of the table, you do not need to specify the column names in the SQL query. However, make sure the order of the values is in the same order as the columns in the table. The INSERT INTO syntax would be as follows:

INSERT INTO *table_name* VALUES (*value1*, *value2*, *value3*, ...);

The SELECT statement is used to select data from a database.

The data returned is stored in a result table, called the result-set.

SELECT Syntax

SELECT *column1*, *column2*, ... FROM *table_name*;

Here, column1, column2, ... are the field names of the table you want to select data from. If you want to select all the fields available in the table, use the following syntax:

SELECT * FROM *table_name*;

The SQL AND, OR and NOT Operators

The WHERE clause can be combined with AND, OR, and NOT operators.

The AND and OR operators are used to filter records based on more than one condition:

- The AND operator displays a record if all the conditions separated by AND is TRUE.
- The OR operator displays a record if any of the conditions separated by OR is TRUE.

The NOT operator displays a record if the condition(s) is NOT TRUE.

AND Syntax

```
SELECT column1, column2, ...  FROM table_name
WHERE condition1 AND condition2 AND condition3 ...;
```

OR Syntax

```
SELECT column1, column2, ...  FROM table_name
WHERE condition1 OR condition2 OR condition3 ...;
```

NOT Syntax

```
SELECT column1, column2, ...  FROM table_name
WHERE NOT condition;
```

AND Example : The following SQL statement selects all fields from "Customers" where country is "Germany" AND city is "Berlin":

Example

```
SELECT * FROM Customers
WHERE Country='Germany' AND City='Berlin';
```

OR Example : The following SQL statement selects all fields from "Customers" where city is "Berlin" OR "München":

Example

```
SELECT * FROM Customers
WHERE City='Berlin' OR City='München';
```

NOT Example : The following SQL statement selects all fields from "Customers" where country is NOT "Germany":

Example

```
SELECT * FROM Customers
WHERE NOT Country='Germany';
```

The SQL ORDER BY Keyword

The ORDER BY keyword is used to sort the result-set in ascending or descending order.

The ORDER BY keyword sorts the records in ascending order by default. To sort the records in descending order, use the DESC keyword.

ORDER BY Syntax

SELECT *column1, column2, ...*
FROM *table_name*
ORDER BY *column1, column2, ...* ASC|DESC;

ORDER BY Example

The following SQL statement selects all customers from the "Customers" table, sorted by the "Country" column:

Example

SELECT * FROM Customers ORDER BY Country;

The SQL SELECT DISTINCT Statement

The SELECT DISTINCT statement is used to return only distinct (different) values. Inside a table, a column often contains many duplicate values; and sometimes you only want to list the different (distinct) values. The SELECT DISTINCT statement is used to return only distinct (different) values.

SELECT DISTINCT Syntax

SELECT DISTINCT *column1, column2, ...* FROM *table_name*;

SELECT DISTINCT Examples

The following SQL statement selects only the DISTINCT values from the "Country" column in the "Customers" table:

Example

SELECT DISTINCT Country FROM Customers;

The SQL WHERE Clause

The WHERE clause is used to filter records.

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

WHERE Syntax

SELECT *column1, column2, ..* FROM *table_name* WHERE *condition*;

WHERE Clause Example

The following SQL statement selects all the customers from the country "Mexico", in the "Customers" table:

Example

```
SELECT * FROM Customers WHERE Country='Mexico';
```

Text Fields vs. Numeric Fields

SQL requires single quotes around text values (most database systems will also allow double quotes).

However, numeric fields should not be enclosed in quotes:

Example

```
SELECT * FROM Customers WHERE CustomerID=1;
```

Operators in The WHERE Clause

The following operators can be used in the WHERE clause:

Operator	Description
=	Equal
<>	Not equal. **Note:** In some versions of SQL this operator may be written as !=
>	Greater than
<	Less than
>=	Greater than or equal
<=	Less than or equal
BETWEEN	Between an inclusive range
LIKE	Search for a pattern
IN	To specify multiple possible values for a column

The SQL DELETE Statement

The DELETE statement is used to delete existing records in a table.

DELETE Syntax

```
DELETE FROM table_name WHERE condition;
```

Note: Be careful when deleting records in a table! Notice the WHERE clause in the DELETE statement. The WHERE clause specifies which record(s) that should be deleted. If you omit the WHERE clause, all records in the table will be deleted!

SQL DELETE Example

The following SQL statement deletes the customer "Alfreds Futterkiste" from the "Customers" table:

Example

```
DELETE FROM Customers
WHERE CustomerName='Alfreds Futterkiste';
```

Delete All Records

It is possible to delete all rows in a table without deleting the table. This means that the table structure, attributes, and indexes will be intact:

```
DELETE FROM table_name;
```

The SQL MIN() and MAX() Functions

The MIN() function returns the smallest value of the selected column.

The MAX() function returns the largest value of the selected column.

MIN() Syntax

```
SELECT MIN(column_name)
FROM table_name
WHERE condition;
```

MAX() Syntax

```
SELECT MAX(column_name) FROM table_name WHERE condition;
```

MIN() Example

The following SQL statement finds the price of the cheapest product:

Example

```
SELECT MIN(Price) AS SmallestPrice FROM Products;
```

MAX() Example

The following SQL statement finds the price of the most expensive product:

Example

```
SELECT MAX(Price) AS LargestPrice FROM Products;
```

The SQL COUNT(), AVG() and SUM() Functions

The COUNT() function returns the number of rows that matches a specified criteria.

The AVG() function returns the average value of a numeric column.

The SUM() function returns the total sum of a numeric column.

COUNT() Syntax

SELECT COUNT(*column_name*) FROM *table_name*
WHERE *condition*;

AVG() Syntax

SELECT AVG(*column_name*) FROM *table_name*
WHERE *condition*;

SUM() Syntax

SELECT SUM(*column_name*) FROM *table_name*
WHERE *condition*;

COUNT() Example

The following SQL statement finds the number of products:

Example

SELECT COUNT(ProductID) FROM Products;

AVG() Example

The following SQL statement finds the average price of all products:

Example

SELECT AVG(Price) FROM Products;

SUM() Example

The following SQL statement finds the sum of the "Quantity" fields in the "OrderDetails" table:

Example

SELECT SUM(Quantity) FROM OrderDetails;

The SQL LIKE Operator

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

There are two wildcards used in conjunction with the LIKE operator:

- % - The percent sign represents zero, one, or multiple characters
- _ - The underscore represents a single character

The percent (%) sign and the underscore (_)can also be used in combinations!

LIKE Syntax

SELECT *column1, column2, ...* FROM *table_name*
WHERE *columnN* LIKE *pattern*;

Tip: You can also combine any number of conditions using AND or OR operators.

Here are some examples showing different LIKE operators with '%' and '_' wildcards:

LIKE Operator	Description
WHERE CustomerName LIKE 'a%'	Finds any values that starts with "a"
WHERE CustomerName LIKE '%a'	Finds any values that ends with "a"
WHERE CustomerName LIKE '%or%'	Finds any values that have "or" in any position
WHERE CustomerName LIKE '_r%'	Finds any values that have "r" in the second position
WHERE CustomerName LIKE 'a_%_%'	Finds any values that starts with "a" and are at least 3 characters in length
WHERE ContactName LIKE 'a%o'	Finds any values that starts with "a" and ends with "o"

SQL LIKE Examples

The following SQL statement selects all customers with a CustomerName starting with "a":

Example

```
SELECT * FROM Customers
WHERE CustomerName LIKE 'a%';
```

The following SQL statement selects all customers with a CustomerName ending with "a":

Example

```
SELECT * FROM Customers
WHERE CustomerName LIKE '%a';
```

The following SQL statement selects all customers with a CustomerName that have "or" in any position:

Example

```
SELECT * FROM Customers
WHERE CustomerName LIKE '%or%';
```

The following SQL statement selects all customers with a CustomerName that have "r" in the second position:

Example

```
SELECT * FROM Customers
WHERE CustomerName LIKE '_r%';
```

The following SQL statement selects all customers with a Customer Name that starts with "a" and are at least 3 characters in length:

Example

```
SELECT * FROM Customers
WHERE CustomerName LIKE 'a_%_%';
```

The following SQL statement selects all customers with a Customer Name that starts with "a" and ends with "o":

Example

```
SELECT * FROM Customers
WHERE ContactName LIKE 'a%o';
```

The following SQL statement selects all customers with a CustomerName that NOT starts with "a":

Example

```
SELECT * FROM Customers
WHERE CustomerName NOT LIKE 'a%';
```

Conclusion: Thus we have studied how to use open source database .

FAQ ?

1. Compare Vs. SQL Server.
2. What are the features of ?
3. What do DDL, DML, and DCL stand for?
4. What is the difference between CHAR and VARCHAR?
5. What is the difference between primary key and candidate key?
6. What is the difference between DELETE TABLE and TRUNCATE TABLE & DROP table commands in ?

Assignment No.	**2**
Title	Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym
Roll No.	
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Subject	**Database Management System Laboratory**
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Assignment No. 2

Title: Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View , Index, Sequence, Synonym

Objectives: To study SQL DDL statements

Theory: SQL – Structured Query Language

Data Definition in SQL

Creating Tables

Syntax:-

Create table<table name>

(colume_name 1 datatype size(),

colume_name 2 datatype size(),

….

colume_name n datatype size());

e.g. Create table student with the following fields(name,roll,class,branch)

Create table student

(name char(20),

Roll number(5),

Class char(10),

Branch char(15));

A table from a table

- **Syntax :**

  CREATE TABLE <TableName> (<ColumnName>, <Columnname>) AS SELECT <ColumnName>, <Columnname> FROM <TableName>;

  - If the source table contains the records, then new table is also created with the same records present in the source table.

- If you want only structure without records then select statement must have condition. Syntax:

  CREATE TABLE <TableName> (<ColumnName>, <Columnname>) AS SELECT <ColumnName>, <Columnname> FROM <TableName> WHERE 1=2; (Or)

  CREATE TABLE <TableName> (<ColumnName>, <Columnname>) AS SELECT <ColumnName>, <Columnname> FROM <TableName> WHERE ColumnName =NULL;

Constraints

The definition of a table may include the specification of integrity constraints. Basically two types of constraints are provided: column constraints are associated with a single column whereas table constraints are typically associated with more than one column. A constraint can be named. It is advisable to name a constraint in order to get more meaningful information when this constraint is violated due to, e.g., an insertion of a tuple that violates the constraint. If no name is specified for the constraint, Oracle automatically generates a name of the pattern SYS C<number>.Rules are enforced on data being stored in a table, are called **Constraints**.

Both the Create table & Alter Table SQL can be used to write SQL sentences that attach constraints.

Basically constraints are of three types

1) Domain
   - Not Null
   - Check
2) Entity
   - Primary Key
   - Unique
3) Referential
   - Foreign key
4) Not Null:-Not null constraint can be applied at column level only.

We can define these constraints

1) at the time of table creation Syntax :

   CREATE TABLE <tableName> (<ColumnName> datatype(size) NOT NULL,
   <ColumnName> datatype(size),….
   );

2) After the table creation

   ALTER TABLE <tableName> Modify(<ColumnName> datatype(size) NOT NULL);

   Check constraints

   - Can be bound to column or a table using CREATE TABLE or ALTER TABLE command.

- Checks are performed when write operation is performed .
- Insert or update statement causes the relevant check constraint.
- Ensures the integrity of the data in tables.

Syntax :

- Check constraints at column level

Syntax :

CREATE TABLE <tableName>

(<ColumnName>datatype(size)CHECK(columnName

condition),<columnname datatype(size));

CREATE TABLE <tableName>

(<ColumnName> datatype(size) CONSTRAINT <constraint_name>

CHECK (columnName condition),..

);

- Check constraints at table level

Syntax :

CREATE TABLE <tableName>

(<ColumnName> datatype(size),
<ColumnName> datatype(size),
CONSTRAINT <constraint_name> CHECK (columnName condition),..);

- Check constraints at table level

Syntax :

CREATE TABLE

<tableName>

(<ColumnName>

datatype(size),

<ColumnName> datatype(size),….,

CHECK (columnName condition));

After table creation

Alter table tablename

Add constraints constraintname ckeck(condition)

The PRIMARY KEY Constraint

A primary key is one or more column(s) in a table used to uniquely identify each row in the table.

- A table can have only one primary key.
- Can not be left blank

- Data must be UNIQUE.
- Not allows null values
- Not allows duplicate values.
- Unique index is created automatically if there is a primary key.

Primary key constraint defined at column level

Syntax:

CREATE TABLE <TableName>

(<ColumnName1> <DataType>(<Size>)PRIMARY KEY,<columnname2

<datatype(<size>),…..);

- Primary key constraint defined at Table level

Syntax:

CREATE TABLE <TableName>

(<ColumnName1> <DataType>(<Size>) ,…., PRIMARY

KEY(<ColumnName1> <ColumnName2>));

- key constraint defined at Table level

Syntax:

CREATE TABLE <TableName>

(<ColumnName1> <DataType>(<Size>) <columnname2

datatype<(size)<,<columnname3 datatype<size>constraint constraintname

PRIMARY KEY(<ColumnName1>));

After table creation

Alter table tablename

Add(constraint constraintname primary key(columnname));

The Unique Key Constraint

- The unique column constraint permits multiple entries of NULL into the column.
- Unique key not allowed duplicate values
- Unique index is automatically created.
- Table can have more than one unique key.

- UNIQUE constraint defined at column level
  Syntax :

  Create table tablename(**<columnname> <datatype>(<Size>**

  UNIQUE),<columnname> datatype(<size>)……);

UNIQUE constraint defined at table level

Syntax :

CREATE TABLE tablename (<columnname> <datatype>(<Size>), <columnname> <datatype>(<Size>), UNIQUE(<columnname>, <columnname>));

After table creation

Alter table tablename

Add constraint constraintname unique(columnname);

- The Foreign Key (Self Reference) Constraint Foreign key represents relationships between tables.

A foreign key is a column(or group of columns) whose values are derived from primary key or unique key of some other table.

Foreign key constraint defined at column level

Syntax:

<columnName> <DataType> (<size>) REFERENCES <TableName>[(<ColumnName>)] [ON DELETE CASCADE]

- If the ON DELETE CASCADE option is set, a DELETE operation in the master table will trigger a DELETE operation for corresponding records in all detail tables.
- If the ON DELETE SET NULL option is set, a DELETE operation in the master table will set the value held by the foreign key of the detail tables to null.

Foreign key :

ALTER TABLE <child_tablename> ADD CONSTRAINT <constraint_name> FOREIGN KEY (<columnname in child_table>) REFERENCES <parent table name>;

1) FOREIGN KEY constraint at table level
2) FOREIGN KEY constraint defined with ON DELETE CASCADE
   FOREIGN KEY(<ColumnName>[,<columnname>]) REFERENCES <TableName> [(<ColumnName>, <ColumnName>) ON DELETE CASCADE

- FOREIGN KEY constraint defined with ON DELETE SET NULL

FOREIGN KEY(<ColumnName>[,<columnname>]) REFERENCES <TableName> [(<ColumnName>, <ColumnName>) ON DELETE SET NULL

- To view the constraint Syntax:

  Select constraint_name, constraint_type, search_condition from user_constraints where table_name=<tablename>;
  Select constraint_name, column_name from user_cons_columns where table_name=<tablename>;

To drop the constraints

Syntax:-

Drop constraint constraintname;

Describe commands

To view the structure of the table created use the **DESCRIBE** command.The command displays the column names and datatypes

Syntax:-

Desc[ribe]<table_name>

e.g desc student

Restrictions for creating a table:

1.Table names and column names must begin with a letter.
2.Table names and column names can be 1 to 30 characters long.
3.table names must contain only the characters A-Z,a-z,0-9,underscore_,$ and #
4.Table name should not be same as the name of another database object.
5.Table name must not be an ORACLE reserved word.
6.Column names should not be duplicate within a table definition.

Alteration of TABLE:-

Alter table command

Syntax:-

Case1:-

Alter table <table_name>

Add(colume_name 1 datatype size(),
colume_name 2 datatype size(),

colume_name n datatype size());

Case2:-

Alter table <table_name>

Modify(colume_name 1 datatype size(),

colume_name 2 datatype size(),

…….

colume_name n datatype size());

After you create a table, you may need to change the table structures because you need to have a column definition needs to be changed. Alter table statement can be used for this purpose. You can add columns to a table using the alter table statement with the ADD clause.

E.g. Suppose you want to add enroll_no in the student table then we write

Alter table student Add(enroll_no number(10));

You can modify existing column in a table by using the alter table statement with modify clause.

E.g. Suppose you want to modify or chang the size of previously defined field name in the student table then we write

Alter table student modify(name char(25));

Dropping a column from a table

Syntax :

ALTER TABLE <Tablename> DROP COLUMN <ColumnName> ;

Drop table command Syntax:-

Drop table <table_name>

Drop table command remnoves the definitions of an oracle table.When you drop a table ,the database loses all the data in the table and all the indexes associated with it.

e.g drop table student;

Truncate table command

Syntax:-

Trunc table<table_name>

The truncate table statement is used to remove all rows from a table and to release the storage space used by the table.

e.g.Trunc table student;

Rename table command

Syntax:-

Rename<oldtable_name> to<newtable_name>

Rename statement is used to rename a table,view,sequence,or synonym. e.g.

Rename student to stud;

Database objects:-

Index

An index is a schema object that can speed up retrieval of rows by using pointer. An index provides direct & fast access to rows in a table. Index can be created explicitly or automatically.

Automatically :- A unique index is created automatically when you define a primary key or unique key constraint in a table definition.

Manually :- users can create non unique indexes or columns to speed up access time to the rows.

Syntax:

Create index<index_name> On table(column[, column]…);

Eg. Create index emp_ename_idx On emp(ename);

When to create an index

a) The column is used frequently in the WHERE clause or in a join condition.

b) The column contains a wide range of values.

c) The column contains a large number of values.

To display created index of a table

eg.

```
Select ic.index_name, ic.column_name, ic.colun_position col_pos, ix.uniqueness from
user_indexes ix, user_ind_columns ic where ic.index_name=ix.index_name
and ic.table_name="emp";
```

Removing an Index

Syntax:-

Drop index <index_name>; eg. Drop

index emp_name_idx;

Note: 1) we cannot modify indexes.

2) To change an index, we must drop it and the re-create it.

Views

View is a logical representation of subsets of data from one or more tables. A view takes the output of a query and treats it as a table therefore view can be called as stored query or a virtual table.The tables upon which a view is based are called base tables. In Oracle the SQL command to create a view (virtual table) has the form

Create [or replace] view <view-name> [(<column(s)>)] as

<select-statement> [with check option [constraint <name>]];

The optional clause or replace re-creates the view if it already exists. <column(s)> names the columns of the view. If <column(s)> is not specified in the view definition, the columns of the view get the same names as the attributes listed in the select statement (if possible).

Example: The following view contains the name, job title and the annual salary of employees working in the department 20:

Create view DEPT20 as
select ENAME, JOB, SAL*12 ANNUAL SALARY from EMP where DEPTNO = 20;

In the select statement the column alias ANNUAL SALARY is specified for the expression SAL*12 and this alias is taken by the view. An alternative formulation of the above view definition is

Create view DEPT20 (ENAME, JOB, ANNUAL SALARY) as select ENAME, JOB, SAL * 12 from EMP where DEPTNO = 20;

A view can be used in the same way as a table, that is, rows can be retrieved from a view(also respective rows are not physically stored, but derived on basis of the select statement inthe view definition), or rows can even be modified. A view is evaluated again each time it is accessed. In Oracle SQL no insert, update, or delete modifications on views are allowed
that use one of the following constructs in the view definition:

- Joins
- Aggregate function such as sum, min, max etc.
- set-valued subqueries (in, any, all) or test for existence (exists)
- group by clause or distinct clause

In combination with the clause with check option any update or insertion of a row into the view is rejected if the new/modified row does not meet the view definition, i.e., these rows would not be selected based on the select statement. A with check option can be named using the constraint clause.

A view can be deleted using the command delete <view-name>. To
describe the structure of a view

e.g. **Describe stud;**

To display the contents of view e.g. Select * from stud

Removing a view:

Syntax:- **Drop view <view_name>**
e.g. Drop view stud

Sequence:

A sequence is a database object, which can generate unique, sequential integer values. It can be used to automatically generate primary key or unique key values. A sequence can be either in an ascending or descending order.

Syntax :

```
Create
sequence<sequence_name>
[increment by n]
[start with n]
[{maxvalue n |
nomaxvalue}] [{minvalue n|
nominvalue}] [{cycle |
nocycle}]
[{cache n| nocache}];
```

Increment by n	Specifies the interval between sequence number where n is an integer. If this clause is omitted, the sequence is increment by 1.
Start with n	Specifies the first sequence number to be generated. If this clause is omitted , the sequence is start with 1.
Maxvalue n	Specifies the maximum value, the sequence can generate
Nomax value n	Specifies the maximum value of 10e27-1 for an ascending sequence & -1 for descending sequence. This is a default option.
Minvalue n	Specifies the minimum sequence value.
Nominvalue n	Specifies the minimum value of 1 for an ascending & 10e26-1 for descending sequence. This is a default option.
Cycle	Specifies that the sequence continues to generate values from the beginning

	after reaching either its max or min value.
Nocycle	Specifies that the sequence can not generate more values after reaching either its max or min value. This is a default option.
Cache / nocache	Specifies how many values the oracle server will preallocate & keep in memory. By default, the oracle server will cache 20 values.

After creating a sequence we can access its values with the help of pseudo columns like **curval** & **nextval**.

Nextval : nextval returns initial value of the sequence when reference to for the first time. Last references to the nextval will increment the sequence using the increment by clause & returns the new value.

Curval : curval returns the current value of the sequence which is the value returned by the last reference to last value.

Modifyning a sequence:

The sequence can be modified when we want to perform the following :

- Set or eliminate minvalue or maxvalue
- Change the increment value.
- Change the number of cache sequence number.

Syntax :

```
Alter sequence <sequence_name>
[increment by n]
[start with n]
[{maxvalue n | nomaxvalue}]
[{minvalue n| nominvalue}]
[{cycle | nocycle}]
[{cache n| nocache}];
```

Synonym:

A synonym is a database object,which is used as an alias(alternative name)for a table,view or sequence.

Syntax:-

Create[public]synonym
<synonym_name>for<table_name>;

In the syntax

Public:-Creates a synonym accessible to all users.
Synonym:-Is the name of the synonym to be created.

Synonym can either be private or public.A private synonym is created by normal user,which is available to that persons.

A public synonym is created by a database administrator(DBA),which can be availed by any other database user.

Uses:-

1.Simplify SQL statements.

2.Hide the name and owner of an object.

3.Provide public access to an object.

Guidelines:-

1.User can do all DML manipulations such as insert ,delete,update on synonym.

2.User cannot perform any DDL operations on the synonym except dropping the synonym.

3.All the manipulations on it actually affect the table e.g
Create synonym stud1 for student;

SQL, pronounced SEQUEL, is the standard language to access relational databases.SQL is an abbreviation for Structured Query Language. I'll just add that SQL is composed of DML and DDL. DML are the keywords you use to access and manipulate data, hence the name DataManipulation Language. DDL are the keywords you use to create objects such as views, tables and procedures, hence the name Data Definition Language.

Tables

In relational database systems (DBS) data are represented using tables (relations). A query issued against the DBS also results in a table. A table has the following structure:

Column 1	Column 2	. . .	Column n	→ Attributes
← Tuple (or Record)				
…….	…….	…….	……..	

A table is uniquely identified by its name and consists of rows that contain the stored information, each row containing exactly one tuple (or record). A table can have one or more columns.

A column is made up of a column name and a data type, and it describes an attribute of the tuples. The structure of a table, also called relation schema, thus is defined by its attributes.The type of information to be stored in a table is defined by the data types of the attributes at table creation time.SQL uses the terms table, row, and column for relation, tuple, and attribute, respectively.

A table can have up to 254 columns which may have different or same data types and sets of values (domains), respectively. Possible domains are alphanumeric data (strings), numbers and date formats.

Datatype	**Description**	**Max Size: Oracle 7**	**Max Size: Oracle 8**	**Max Size: Oracle 9**	**Max Size: PL/SQL**	**PL/SQL Subtypes/ Synonyms**
VARCHAR2(size)	Variable length character string having maximum length *size* bytes. You must specify size	2000 bytes minimum is 1	**4000** bytes minimum is 1	**4000** bytes minimum is 1	32767 bytes minimum is 1	STRING VARCHAR
NVARCHAR2(size)	Variable length national character set string having maximum length *size* bytes. You must specify size	N/A	4000 bytes minimum is 1	4000 bytes minimum is 1	32767 bytes minimum is 1	STRING VARCHAR
VARCHAR	Now deprecated - VARCHAR is a synonym for VARCHAR2 but this usage may change in future versions.	-	-	-		
CHAR(size)	Fixed length character data of length size bytes. This should be used for fixed length data. Such as codes A100, B102...	255 bytes Default and minimum size is 1 byte.	**2000** bytes Default and minimum size is 1 byte.	**2000** bytes Default and minimum size is 1 byte.	32767 bytes Default and minimum size is 1 byte.	CHARACTER
NCHAR(size)	Fixed length national character set	N/A	2000 bytes Default	2000 bytes Default and minimum size	32767 bytes Default	

	data of length size bytes. This should be used for fixed length data. Such as codes A100, B102...		and minimum size is 1 byte.	is 1 byte.	and minimum size is 1 byte.	
NUMBER(p,s)	Number having precision p and scale s.	The precision p can range from 1 to 38. The scale s can range from -84 to 127.	The precision p can range from 1 to 38. The scale s can range from -84 to 127.	The precision p can range from 1 to 38. The scale s can range from -84 to 127.	Magnitude 1E-130 .. 10E125 maximum precision of 126 binary digits, which is roughly equivalent to 38 decimal digits The scale s can range from -84 to 127. For floating point don't specify p,s REAL has a maximum precision of 63 binary digits, which is roughly equivalent to 18 decimal digits	fixed-point numbers: DEC DECIMAL NUMERIC floating-point: DOUBLE PRECISION FLOAT binary_double binary_float integers: INTEGER INT SMALLINT simple_integer(10g) BOOLEAN REAL
PLS_INTEGER	signed integers PLS_INTEGER values require less storage and	PL/SQL only	PL/SQL only	PL/SQL only	magnitude range is -21474836	

	provide better performance than NUMBER values. So use PLS_INTEGER where you can!				47 .. 2147483647	
BINARY_INTEGER	signed integers (older slower version of PLS_INTEGER)				magnitude range is -2147483647 .. 2147483647	NATURAL NATURALN POSITIVE POSITIVEN SIGNTYPE
LONG	Character data of variable length (A bigger version the VARCHAR2 datatype)	2 Gigabytes	2 Gigabytes	2 Gigabytes - but now deprecated	32760 bytes Note this is smalller than the maximum width of a LONG column	
DATE	Valid date range	from January 1, 4712 BC to December 31, 4712 AD.	from January 1, 4712 BC to December 31, **9999** AD.	from January 1, 4712 BC to December 31, **9999** AD.	from January 1, 4712 BC to December 31, **9999** AD. (in Oracle7 = 4712 AD)	
TIMESTAMP (fractional_seconds_precision)	the number of digits in the fractional part of the SECOND datetime field.	-	-	Accepted values of fractional_seconds_precision are 0 to 9. (default = 6)		
TIMESTAMP (fractional_seconds_precision) WITH {LOCAL} TIMEZONE	As above with time zone displacement value	-	-	Accepted values of fractional_seconds_precision are 0 to 9. (default = 6)		
INTERVAL	Time in years	-	-	Accepted		

YEAR (year_precision) TO MONTH	and months, where year_precision is the number of digits in the YEAR datetime field.			values are 0 to 9. (default = 2)		
INTERVAL DAY (day_precision) TO SECOND (fractional_seconds_precision)	Time in days, hours, minutes, and seconds. *day_precision* is the maximum number of digits in 'DAY' *fractional_seconds_precision* is the max number of fractional digits in the SECOND field.	-	-	*day_precision* may be 0 to 9. (default = 2) *fractional_seconds_precision* may be 0 to 9. (default = 6)		
RAW(size)	Raw binary data of length size bytes. You must specify size for a RAW value.	Maximum size is 255 bytes.	Maximum size is **2000** bytes	Maximum size is **2000** bytes	32767 bytes	
LONG RAW	Raw binary data of variable length. (not intrepreted by PL/SQL)	2 Gigabytes.	2 Gigabytes.	2 Gigabytes - but now deprecated	32760 bytes Note this is smalller than the maximum width of a LONG RAW column	
ROWID	Hexadecimal string representing the unique address of a row in its table. (primarily for values returned by the ROWID pseudocolumn.)	8 bytes	10 bytes	10 bytes	Hexadecimal string representing the unique address of a row in its table. (primarily for values returned	

					by the ROWID pseudocolumn.)	
UROWID	Hex string representing the logical address of a row of an index-organized table	N/A	The maximum size and default is 4000 bytes	The maximum size and default is 4000 bytes	universal rowid - Hex string representing the logical address of a row of an index-organized table, either physical, logical, or foreign (non-Oracle)	See CHARTOROWID and the package: DBMS_ROWID
MLSLABEL	Binary format of an operating system label.This datatype is used with Trusted Oracle7.					
CLOB	Character Large Object	4Gigabytes	4Gigabytes	4Gigabytes	4Gigabytes	
NCLOB	National Character Large Object		4Gigabytes	4Gigabytes	4Gigabytes	
BLOB	Binary Large Object		4Gigabytes	4Gigabytes	4Gigabytes	
BFILE	pointer to binary file on disk		4Gigabytes	4Gigabytes	The size of a BFILE is system dependent but cannot exceed four gigabytes (2**32 - 1 bytes).	

XMLType	XML data	-	-	4Gigabytes	Populate with XML from a CLOB or VARCHAR2. or query from another XMLType column.	

Conclusion: Thus we have studied how to use SQL DDL Statements.

FAQ : Consider relational schema **Student(Roll_no, Name, Deptno, Marks,Email_id)** Develop SQL DDL statements.

1. Create table Student;
2. Insert values in student table.
3. Add a new attribute date of birth in student record using alter statement.
4. Drop date of birth attribute from student table.
5. Update a student marks where roll no is 7;
6. Delete a record of student whose roll no is 4;
7. Create view for student table;
8. Create index on Roll no in student table.
9. Create sequence on student table.
10. Create synonym on student table.

Assignment No.	**3**
Title	Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator.
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 3

Title:- Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator.

Objectives:- To study SQL DML statements

THEORY: Data Manipulation Language (DML)

A **data manipulation language (DML)** is a family of syntax elements similar to a computer programming language used for selecting, inserting, deleting and updating data in a database. Performing read-only queries of data is sometimes also considered a component of DML.

Data manipulation language comprises the SQL data change statements, [2] which modify stored data but not the schema or database objects.

Data manipulation languages have their functional capability organized by the initial word in a statement, which is almost always a verb. In the case of SQL, these verbs are:

- SELECT ... FROM ... WHERE ...
- INSERT INTO ... VALUES ...
- UPDATE ... SET ... WHERE ...
- DELETE FROM ... WHERE ...

The purely read-only SELECT query statement is classed with the 'SQL-data' statements and so is considered by the standard to be outside of DML. The SELECT ... INTO form is considered to be DML because it manipulates (i.e. modifies) data. In common practice though, this distinction is not made and SELECT is widely considered to be part of DML.

Most SQL database implementations extend their SQL capabilities by providing imperative, i.e. procedural languages.

Inserting Data into Table:

To insert data into table, you would need to use SQL **INSERT INTO** command. You can insert data into table by using > prompt or by using any script like PHP.

Syntax:

Here is generic SQL syntax of INSERT INTO command to insert data into table:

```
INSERT INTO table_name ( field1, field2,...fieldN )
                       VALUES  ( value1, value2,...valueN );
```

To insert string data types, it is required to keep all the values into double or single quote, for example:-**"value"**.

Inserting Data from Command Prompt:

This will use SQL INSERT INTO command to insert data into table tutorials_tbl.

Example:

Following example will create 3 records into **tutorials_tbl** table:

```
INSERT INTO tutorials_tbl (tutorial_title, tutorial_author, submission_date)
  VALUES ("Learn PHP", "John Poul", NOW());

INSERT INTO tutorials_tbl (tutorial_title, tutorial_author, submission_date)
  VALUES ("Learn  ", "Abdul S", NOW());
```

```
INSERT INTO tutorials_tbl (tutorial_title, tutorial_author, submission_date)
  VALUES ("JAVA Tutorial", "Sanjay", '2007-05-06');
```

Here, **NOW()** is a function, which returns current date and time.

Fetching Data from Table:

The SQL **SELECT** command is used to fetch data from database. You can use this command at > prompt as well as in any script like PHP.

Syntax:

Here is generic SQL syntax of SELECT command to fetch data from table:

```
SELECT field1, field2,...fieldN table_name1, table_name2...
[WHERE Clause]
[OFFSET M ][LIMIT N]
```

- You can use one or more tables separated by comma to include various conditions using a WHERE clause, but WHERE clause is an optional part of SELECT command.
- You can fetch one or more fields in a single SELECT command.
- You can specify star (*) in place of fields. In this case, SELECT will return all the fields.
- You can specify any condition using WHERE clause.
- You can specify an offset using **OFFSET** from where SELECT will start returning records. By default offset is zero.
- You can limit the number of returns using **LIMIT** attribute.

Fetching Data from Command Prompt:

This will use SQL SELECT command to fetch data from table tutorials_tbl

Example:

Following example will return all the records from **tutorials_tbl** table:

```
> SELECT * from tutorials_tbl
+-------------+----------------+-----------------+-----------------+
| tutorial_id | tutorial_title | tutorial_author | submission_date |
+-------------+----------------+-----------------+-----------------+
|           1 | Learn PHP      | John Poul       | 2007-05-21      |
|           2 | Learn          | Abdul S         | 2007-05-21      |
|           3 | JAVA Tutorial  | Sanjay          | 2007-05-21      |
+-------------+----------------+-----------------+-----------------+
```

The SQL **SELECT** statement returns a result set of records from one or more tables. A **SELECT** statement retrieves zero or more rows from one or more database tables or database views. In most applications, SELECT is the most commonly used Data Manipulation Language (DML) command. As SQL is a declarative programming language, SELECT queries specify a result set, but do not specify how to calculate it. The database translates the query into a "query plan" which may vary between executions, database versions and database software. This functionality is called the "query optimizer" as it is responsible for finding the best possible execution plan for the query, within applicable constraints.

The SELECT statement has many optional clauses:

- WHERE specifies which rows to retrieve.

- GROUP BY groups rows sharing a property so that an aggregate function can be applied to each group.
- HAVING selects among the groups defined by the GROUP BY clause.
- ORDER BY specifies an order in which to return the rows.
- AS provides an alias which can be used to temporarily rename tables or columns.

WHERE Clause

We have seen SQL **SELECT** command to fetch data from table. We can use a conditional clause called **WHERE** clause to filter out results. Using WHERE clause, we can specify a selection criteria to select required records from a table.

Syntax:

Here is generic SQL syntax of SELECT command with WHERE clause to fetch data from table:

```
SELECT field1, field2,...fieldN table_name1, table_name2...
[WHERE condition1 [AND [OR]] condition2.....
```

- You can use one or more tables separated by comma to include various conditions using a WHERE clause, but WHERE clause is an optional part of SELECT command.
- You can specify any condition using WHERE clause.
- You can specify more than one conditions using **AND** or **OR** operators.
- A WHERE clause can be used along with DELETE or UPDATE SQL command also to specify a condition.

The **WHERE** clause works like an if condition in any programming language. This clause is used to compare given value with the field value available in table. If given value from outside is equal to the available field value in table, then it returns that row.

Here is the list of operators, which can be used with **WHERE** clause.

Assume field A holds 10 and field B holds 20, then:

Operator	Description	Example
=	Checks if the values of two operands are equal or not, if yes then condition becomes true.	(A = B) is not true.
!=	Checks if the values of two operands are equal or not, if values are not equal then condition becomes true.	(A != B) is true.
>	Checks if the value of left operand is greater than the value of right operand, if yes then condition becomes true.	(A > B) is not true.
<	Checks if the value of left operand is less than the value of right operand, if yes then condition becomes true.	(A < B) is true.
>=	Checks if the value of left operand is greater than or equal to the value of right operand, if yes then condition becomes true.	(A >= B) is not true.
<=	Checks if the value of left operand is less than or equal to the value of right operand, if yes then condition becomes true.	(A <= B) is true.

The WHERE clause is very useful when you want to fetch selected rows from a table, especially when you use **Join**.
It is a common practice to search records using **Primary Key** to make search fast.
If given condition does not match any record in the table, then query would not return any row.

Fetching Data from Command Prompt:
This will use SQL SELECT command with WHERE clause to fetch selected data from table tutorials_tbl.
Example:
Following example will return all the records from **tutorials_tbl** table for which author name is **Sanjay**:

```
> SELECT * from tutorials_tbl WHERE tutorial_author='Sanjay';
+-------------+---------------+----------------+-----------------+
| tutorial_id | tutorial_title | tutorial_author | submission_date |
+-------------+---------------+----------------+-----------------+
|           3 | JAVA Tutorial  | Sanjay         | 2007-05-21      |
+-------------+---------------+----------------+-----------------+
```

Unless performing a **LIKE** comparison on a string, the comparison is not case sensitive. You can make your search case sensitive using **BINARY** keyword as follows:

```
SELECT * from tutorials_tbl  WHERE BINARY tutorial_author='sanjay';
```

LIKE Clause

We have seen SQL **SELECT** command to fetch data from table. We can also use a conditional clause called **WHERE** clause to select required records.
A WHERE clause with equals sign (=) works fine where we want to do an exact match. Like if "tutorial_author = 'Sanjay'". But there may be a requirement where we want to filter out all the results where tutorial author name should contain "iav". This can be handled using SQL **LIKE** clause along with WHERE clause.
If SQL LIKE clause is used along with % characters, then it will work like a meta character (*) in UNIX while listing out all the files or directories at command prompt.
Without a % character, LIKE clause is very similar to equals sign along with WHERE clause.
Syntax:
Here is generic SQL syntax of SELECT command along with LIKE clause to fetch data from table:

```
SELECT field1, field2,...fieldN table_name1, table_name2...
WHERE field1 LIKE condition1 [AND [OR]] filed2 = 'somevalue'
```

- You can specify any condition using WHERE clause.
- You can use LIKE clause along with WHERE clause.
- You can use LIKE clause in place of equals sign.
- When LIKE is used along with % sign then it will work like a meta character search.
- You can specify more than one conditions using **AND** or **OR** operators.
- A WHERE...LIKE clause can be used along with DELETE or UPDATE SQL command also to specify a condition.

Using LIKE clause at Command Prompt:
This will use SQL SELECT command with WHERE...LIKE clause to fetch selected data from table tutorials_tbl.
Example:
Following example will return all the records from **tutorials_tbl** table for which author name ends with **jay**:

```
SELECT * from tutorials_tbl  WHERE tutorial_author LIKE '%jay';
+------------+---------------+----------------+-----------------+
| tutorial_id | tutorial_title | tutorial_author | submission_date |
+------------+---------------+----------------+-----------------+
|          3 | JAVA Tutorial  | Sanjay         | 2007-05-21      |
+------------+---------------+----------------+-----------------+
```

GROUP BY Clause

You can use **GROUP BY** to group values from a column, and, if you wish, perform calculations on that column. You can use COUNT, SUM, AVG, etc., functions on the grouped column.
To understand **GROUP BY** clause, consider an **employee tbl** table, which is having the following records:

```
> SELECT * FROM employee_tbl;
+------+------+------------+-------------------+
| id   | name | work_date  | daily_typing_pages |
+------+------+------------+-------------------+
|    1 | John | 2007-01-24 |               250 |
|    2 | Ram  | 2007-05-27 |               220 |
|    3 | Jack | 2007-05-06 |               170 |
|    3 | Jack | 2007-04-06 |               100 |
|    4 | Jill | 2007-04-06 |               220 |
|    5 | Zara | 2007-06-06 |               300 |
|    5 | Zara | 2007-02-06 |               350 |
+------+------+------------+-------------------+
7 rows in set (0.00 sec)
```

Now, suppose based on the above table we want to count number of days each employee did work.
If we will write a SQL query as follows, then we will get the following result:

```
SELECT COUNT(*) FROM employee_tbl;
+--------------------------+
| COUNT(*)                 |
+--------------------------+
| 7                        |
```

But this is not serving our purpose, we want to display total number of pages typed by each person separately. This is done by using aggregate functions in conjunction with a **GROUP BY** clause as follows:

```
SELECT name, COUNT(*)  FROM   employee_tbl  GROUP BY name;

+------+----------+
| name | COUNT(*) |
+------+----------+
| Jack |        2 |
| Jill |        1 |
| John |        1 |
| Ram  |        1 |
| Zara |        2 |
+------+----------+
5 rows in set (0.04 sec)
```

We will see more functionality related to GROUP BY in other functions like SUM, AVG, etc.

COUNT Function

COUNT Function is the simplest function and very useful in counting the number of records, which are expected to be returned by a SELECT statement.
To understand **COUNT** function, consider an **employee_tbl** table, which is having the following records:

```
> SELECT * FROM employee_tbl;
+------+------+------------+--------------------+
| id   | name | work_date  | daily_typing_pages |
+------+------+------------+--------------------+
|    1 | John | 2007-01-24 |                250 |
|    2 | Ram  | 2007-05-27 |                220 |
|    3 | Jack | 2007-05-06 |                170 |
|    3 | Jack | 2007-04-06 |                100 |
|    4 | Jill | 2007-04-06 |                220 |
|    5 | Zara | 2007-06-06 |                300 |
|    5 | Zara | 2007-02-06 |                350 |
+------+------+------------+--------------------+
7 rows in set (0.00 sec)
```

Now, suppose based on the above table you want to count total number of rows in this table, then you can do it as follows:

```
>SELECT COUNT(*) FROM employee_tbl ;
+----------+
| COUNT(*) |
+----------+
|        7 |
+----------+
1 row in set (0.01 sec)
```

Similarly, if you want to count the number of records for Zara, then it can be done as follows:

```
SELECT COUNT(*) FROM employee_tbl  WHERE name="Zara";
+----------+
```

```
| COUNT(*) |
+----------+
|        2 |
+----------+
1 row in set (0.04 sec)
```

NOTE: All the SQL queries are case insensitive so it does not make any difference if you give ZARA or Zara in WHERE condition.

MAX Function

MAX function is used to find out the record with maximum value among a record set.
To understand **MAX** function, consider an **employee_tbl** table, which is having the following records:

```
 > SELECT * FROM employee_tbl;
+------+------+------------+--------------------+
| id   | name | work_date  | daily_typing_pages |
+------+------+------------+--------------------+
|    1 | John | 2007-01-24 |                250 |
|    2 | Ram  | 2007-05-27 |                220 |
|    3 | Jack | 2007-05-06 |                170 |
|    3 | Jack | 2007-04-06 |                100 |
|    4 | Jill | 2007-04-06 |                220 |
|    5 | Zara | 2007-06-06 |                300 |
|    5 | Zara | 2007-02-06 |                350 |
+------+------+------------+--------------------+
7 rows in set (0.00 sec)
```

Now, suppose based on the above table you want to fetch maximum value of daily_typing_pages, then you can do so simply using the following command:

```
SELECT MAX(daily_typing_pages) FROM employee_tbl;
+------------------------+
| MAX(daily_typing_pages) |
+------------------------+
|                    350 |
+------------------------+
1 row in set (0.00 sec)
```

You can find all the records with maximum value for each name using **GROUP BY** clause as follows:

```
 SELECT id, name, MAX(daily_typing_pages)  FROM employee_tbl GROUP BY name;
+------+------+------------------------+
| id   | name | MAX(daily_typing_pages) |
+------+------+------------------------+
|    3 | Jack |                    170 |
|    4 | Jill |                    220 |
```

```
|    1 | John |                250 |
|    2 | Ram  |                 220 |
|    5 | Zara |                350 |
+------+------+--------------------+
5 rows in set (0.00 sec)
```

You can use **MIN** Function along with **MAX** function to find out minimum value as well. Try out the following example:

```
SELECT MIN(daily_typing_pages) least, MAX(daily_typing_pages) max FROM employee_tbl;
+-------+------+
| least | max  |
+-------+------+
|   100 |  350 |
+-------+------+
1 row in set (0.01 sec)
```

MIN Function

MIN function is used to find out the record with minimum value among a record set.
To understand **MIN** function, consider an **employee_tbl** table, which is having the following records:

```
 SELECT * FROM employee_tbl;
+------+------+------------+-------------------+
| id   | name | work_date  | daily_typing_pages |
+------+------+------------+-------------------+
|    1 | John | 2007-01-24 |              250 |
|    2 | Ram  | 2007-05-27 |              220 |
|    3 | Jack | 2007-05-06 |              170 |
|    3 | Jack | 2007-04-06 |              100 |
|    4 | Jill | 2007-04-06 |              220 |
|    5 | Zara | 2007-06-06 |              300 |
|    5 | Zara | 2007-02-06 |              350 |
+------+------+------------+-------------------+
7 rows in set (0.00 sec)
```

Now, suppose based on the above table you want to fetch minimum value of daily_typing_pages, then you can do so simply using the following command:

```
SELECT MIN(daily_typing_pages) FROM employee_tbl;
+------------------------+
| MIN(daily_typing_pages) |
+------------------------+
|                    100 |
+------------------------+
1 row in set (0.00 sec)
```

You can find all the records with minimum value for each name using **GROUP BY** clause as follows:

```
SELECT id, name, MIN(daily_typing_pages) FROM employee_tbl GROUP BY name;
+------+------+-----------------------+
| id   | name | MIN(daily_typing_pages) |
+------+------+-----------------------+
|    3 | Jack |                   100 |
|    4 | Jill |                   220 |
|    1 | John |                   250 |
|    2 | Ram  |                   220 |
|    5 | Zara |                   300 |
+------+------+-----------------------+
5 rows in set (0.00 sec)
```

You can use **MIN** Function along with **MAX** function to find out minimum value as well. Try out the following example:

```
SELECT MIN(daily_typing_pages) least, MAX(daily_typing_pages) max FROM employee_tbl;
+-------+------+
| least | max  |
+-------+------+
|   100 |  350 |
+-------+------+
1 row in set (0.01 sec)
```

AVG Function

AVG function is used to find out the average of a field in various records.

To understand **AVG** function, consider an **employee tbl** table, which is having following records:

```
 SELECT * FROM employee_tbl;
+------+------+------------+--------------------+
| id   | name | work_date  | daily_typing_pages |
+------+------+------------+--------------------+
|    1 | John | 2007-01-24 |                250 |
|    2 | Ram  | 2007-05-27 |                220 |
|    3 | Jack | 2007-05-06 |                170 |
|    3 | Jack | 2007-04-06 |                100 |
|    4 | Jill | 2007-04-06 |                220 |
|    5 | Zara | 2007-06-06 |                300 |
|    5 | Zara | 2007-02-06 |                350 |
+------+------+------------+--------------------+
7 rows in set (0.00 sec)
```

Now, suppose based on the above table you want to calculate average of all the dialy_typing_pages, then you can do so by using the following command:

```
SELECT AVG(daily_typing_pages)  FROM employee_tbl;
+------------------------+
| AVG(daily_typing_pages) |
+------------------------+
|              230.0000 |
+------------------------+
1 row in set (0.03 sec)
```

You can take average of various records set using **GROUP BY** clause. Following example will take average all the records related to a single person and you will have average typed pages by every person.

```
SELECT name, AVG(daily_typing_pages) FROM employee_tbl GROUP BY name;
+------+------------------------+
| name | AVG(daily_typing_pages) |
+------+------------------------+
| Jack |              135.0000 |
| Jill |              220.0000 |
| John |              250.0000 |
| Ram  |              220.0000 |
| Zara |              325.0000 |
+------+------------------------+
5 rows in set (0.20 sec)
```

SUM Function

SUM function is used to find out the sum of a field in various records.
To understand **SUM** function, consider an **employee_tbl** table, which is having the following records:

```
SELECT * FROM employee_tbl;
+------+------+------------+-------------------+
| id   | name | work_date  | daily_typing_pages |
+------+------+------------+-------------------+
|    1 | John | 2007-01-24 |               250 |
|    2 | Ram  | 2007-05-27 |               220 |
|    3 | Jack | 2007-05-06 |               170 |
|    3 | Jack | 2007-04-06 |               100 |
|    4 | Jill | 2007-04-06 |               220 |
|    5 | Zara | 2007-06-06 |               300 |
|    5 | Zara | 2007-02-06 |               350 |
+------+------+------------+-------------------+
7 rows in set (0.00 sec)
```

Now, suppose based on the above table you want to calculate total of all the dialy_typing_pages, then you can do so by using the following command:

```
SELECT SUM(daily_typing_pages)  FROM employee_tbl;
+------------------------+
| SUM(daily_typing_pages) |
```

```
+-----------------------+
|                  1610 |
+-----------------------+
1 row in set (0.00 sec)
```

You can take sum of various records set using **GROUP BY** clause. Following example will sum up all the records related to a single person and you will have total typed pages by every person.

```
SELECT name, SUM(daily_typing_pages) FROM employee_tbl GROUP BY name;
+------+-----------------------+
| name | SUM(daily_typing_pages) |
+------+-----------------------+
| Jack |                   270 |
| Jill |                   220 |
| John |                   250 |
| Ram  |                   220 |
| Zara |                   650 |
+------+-----------------------+
5 rows in set (0.17 sec)
```

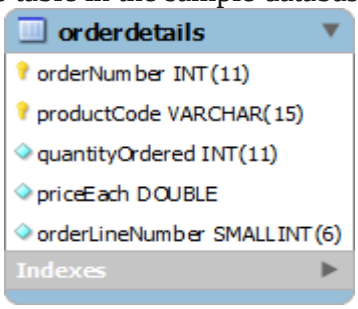
HAVING clause

The HAVING clause is used in the SELECT statement to specify filter conditions for group of rows or aggregates. The HAVING clause is often used with the GROUP BY clause. When using with the GROUP BY clause, you can apply a filter condition to the columns that appear in the GROUP BY clause. If the GROUP BY clause is omitted, the HAVING clause behaves like the WHERE clause. Notice that the HAVING clause applies the condition to each group of rows, while the WHERE clause applies the condition to each individual row.

Examples of using HAVING clause

Let‟s take a look at an example of using HAVING clause.

We will use the orderdetails table in the sample database for the sake of demonstration.



We can use the GROUP BY clause to get order number, the number of items sold per order and total sales for each:

```
SELECT ordernumber,
      SUM(quantityOrdered) AS itemsCount,
      SUM(priceeach) AS total
FROM orderdetails
GROUP BY ordernumber
```

ordernumber	itemsCount	total
10100	151	301.84000000000003
10101	142	352
10102	80	138.68
10103	541	1520.3699999999997
10104	443	1251.8899999999999
10105	545	1479.71

Now, we can find which order has total sales greater than $1000. We use the HAVING clause on the aggregate as follows:

```
SELECT ordernumber,
      SUM(quantityOrdered) AS itemsCount,
      SUM(priceeach) AS total
       FROM orderdetails
      GROUP BY ordernumber
      HAVING total > 1000
```

ordernumber	itemsCount	total
10103	541	1520.3699999999997
10104	443	1251.8899999999999
10105	545	1479.71
10106	675	1427.2800000000002
10108	561	1432.86
10110	570	1338.4699999999998

We can construct a complex condition in the HAVING clause using logical operators such as OR and AND. Suppose we want to find which order has total sales greater than $1000 and contains more than 600 items, we can use the following query:

```
SELECT ordernumber,
      sum(quantityOrdered) AS itemsCount,
      sum(priceeach) AS total
       FROM orderdetails
       GROUP BY ordernumber
       HAVING total > 1000 AND itemsCount > 600
```

ordernumber	itemsCount	total
10106	675	1427.2800000000002
10126	617	1623.71
10135	607	1494.86
10165	670	1794.9399999999996
10168	642	1472.5
10204	619	1619.73
10207	615	1560.08

The HAVING clause is only useful when we use it with the GROUP BY clause to generate the output of the high-level reports. For example, we can use the HAVING clause to answer some kinds of queries like give me all the orders in this month, this quarter and this year that have total sales greater than 10K.

UPDATE Query

There may be a requirement where existing data in a table needs to be modified. You can do so by using SQL **UPDATE** command. This will modify any field value of any table.

Syntax:

Here is generic SQL syntax of UPDATE command to modify data into table:

```
UPDATE table_name SET field1=new-value1, field2=new-value2
[WHERE Clause]
```

- You can update one or more field altogether.
- You can specify any condition using WHERE clause.
- You can update values in a single table at a time.

The WHERE clause is very useful when you want to update selected rows in a table.

Updating Data from Command Prompt:

This will use SQL UPDATE command with WHERE clause to update selected data into table tutorials_tbl.

Example:

Following example will update **tutorial_title** field for a record having tutorial_id as 3.

```
UPDATE tutorials_tbl
  SET tutorial_title='Learning JAVA'
    WHERE tutorial_id=3;
```

DELETE Query

If you want to delete a record from any table, then you can use SQL command **DELETE FROM**. You can use this command at > prompt as well as in any script like PHP.

Syntax:

Here is generic SQL syntax of DELETE command to delete data from a table:

```
DELETE FROM table_name [WHERE Clause]
```

- If WHERE clause is not specified, then all the records will be deleted from the given table.
- You can specify any condition using WHERE clause.
- You can delete records in a single table at a time.

The WHERE clause is very useful when you want to delete selected rows in a table.

Deleting Data from Command Prompt:

This will use SQL DELETE command with WHERE clause to delete selected data into table tutorials_tbl.

Example:

Following example will delete a record into tutorial_tbl whose tutorial_id is 3.

```
DELETE FROM tutorials_tbl WHERE tutorial_id=3;
```

Create table **location**(location_id numeric(3) primary key,regional_group varchar(15));

Create table **department**(Department_ID numeric(2) primary key,name varchar(20),location_id int, foreign key(location_id) references location(location_id));

Create table **job**(job_ID numeric(3) primary key,function varchar(20));

Create table **employee**(employee_ID numeric(4) primary key,last_name varchar(20),first_name varchar(20),middle_name varchar(20),job_id numeric(3),manager_id varchar(20), hired_date date, salary numeric(6), comm numeric(4), department_id numeric(2) not null,FOREIGN KEY (job_id) REFERENCES job(job_id),FOREIGN KEY (department_id) REFERENCES department(department_id));

1. List the details about “SMITH”

   *Select * from employee where last_name=‘SMITH’;*

2. List out the employees who are working in department 20

   *Select * from employee where department_id=20*

3. List out the employees who are earning salary between 3000 and 4500

   *Select * from employee where salary between 3000 and 4500*

4. List out the employees who are working in department 10 or 20

   *Select * from employee where department_id in (10,20)*

5. Find out the employees who are not working in department 10 or 30

   Select last_name, salary, comm, department_id from employee where department_id not in (10,30)

6. List out the employees whose name starts with “S”

   *Select * from employee where last_name like 'S%';*

7. List out the employees whose name start with “S” and end with “H”

   *Select * from employee where last_name Like 'S%H';*

8. List out the employees whose name length is 5 and start with “S”

   *Select * from employee where last_name like 'S____';*

9. List out the employees who are working in department 10 and draw the salaries more than 3500

   *Select * from employee where department_id=10 and salary>3500*

10. List out the employees who are not receiving commission.

    *Select * from employee where commission is Null*

11. List out the employee id, last name in ascending order based on the employee id.

    Select employee_id, last_name from employee order by employee_id

12. List out the employee id, name in descending order based on salary column

    Select employee_id, last_name, salary from employee order by salary desc

13. List out the employee details according to their last_name in ascending order and salaries in descending order

Conclusion: Thus we have studied to use & implement various DML queries.

FAQ :

1. Explain DML.
2. Explain INSERT command with syntax.
3. Explain DELETE command with syntax.
4. Explain UPDATE command with syntax.
5. Explain SELECT command with syntax.
6. Enlist different comparisons operator. Explain with example.
7. Enlist different Logical operator. Explain with example.
8. Explain Order by clause.
9. Enlist different Aggregation function. Explain with example.

Assignment No.	**4**
Title	Design at least 10 SQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No: 4

Title:- Design at least 10 SQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.

Objectives:- To study all types of Join, Sub-Query and View SQL statements.

THEORY: SQL – Join

The ability of relational „join" operator is an important feature of relational systems. A join makes it possible to select data from more than table by means of a single statement. This joining of tables may be done in a many ways.

Types of JOIN

1) Inner
2) Outer(left, right,full)
3) Cross

1) Inner join :

- Also known as equi join.
- Statements generally compares two columns from two columns with the equivalence operator =.
- This type of join can be used in situations where selecting only those rows that have values in common in the columns specified in the ON clause, is required.

• Syntax :

(ANSI style)

SELECT<columnname1>, <columnname2> <columnNameN> FROM <tablename1> INNER JOIN <tablename2>ON <tablename1>.<columnname> = <tablename2>.<columnname> WHERE <condition> ORDER BY <columnname1>;

(theta style)

SELECT<columnname1>, <columnname2> <columnNameN> FROM <tablename1>, <tablename2> WHERE <tablename1>.<columnname> = <tablename2>.<columnname> AND <condition> ORDER BY <columnname1>;

- List the employee details along with branch names to which they belong.

Emp(empno,fname,lname,dept,desig,branchno)

Branch(bname,branchno)

Select e.empno,e.fname,e.lname,e.dept, b.bname, e.desig from emp e inner join branch b on b.branchno=e.branchno;

Select e.empno, e.fname, e.lname, e.dept, b.bname, e.desig from emp e, branch b on where b.branchno=e.branchno;

Eg. List the customers along with the account details associated with them.

Customer(custno,fname,lname)

Acc_cust_dtls(fdno,custno)

Acc_mstr(accno,branchno,curbal)

Branch_mstr(name,branchno)

- Select c.custno, c.fname, c.lname, a.accno,a.curbal,b.branchno,b.name from customer c inner join acc_cust_dtls k on c.custno=k.custno inner join acc_mstr a on k.fdno=a.accno inner join branch b on b.branchno=a.branchno where c.custno like „C%" order by c.custno;
- Select c.custno, c.fname, c.lname, a.accno,a.curbal,b.branchno,b.name from customer c, acc_cust_dtls k, acc_mstr a, branch b where c.custno=k.custno and k.fdno=a.accno and b.branchno=a.branchno and c.custno like „C%" order by c.custno;

Outer Join

Outer joins are similar to inner joins, but give a little bit more flexibility when selecting data from related tables. This type of joins can be used in situations where it is desired, to select all rows from the table on left(or right, or both) regardless of whether the other table has values in common & (usually) enter NULL where data is missing.

- Tables

Emp_mstr(empno,fname,lname,dept)

Cntc_dtls(codeno,cntc_type,cntc_data)

Left Outer Join

List the employee details along with the contact details(if any) using left outer join.

- Select e.empno, e.fname, e.lname, e.dept, c.cntc_type, c.cntc_data from emp_mstr e left join cntc_dtls c on e.empno=c.codeno;
- Select e.empno, e.fname, e.lname, e.dept, c.cntc_type, c.cntc_data from emp_mstr e cntc_dtls c where e.empno=c.codeno(+);

All the employee details have to be listed even though their corresponding contact information is not present. This indicates all the rows from the first table will be displayed even though there exists no matching rows in the second table.

Right outer join

List the employee details with contact details(if any using right outer join.

- Tables

Emp_mstr(empno,fname,lname,dept)

Cntc_dtls(codeno,cntc_type,cntc_data)

- Select e.empno, e.fname, e.lname, e.dept, c.cntc_type, c.cntc_data from emp_mstr e right join cntc_dtls c on e.empno=c.codeno;
- Select e.empno, e.fname, e.lname, e.dept, c.cntc_type, c.cntc_data from emp_mstr e cntc_dtls c where e.empno(+)=c.codeno;

Since the RIGHT JOIN returns all the rows from the second table even if there are no matches in the first table.

Cross join

A cross join returns what known as a Cartesian Product. This means that the join combines every row from the left table with every row in the right table. As can be imagined, sometimes this join produces a mess, but under the right circumstances, it can be very useful. This type of join can be used in situation where it is desired, to select all possible combinations of rows & columns from both tables. The kind of join is usually not preferred as it may run for a very long time & produce a huge result set that may not be useful.

- Create a report using cross join that will display the maturity amounts for predefined deposits, based on min & max period fixed/ time deposit.
- Tables

Tem_fd_amt(fd_amt)

Fd_mstr(minprd,maxprd,intrate)

- Select fd_amt, s.minprd, s.maxprd, s.intrate,round (t.fd_amt+(s.intrate/100) * (s.minprd/365))) “amount_min_period”,round(t.fd_amt+(s.intrate/100)*(s.maxprd/365))) “amount_max_period” from fd_mstr s cross join tem_fd_amt t;
- Select t.fd_amt, s.minprd, s.maxprd, s.intrate, round(t.fd_amt+(s.intrate/100) * (s.minprd/365))) “amount_min_period”, round(t.fd_amt+(s.intrate/100)*(s.maxprd/365))) “amount_max_period” from fd_mstr s, tem_fd_amt t;

Self join

- In some situation, it is necessary to join to itself, as though joining 2 separate tables.
- This is referred to as self join

Example

- Emp_mgr(empno,fname, lname,mgrno)
- Select e.empno,e.fname,e.lname, m.fname “manager” from emp_mgr e, emp_mgr m where e.mgrno=m.empno;

Three tire Architecture:

A three-tier architecture is a client-server architecture in which the functional process logic, data access, computer data storage and user interface are developed and maintained as independent modules on separate platforms. Three-tier architecture is a software design pattern and a well-established software architecture.

In a Three-tier architecture, the client machine acts as merely a front end and does not contain any direct database calls. Instead, the client end communicates with an application server, usually through a forms interface. The application server in turn communicates with a

database system to access data. The business logic of the application, which says what actions to carry out under what conditions, is embedded in the application server, instead of being distributed across multiple clients. Three-tier applications are more appropriate for large applications, and for applications that run on the World Wide Web.

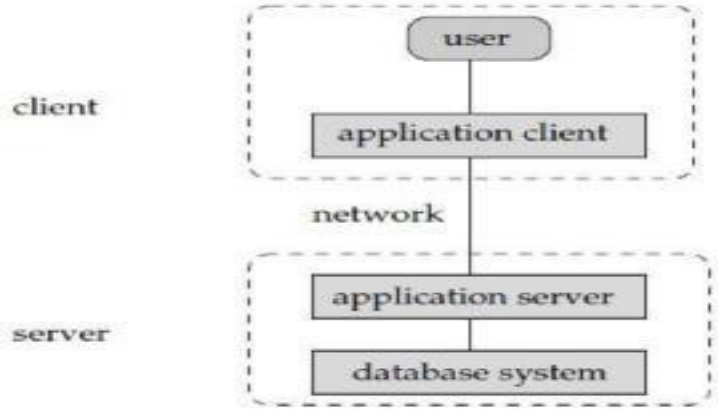


Fig. 1 Three Tire Architecture

Three-tier architecture allows any one of the three tiers to be upgraded or replaced independently. The user interface is implemented on a desktop PC and uses a standard graphical user interface with different modules running on the application server. The relational database management system on the database server contains the computer data storage logic. The middle tiers are usually multitiered.

The three tiers in a three-tier architecture are:

1. Presentation Tier: Occupies the top level and displays information related to services available on a website. This tier communicates with other tiers by sending results to the browser and other tiers in the network.
2. Application Tier: Also called the middle tier, logic tier, business logic or logic tier, this tier is pulled from the presentation tier. It controls application functionality by performing detailed processing.
3. Data Tier: Houses database servers where information is stored and retrieved. Data in this tier is kept independent of application servers or business logic.

Employee (Eno, Ename, Deptno, Salary) Eno=pk, Deptno=fk

Department (Deptno, Dname) Deptno=pk

Implement all join operation –cross join, natural join ,equi join, left outer ,right outer join etc & Write SQL Queries for following questions

i) List of employee names of 'Computer' department.

ii) Find the Employee who"s Salary above 50000 of each department.

iii) Find department name of employee name 'Amit'.

Conclusion: Thus we have studied to use & implement various join operation with nested queries.

FAQ:

1. Explain Join Function.
2. Enlist the different types of join operations.
3. Explain CROSS Join explain with example.
4. Explain Natural join explain with example.
5. Explain Inner join explain with example.
6. Explain Outer join explain with example.
7. What is the use of nested Query. Explain with Example.

Assignment No.	**5**
Title	Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory.
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No: 5

Title:- Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory.

Write a PL/SQL block of code for the following requirements:-
Schema:
1. Borrower(Rollin, Name, DateofIssue, NameofBook, Status)
2. Fine(Roll_no,Date,Amt)
 Accept roll_no & name of book from user.
 Check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5per day.
 If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day.
 After submitting the book, status will change from I to R.
 If condition of fine is true, then details will be stored into fine table.

Frame the problem statement for writing PL/SQL block inline with above statement.

Objective:- Learn the concept of PL/SQL

Theory:
Introduction :-PL/SQL

The development of database applications typically requires language constructs similar to those that can be found in programming languages such as C, C++, or Pascal. These constructs are necessary in order to implement complex data structures and algorithms. A major restriction of the database language SQL, however, is that many tasks cannot be accomplished by using only the provided language elements.

PL/SQL (Procedural Language/SQL) is a procedural extension of Oracle-SQL that o ffers language constructs similar to those in imperative programming languages.

Or

A PL/SQL is a procedural language extension to the SQL in which you can declare and use the variables, constants, do exception handling and you can also write the program modules in the form of PL/SQL subprograms.PL/SQL combines the features of a procedural language with structured query language

PL/SQL allows users and designers to develop complex database applications that require the usage of control structures and procedural elements such as procedures, functions, and modules.

The basic construct in PL/SQL is a block. Blocks allow designers to combine logically related (SQL-) statements into units. In a block, constants and variables can be declared, and variables can be used to store query results. Statements in a PL/SQL block include SQL statements, control structures (loops), condition statements (if-then-else), exception handling, and calls of other PL/SQL blocks.

PL/SQL blocks that specify procedures and functions can be grouped into packages. A package is similar to a module and has an interface and an implementation part. Oracle o ffers several predefined packages, for example, input/output routines, file handling, job scheduling etc. (see directory $ORACLE HOME/rdbms/admin).

Another important feature of PL/SQL is that it o ffers a mechanism to process query results in a tuple-oriented way, that is, one tuple at a time. For this, cursors are used. A cursor basically is a pointer to a query result and is used to read attribute values of selected tuples into variables. A cursor typically is

used in combination with a loop construct such that each tuple read by the cursor can be processed individually.

In summary, the major goals of PL/SQL are to

- Increase the expressiveness of SQL,
- Process query results in a tuple-oriented way,
- Optimize combined SQL statements,
- Develop modular database application programs,
- Reuse program code, and
- Reduce the cost for maintaining and changing applications

Advantages of PL/SQL:-

Following are some advantages of Pl/SQL

1) Support for SQL :-PL/SQL is the procedural language extension to SQL supports all the functionalities of SQL.

2) Improved performance:- In SQL every statement individually goes to the ORACLE server, get processed and then execute. But in PL/SQL an entire block of statements can be sent to ORACLE server at one time, where SQL statements are processed one at atime.PL/SQL block statements drastically reduce communication between the application and ORACLE. This helps in improving the performance.

3) Higher Productivity:- Users use procedural features to build applications.PL/SQL code is written in the form of PL/SQL block.PL/SQL blocks can also used in other ORACLE Forms, ORACLE reports. This code reusability increases the programmers productivity.

4) Portability :- Applications written in PL/SQL are portable. We can port them from one environment to any computer hardware and operating system environment running ORACLE.

5) Integration with ORACLE :-Both PL/SQL and ORACLE are SQL based.PL/SQL variables have datatypes native to the oracle RDBMS dictionary. This gives tight integration with ORACLE.

Features of PL/SQL:-

1) We can define and use variables and constants in PL/SQL.

2) PL/SQL provides control structures to control the flow of a program. The control structures supported by PL/SQL are if..Then, loop, for..loop and others.

3) We can do row by row processing of data in PL/SQL.PL/SQL supports row by row processing using the mechanism called cursor.

4) We can handle pre-defined and user-defined error situations. Errors are warnings and called as exceptions in PL/SQL.

5) We can write modular application by using sub programs.

The structure of PL/SQL program:-

The basic unit of code in any PL/SQL program is a block. All PL/SQL programs are composed of blocks. These blocks can be written sequentially.

The structure of PL/SQL block:-

DECLARE

Declaration section
BEGIN
Executable section
EXCEPTION
Exception handling section
END;

Where

1) Declaration section
PL/SQL variables, types, cursors, and local subprograms are defined here.
2) Executable section
Procedural and SQL statements are written here. This is the main section of the block. This section is required.
3) Exception handling section
Error handling code is written here
This section is optional whether it is defined within body or outside body of program.

Conditional statements and Loops used in PL/SQL

Conditional statements check the validity of a condition and accordingly execute a set of statements. The conditional statements supported by Pl/SQL is

1) IF..THEN
2) IF..THEN..ELSE
3) IF..THEN..ELSIF

1) IF..THEN

Syntax1:-

```
If condition THEN
Statement list
END IF;
```

2) IF..THEN..ELSE

Syntax 2:-

```
IF condition THEN
        Statement list
ELSE
        Statements
END IF;
```

3) IF..THEN..ELSIF

Syntax 3:-

```
If condition THEN
        Statement list
ELSIF condition THEN
        Statement list
ELSE
        Statement list
END IF;

END IF;
```

2) CASE Expression :CASE expression can also be used to control the branching logic within PL/SQL blocks. The general syntax is

```
CASE
WHEN <expression> THEN <statements>;
WHEN <expression> THEN <statements>;
.
.
ELSE
<statements>;
END CASE;
```

Here expression in WHEN clause is evaluated sequentially. When result of expression is TRUE, then corresponding set of statements are executed and program flow goes to END CASE.

ITERATIVE Constructs : Iterative constructs are used to execute a set of statements respectively. The iterative constructs supported by PL/SQL are follows:

1) SIMPLE LOOP
2) WHILE LOOP
3) FOR LOOP

1) The Simple LOOP : It is the simplest iterative construct and has syntax like:

```
LOOP
   Statements
END LOOP;
```

The LOOP does not facilitate a checking for a condition and so it is an endless loop. To end the iterations, the EXIT statement can be used.

```
LOOP
        <statement list>
                IF condition THEN
                EXIT;
                END IF;
END LOOP;
```

The statements here is executable statements,which will be executed repeatedly until the condition given if IF..THEN evaluates TRUE.

2) THE WHILE LOOP

The WHILE…LOOP is a condition driven construct i.e the condition is a part of the loop construct and not to be checked separately. The loop is executed as long as the condition evaluates to TRUE.

The syntax is:-

```
WHILE condition LOOP
      Statements
END LOOP;
```

The condition is evaluated before each iteration of loop. If it evaluates to TRUE, sequence of statements are executed. If the condition is evaluated to FALSE or NULL, the loop is finished and the control resumes after the END LOOP statement.

3) THE FOR LOOP :The number of iterations for LOOP and WHILE LOOP is not known in advance. THE number of iterations depends on the loop condition. The FOR LOOP can be used to have a definite numbers of iterations.

The syntax is:-

```
For loop counter IN  [REVERSE] Low bound..High bound LOOP
Statements;
End loop;
```

Where

- loop counter ⁻is the implicitly declared index variable as BINARY_INTEGER.
- Low bound and high bound specify the number of iteration .
- Statements:-Are the contents of the loop

EXCEPTIONS:- Exceptions are errors or warnings in a PL/SQL program.PL/SQL implements error handling using exceptions and exception handler.
Exceptions are the run time error that a PL/SQL program may encounter.
There are two types of exceptions

1) Predefined exceptions
2) User defined exceptions

1) Predefined exceptions:- Predefined exceptions are the error condition that are defined by ORACLE. Predefined exceptions cannot be changed. Predefined exceptions correspond to common SQL errors. The predefined exceptions are raised automatically whenever a PL/SQL program violates an ORACLE rule.

2)User defined Exceptions:- A user defined exceptions is an error or a warning that is defined by the program.User defined exceptions can be define in the declaration section of PL/SQL block.
User defined exceptions are declared in the declarative section of a PL/SQL block. Exceptions have a type Exception and scope**.**

Syntax :

```
DECLARE
        <Exception Name> EXCEPTION;
BEGIN
        ….
        RAISE <Exception Name>
        …
EXCEPTION
        WHEN <Exception name> THEN
        <Action>
END;
```

Exception Handling

A PL/SQL block may contain statements that specify exception handling routines. Each error or warning during the execution of a PL/SQL block raises an exception. One can distinguish between two types of exceptions:

• **System defined exceptions**
• **User defined exceptions** (which must be declared by the user in the declaration part of a block where the exception is used/implemented)

System defined exceptions are always automatically raised whenever corresponding errors or warnings occur. User defined exceptions, in contrast, must be raised explicitly in a sequence of statements using raise <exception name>. After the keyword exception at the end of a block, user defined exception handling routines are implemented. An implementation has the pattern

when <exception name> then <sequence of statements>;

The most common errors that can occur during the execution of PL/SQL programs are handled by system defined exceptions. The table below lists some of these exceptions with their names and a short description.

Oracle Error	Equivalent Exception	Description
ORA-0001	DUP_VAL_ON_INDEX	Unique constraint violated.
ORA-0051	TIMEOUT_ON_RESOURSE	Time-out occurred while waiting for recourse
ORA-0061	TRANSACTION_BACKED_OUT	The transaction was rolled back to due to deadlock.
ORA-1001	INVALID_CURSOR	Illegal cursor operation.
ORA-1012	NOT_LOGGED_ON	Not connected to Oracle.
ORA-1017	LOGIN_DENIED	Invalid username/password
ORA-1403	NO_DATA_FOUND	No data found.
ORA-1410	SYS_INVALID_CURSOR	Conversion to a universal rowed failed.
ORA-1422	TOO_MANY_ROWS	A SELECT…INTO statement matches more than one row.
ORA-1476	ZERO_DIVIDE	Division by zero.
ORA-1722	INVALID_NUMBER	Conversion to a number failed.
ORA-6500	STORAGE_ERROR	Internal PL/SQL error raised if PL/SQL runs out of memory.
ORA-6501	PROGRAM_ERROR	Internal PL/SQL error.
ORA-6502	VALUE_ERROR	Truncation, arithmetic or conversion error.
ORA-6504	ROWTYPE_MISMATCH	Host cursor variable and PL/SQL cursor variable have incompatible row type
ORA-6511	CURSOR_ALREADY_OPEN	Attempt to open a cursor that is already open.
ORA-6530	ACCESS_INTO_NULL	Attempt to assign values to the attributes of a NULL object.
ORA-6531	COLLECTION_IS_NULL	Attempt to apply collection methods other than EXISTS to a NULL PL/SQL table or varray.
ORA-6532	SUBSCRIPT_OUTSIDE_LIMIT	Reference to a nested table or varray index outside the declared range.
ORA-6533	SUBSCRIPT_BEYOND_COUNT	Reference to a nested table or varray index higher than the number of

		elements in the collection
ORA-6592	CASE_NOT_FOUND	No matching WHEN clause in a CASE statement is found
ORA-30625	SELF_IS_NULL	Attempt to call a method on a NULL object instance

Syntax:-

<Exception_name>Exception;

Handling Exceptions:- Exceptions handlers for all the exceptions are written in the exception handling section of a PL/SQL block.
Syntax:-

```
Exception
        When exception_name then
                Sequence_of_statements1;
        When exception_name then
                Sequence_of_statements2;
        When exception_name then
                Sequence_of_statements3;
End;
```

Example:

```
Declare
        emp sal EMP.SAL%TYPE;
        emp no EMP.EMPNO%TYPE;
        too_high_sal exception;
begin
        select EMPNO, SAL into emp no, emp sal
        from EMP where ENAME = "KING";
        if emp sal *1.05 > 4000 then raise too high sal
        else update EMP set SQL . . .
        end if ;
exception
        when NO DATA FOUND  -- no tuple selected
        then rollback;
        when too_high_sal then insert into high sal emps values(emp no);
        commit;
end;
```

After the keyword when a list of exception names connected with or can be specified. The last when clause in the exception part may contain the exception name others. This introduces the default exception handling routine, for example, a rollback.

If a PL/SQL program is executed from the SQL*Plus shell, exception handling routines may contain statements that display error or warning messages on the screen. For this, the procedure raise application error can be used. This procedure has two parameters <error number> and <message text>. <error number> is a negative integer defined by the user and must range between -20000 and -20999. <error message> is a string with a length up to 2048 characters.

The concatenation operator "||" can be used to concatenate single strings to one string. In order to display numeric variables, these variables must be converted to strings using the function to char. If the procedure raise application error is called from a PL/SQL block, processing the PL/SQL block terminates and all database modifications are undone, that is, an implicit rollback is performed in addition to displaying the error message.

Example:

```
if emp sal *1.05 > 4000
then raise application error(-20010, "Salary increase for employee with Id "|| to char (EMP no) ||" is too high");
```

E.g.

```
Declare
        V_maxno number (2):=20;
        V_curno number (2);
        E_too_many_emp exception;
Begin
        Select count (empno)into v_curno from emp
        Where deptno=10;
        If v_curno>25 then
        Raise e_too_many_Emp;
        End if;
Exception
        when e_too_many_emp then
        ….
        …..
end;
```

Lab Exercise

1) Write a PL/SQL block to calculate factorial. Use Exception Handling.
2) Write a PL/SQL block to find prime number for first 30 numbers.
3) Write a PL/SQL block to find Fibonacci series for first 50 numbers.
4) Write a PL/SQL block to find **a** raised to power **b i.e. a^{b}**
5) Write a PL/SQL block to find the grade of a student. Enter marks for 5 subjects.
6) Write a PL/SQL block to update the table. **Table: ACCT_MSTR** ==>

ACCT_NO	CURBAL
SB1	500
SB5	500
SB9	500
SB13	500

7) Write on your own one PL/SQL block for the problem statement.

FAQ :

1) What is PL/SQL? Explain.
2) What is the difference between "SQL" and "PL/SQL"?
3) What are the different Goals of PL/SQL?
4) What are exceptions? What are the different types of exceptions?
5) What are the different conditional statements used in PL/SQL?
6) What are the different iterative construct used in PL/SQL? Explain in short.
7) What are the features of PL/SQL? Explain.
8) What are the advantages of PL/SQL? Explain
9) How will you stop an infinite loop without closing the program?
10) Why PL/SQL does not support retrieving multiple records?

Assignment No.	**6**
Title	Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor)
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No: 6

Title :- Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table Cust_New with the data available in the table Cust_Old. If the data in the first table already exist in the second table then that data should be skipped. Frame the separate problem statement for writing PL/SQL block to implement all types

Objective **:-** Learning the concept of cursor in PL/SQL

Theory **:- CURSOR:-**

For the processing of any SQL statement, database needs to allocate memory. This memory is called context area. The context area is a part of PGA (Process global area) and is allocated on the oracle server.

A cursor is associated with this work area used by ORACLE, for multi row queries. A cursor is a handle or pointer to the context area .The cursor allows to process contents in the context area row by row.

There are two types of cursors.

1) Implicit cursor:-Implicit cursors are defined by ORACLE implicitly. ORACLE defines implicit cursor for every DML statements.
2) Explicit cursor:-These are user-defined cursors which are defined in the declaration section of the PL/SQL block. There are four steps in which the explicit cursor is processed.
    1) Declaring a cursor
    2) Opening a cursor
    3) Fetching rows from an opened cursor
    4) Closing cursor

General syntax for CURSOR:-

```
DECLARE
    Cursor cursor_name IS select_statement or query;
BEGIN
    Open cursor_name;
Fetch cursor_name into list_of_variables;
    Close cursor_name;
END;
```

Where

1) Cursor_name:-is the name of the cursor.
2) Select_statement:-is the query that defines the set of rows to be processed by the cursor.
3) Open cursor_name:-open the cursor that has been previously declared.

When cursor is opened following things happen

i) The active set pointer is set to the first row.

ii) The value of the binding variables are examined.

4) Fetch statement is used to retrieve a row from the selected rows, one at a time, into PL/SQL variables.

5) Close cursor_name:-When all of cursor rows have been retrieved, the cursor should be closed.

Explicit cursor attributes:-

Following are the cursor attributes

1. %FOUND: - This is Boolean attribute. It returns TRUE if the previous fetch returns a row and false if it doesn‟t.

2. %NOTFOUND:-If fetch returns a row it returns FALSE and TRUE if it doesn‟t. This is often used as the exit condition for the fetch loop;

3. %ISOPEN:-This attribute is used to determine whether or not the associated cursor is open. If so it returns TRUE otherwise FALSE.

4. %ROWCOUNT:-This numeric attribute returns a number of rows fetched by the cursor.

Cursor Fetch Loops

1) Simple Loop

Syntax:-

```
LOOP
    Fetch cursorname into list of variables;
EXIT WHEN cursorname%NOTFOUND
    Sequence_of_statements;
END LOOP;
```

2) WHILE Loop

Syntax:-

```
FETCH cursorname INTO list of variables;
WHILE cursorname%FOUND LOOP
    Sequence_of_statements;
    FETCH cursorname INTO list of variables;
END LOOP;
```

3) Cursor FOR Loop

Syntax:

```
FOR variable_name IN cursorname LOOP
    -- an implicit fetch is done here.
    -- cursorname%NOTFOUND is also implicitly checked.
```

```
                    -- process the fetch records.
                    Sequence_of_statements;
                END LOOP;
```

There are two important things to note about :-

i) Variable_name is not declared in the DECLARE section. This variable is implicitly declared by the PL/SQL compiler.

ii) Type of this variable is cursorname%ROWTYPE.

Implicit Cursors

PL/SQL issues an implicit cursor whenever you execute a SQL statement directly in your code, as long as that code does not employ an explicit cursor. It is called an "implicit" cursor because you, the developer, do not explicitly declare a cursor for the SQL statement.

If you use an implicit cursor, Oracle performs the open, fetches, and close for you automatically; these actions are outside of your programmatic control. You can, however, obtain information about the most recently executed SQL statement by examining the values in the implicit SQL cursor attributes.

PL/SQL employs an implicit cursor for each UPDATE, DELETE, or INSERT statement you execute in a program. You cannot, in other words, execute these statements within an explicit

cursor, even if you want to. You have a choice between using an implicit or explicit cursor only when you execute a single-row SELECT statement (a SELECT that returns only one row).

In the following UPDATE statement, which gives everyone in the company a 10% raise, PL/SQL creates an implicit cursor to identify the set of rows in the table which would be affected by the update:

```
UPDATE employee
  SET salary = salary * 1.1;
```

The following single-row query calculates and returns the total salary for a department. Once again, PL/SQL creates an implicit cursor for this statement:

```
SELECT SUM (salary) INTO department_total
  FROM employee
 WHERE department_number = 10;
```

If you have a SELECT statement that returns more than one row, you must use an explicit cursor for that query and then process the rows returned one at a time. PL/SQL does not yet support any kind of array interface between a database table and a composite PL/SQL datatype such as a PL/SQL table.

Drawbacks of Implicit Cursors

Even if your query returns only a single row, you might still decide to use an explicit cursor. The implicit cursor has the following drawbacks:

- It is less efficient than an explicit cursor
- It is more vulnerable to data errors
- It gives you less programmatic control

The following sections explore each of these limitations to the implicit cursor.

Inefficiencies of implicit cursors

An explicit cursor is, at least theoretically, more efficient than an implicit cursor. An implicit cursor executes as a SQL statement and Oracle's SQL is ANSI-standard. ANSI dictates that a single-row query must not only fetch the first record, but must also perform a second fetch to determine if too many rows will be returned by that query (such a situation will RAISE the TOO_MANY_ROWS PL/SQL exception). Thus, an implicit query always performs a minimum of two fetches, while an explicit cursor only needs to perform a single fetch.

This additional fetch is usually not noticeable, and you shouldn't be neurotic about using an implicit cursor for a single-row query (it takes less coding, so the temptation is always there). Look out for indiscriminate use of the implicit cursor in the parts of your application where that cursor will be executed repeatedly. A good example is the Post-Query trigger in the Oracle Forms.

Post-Query fires once for each record retrieved by the query (created from the base table block and the criteria entered by the user). If a query retrieves ten rows, then an additional ten fetches are needed with an implicit query. If you have 25 users on your system all performing a similar query, your server must process 250 additional (unnecessary) fetches against the database. So, while it might be easier to write an implicit query, there are some places in your code where you will want to make that extra effort and go with the explicit cursor.

Vulnerability to data errors

If an implicit SELECT statement returns more than one row, it raises the TOO_MANY_ROWS exception. When this happens, execution in the current block terminates and control is passed to the exception section. Unless you deliberately plan to handle this scenario, use of the implicit cursor is a declaration of faith. You are saying, "I trust that query to always return a single row!"

It may well be that today, with the current data, the query will only return a single row. If the nature of the data ever changes, however, you may find that the SELECT statement which formerly identified a single row now returns several. Your program will raise an exception. Perhaps this is what you will want. On the other hand, perhaps the presence of additional records is inconsequential and should be ignored.

With the implicit query, you cannot easily handle these different possibilities. With an explicit query, your program will be protected against changes in data and will continue to fetch rows without raising exceptions.

Lab Exercise

1) Create table with name **student** having the field **rollno**, **first name**, **last name** & **branch**. Insert 10 records into table. Write a PL/SQL to create a cursor to hold all the record of student table having branch „**Computer Science**". Display all the records.

2) Write a PL/SQL block to update the record of rollno =100 & set the **branch** to **E and TC'**, if it is not present then insert the record into the student table with the id=100; (use implicit cursor sql%notfound).
3) Write a cursor and use it to raise the employee salaries as follows:
   i) All employees of department 20 get 5% raise
   ii) All employees of department 30 get 10% raise
   iii) Rest of employees get 7.5% raise

   Use separate cursor.

FAQ :

1) What is cursor?
2) What are the different types of cursors?
3) What are the different attributes of explicit cursor? Explain in brief.
4) What is implicit cursor?
5) Explain the FOR loop of Cursor.
6) What is difference between simple loop, while loop & for loop?
7) What is difference between Implicit & Explicit Cursor?
8) Explain FOR UPDATE cursor with an example.
9) What is CURRENT OF clause in cursor? Give an example.
10) List all predefined cursor.

Assignment No.	**7**
Title	Write a PL/SQL stored procedure and function.
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No: 7

Title :- PL/SQL Stored Procedure and Stored Function Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class. Write a PL/SQL block for using procedure created with above requirement. Stud_Marks(name, total_marks) Result(Roll,Name, Class). **Frame the separate problem statement for writing PL/SQL Stored Procedure and function, inline with above statement. The problem statement should clearly state the requirements.**

Objective **:**-Learning the concept of procedure, function & package in PL/SQL

Theory **:-**

PROCEDURE:-

A procedure is a subprogram that performs a specific action or task. A procedure has two parts.

1) The procedure specification: The procedure specification specifies the procedure name and the parameters it accepts. It is not necessary to create a procedure that accepts parameters.

2) The procedure body: The procedure body contains the declarative section without DECLARE keyword, the executable section and an exception section.

Syntax for creating a procedure

Create [or replace] PROCEDURE procedure_name

[(argument1 [IN / OUT / IN OUT] type),

(argument2 [IN / OUT / IN OUT] type),

….]

IS/AS

Procedure_body

Where

Procedure_name: – is the name of the procedure to be created

Argument:- is the name of the procedure parameter

Type:- Is the data type of the associated parameter

Procedure_body:-Is a PL/SQL block that makes up the code of the procedure.

IN:-This is default mode. The value of the actual parameter is passed into the procedure. Inside the procedure the formal parameter is considered read only.

OUT:-Any value the actual parameter has when the procedure is called ignored. Inside the procedure ,the formal parameters are considered as write only.

IN OUT:-this mode is combination of IN and OUT

Deleting procedure:- To remove a procedure from the database.

Syntax:-

Drop procedure<procedure_name>;

FUNCTION:-

A function is a subprogram, which is used to compute values. It is similar to a procedure, function also takes arguments and can be in different modes. Function also can be stored in the database. It is a PL/SQL block consisting of declarative, executable and exception section.

Difference between procedure and function is that the procedure call is a PL/SQL statement by itself, while a function call is called as a part of an expression.

A function can return more than one value using OUT parameter.

A function can be called using positional or named notation.

Syntax for creating a function:-

Create [or replace] FUNCTION function_name
[(argument1 [IN / OUT / IN OUT] type),
(argument2 [IN / OUT / IN OUT] type),
….]
Return return_type IS / AS

Function_body

Where

Function_name: – is the name of the function to be created

Argument: - is the name of the function parameter

Type:- Is the data type of the associated parameter

Function_body:-Is a PL/SQL block containing code for the function.

IN:-This is default mode. The value of the actual parameter is passed into the procedure. Inside the procedure the formal parameter is considered read only.

OUT:-Any value the actual parameter has when the procedure is called ignored. Inside the procedure ,the formal parameters are considered as write only.

INOUT:-this mode is combination of IN and OUT

Deleting a Function:- To remove the subprogram from the database.

Syntax:-

Drop function<function_name>;

Package :

A package is a PL/SQL construct that allows related objects to be stored together. A package has 2 separate parts: the specification and the body. Each of them stored separately in the data dictionary.

Package Specification :

```
CREATE OR REPLACE PACKAGE package_name
{IS|AS}
type_definition|
procedure_specification |Function specification|
variable_declaration |
exception_declaration |
cursor_declaration |
pragma declaration |
end [procedure_name];
```

Package Body:

The package body is separate data dictionary object from the package header. It cannot be successfully compiled unless the package header has already been successfully compiled.

Syntax:

```
CREATE OR REPLACE PACKAGE BODY package_name  AS
Procedure definition;
Function definition;
…….
End package_name
```

To drop the package(both specification & the body) use the **drop package** command as follows:

Syntax :

Drop package <package_name>;

Lab Exercise

1) Write a procedure on EMP table. It should increase commission of an employee. Employee number and commission are passed as parameters to the called procedure.
2) Write a function that returns the number of employees working in a department. Pass department number as an input to the function.
3) Create table classes with the following fields
   (Deptno, course, cur_student, max_student) Insert 4 or 5 records and

Write a function which returns true if the specified class is 80 percent full or more, and false otherwise. Write a PL/SQL block to call this function and use cursor in PL/SQL block to hold the records of all department.

4) Write a procedure to update records of classes table and write a PL/SQL block to call that procedure.
5) Create a package which consist of procedures for insert ,delete and update the data of classes table.

FAQ :

1) Explain the term procedure and function of PL/SQL in short.
2) What is the difference between "procedure" and "function"?
3) What is the difference between "%type" and "%rowtype"?
4) What is package? Explain.
5) What is the use of package?
6) What are the different modes of argument passing?
7) What is difference between IN & IN OUT?
8) Write a package which consists of cursor, trigger, procedure & function.
9) What are the advantages of procedure & function?
10) Write the syntax to drop function, procedure & package.

Assignment No.	**8**
Title	To create row level & statement level trigger.
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No: 8

Title :- Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers). Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should be added in Library_Audit table.

Frame the problem statement for writing Database Triggers of all types, in-line with above statement. The problem statement should clearly state the requirements.

Objective **:**-Learning the concept of use of trigger

Theory **:-**

DATABASE TRIGGERS:-

A database trigger is a PL/SQL program unit, which gets fired automatically whenever the data event such as DML or DDL system event. Triggers are associated with a specific table and are fired automatically whenever the table gets manipulated in a predefined way. The act of executing a trigger is called as firing a trigger.

Triggers are similar to procedures in that they are named PL/SQL blocks with declarative, executable and exception handling sections. But the difference is a procedure is executed explicitly from another block via a procedure call but a trigger is executed implicitly whenever the triggering event happens. A procedure can pass arguments but trigger doesn‟t accept arguments

A database trigger has following components:-

1.A triggering **Event**

2.A triggering **Constraint**

3.A triggering **Action**

Trigger categories

Triggers are categorized in various ways.

1)Trigger type

2)Triggering time

3)Triggering event

Trigger types

There are two types of triggers

1. **Statement Trigger**:-A statement trigger is a trigger in which the trigger action is executed once for the manipulation operation that fires the trigger.

2. **Row Trigger**:-A row trigger is a trigger in which the trigger action is performed repeatedly for each row of the table that is affected by the manipulation operation that fires the trigger.

Triggering time

Triggers can specify the time of trigger action.

1) Before the triggering event

The trigger action is performed before the operation that fires the trigger is executed. This trigger is used when execution of operation depends on trigger action.

2)After the triggering event

The trigger action is performed after the operation that fires the trigger is executed.

This trigger is used when triggering action depends on the execution of operation.

Triggering Events

Triggering events are the DML operations. These operations are **insert, update and delete** When these operations are performed on a table, the trigger which is associated with the operation is fired.

Triggering events divide triggers into three types.

1) DELETE TRIGGER

2) UPDATE TRIGGER

3) INSERT TRIGGER

General syntax for creation of Trigger

Create [or replace] TRIGGER <trigger_name>

<BEFORE | AFTER>

DELETE | [OR] INSERT | [OR] UPDATE[OF <column1>[,<column2>…..]

ON <table_name>

[for each row[when <condition>]

Begin

……. …….

…….

End;

Where

Trigger_name:-trigger name is the name of the trigger.

Table_name :-is thye table name for which the trigger is defined.

Trigger-condition:-The trigger condition in the when clause,if present is evaluated first.The body of the trigger is executed only when this condition evaluates to true.

Dropping trigger

Suppose you want to drop trigger then the syntax is

Syntax:-Drop trigger trigger_name;

Enabling and Disabling Triggers

The Trigger can be disabled without dropping them. When the trigger is disabled, it is still exists in data dictionary but never fired, To disable trigger, use alter command.

Syntax:-

Alter TRIGGER trigger_name DISABLE/ENABLE;

For all triggers on a particular table

Syntax:-

Alter TRIGGER trigger_name (DISABLE/ENABLE) all triggers;

Lab Exercise :-

1) Create a trigger that audits the operations on an Emp table.

   Steps

   Create table emp_audit

   (id number, operation varchar2(6), Dt date, User_id number, Username varchar2(20));

   If any operation like insert, update, delete done on EMP table then insert into EMP_audit table information like the name of the operation with id, user_id and date.
2) Create a table Employee(id, Emp_name, Salary, City)

   Create a trigger to convert the Emp_name into upper case before inserting or updating on Employee table.
3) Create a trigger to check Salary is less than 20000 before inserting or updating on Employee table.
4) Create a trigger (Statement Level Trigger) to display messages after inserting or updating or deleting records on Employee Table.

FAQ :

1) Write a database Trigger
2) Explain Database Trigger Components.
3) Explain Trigger Types with e.g.
4) Explain difference between Row-Level & Statement-Level Trigger.
5) Write a Syntax for Enable & Disable Trigger.
6) Write a Syntax for Displaying Trigger Errors.

Assignment No.	**9**
Title	Study of Open Source NOSQL Database
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 9

Title : Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution)

Objectives : Learn the concept of NOSQL

Theory : **NOSQL**

A **NoSQL** (originally referring to "non SQL" or "non relational") database provides a mechanism for storage and retrieval of data that is modeled in means other than the tabular relations used in relational databases. Such databases have existed since the late 1960s, but did not obtain the "NoSQL" moniker until a surge of popularity in the early twenty-first century, triggered by the needs of Web 2.0 companies such as Facebook, Google, and Amazon.com. NoSQL databases are increasingly used in big data and real-time web applications. [6] NoSQL systems are also sometimes called "Not only SQL" to emphasize that they may support SQL-like query languages.

Motivations for this approach include: simplicity of design, simpler "horizontal" scaling to clusters of machines (which is a problem for relational databases), [2] and finer control over availability. The data structures used by NoSQL databases (e.g. key-value, wide column, graph, or document) are different from those used by default in relational databases, making some operations faster in NoSQL. The particular suitability of a given NoSQL database depends on the problem it must solve. Sometimes the data structures used by NoSQL databases are also viewed as "more flexible" than relational database tables.

Many NoSQL stores compromise consistency (in the sense of the CAP theorem) in favor of availability, partition tolerance, and speed. Barriers to the greater adoption of NoSQL stores include the use of low-level query languages (instead of SQL, for instance the lack of ability to perform ad-hoc joins across tables), lack of standardized interfaces, and huge previous investments in existing relational databases. Most NoSQL stores lack true ACID transactions, although a few databases, such as MarkLogic, Aerospike, FairCom c-treeACE, Google Spanner (though technically a NewSQL database), Symas LMDB, and OrientDB have made them central to their designs. (See ACID and join support.)

MongoDB

MongoDB is a cross-platform, document oriented database that provides, high performance, high availability, and easy scalability. MongoDB works on concept of collection and document.Database

Database is a physical container for collections. Each database gets its own set of files on the file system. A single MongoDB server typically has multiple databases.

Collection

Collection is a group of MongoDB documents. It is the equivalent of an RDBMS table. A collection exists within a single database. Collections do not enforce a schema. Documents within a collection can have different fields. Typically, all documents in a collection are of similar or related purpose.

Document

A document is a set of key-value pairs. Documents have dynamic schema. Dynamic schema means that documents in the same collection do not need to have the same set of fields or structure, and common fields in a collection's documents may hold different types of data.

Sample Document

Following example shows the document structure of a blog site, which is simply a comma separated key value pair.

```
{
_id: ObjectId(7df78ad8902c)
title: 'MongoDB Overview',
description: 'MongoDB is no sql database',
by: 'tutorials point',
url: 'http://www.tutorialspoint.com',
tags: ['mongodb', 'database', 'NoSQL'],
likes: 100,
comments: [ {
user:'user1',
message: 'My first comment',
dateCreated: new Date(2011,1,20,2,15),
like: 0
},
{
user:'user2',
message: 'My second comments',
dateCreated: new Date(2011,1,25,7,45),
like: 5
}]
}
```

_id is a 12 bytes hexadecimal number which assures the uniqueness of every document. You can provide _id while inserting the document. If you don‟t provide then MongoDB provides a unique id for every document. These 12 bytes first 4 bytes for the current timestamp, next 3 bytes for machine id, next 2 bytes for process id of MongoDB server and remaining 3 bytes are simple incremental VALUE.

MongoDB – Advantages:

Any relational database has a typical schema design that shows number of tables and the relationship between these tables. While in MongoDB, there is no concept of relationship.

Advantages of MongoDB over RDBMS

- Schema less: MongoDB is a document database in which one collection holds different documents. Number of fields, content and size of the document can differ from one document to another.
- Structure of a single object is clear.
- No complex joins.
- Deep query -ability.

MongoDB supports dynamic queries on documents using a document-based query language that's nearly as powerful as SQL.

- Tuning.
- Ease of scale -out: MongoDB is easy to scale.
- Conversion/mapping of application objects to database objects not needed.
- Uses internal memory for storing the (windowed) workin g set, enabling faster access of data.

Why Use MongoDB?

- Document Oriented Storage: Data is stored in the form of JSON style documents.
- Index on any attribute
- Replication and high availability
- Auto -sharding
- Rich queries
- Fast in -place updates
- Professional support by MongoDB

Where to Use MongoDB?

- Big Data
- Content Management and Delivery
- Mobile and Social Infrastructure
- User Data Management

 Data Hub

MongoDB Help

To get a list of commands, type db.help() in MongoDB client. This will give you a list of commands as shown in the following screenshot.

The use Command

MongoDB use DATABASE_NAME is used to create database. The command will create a new database if it doesn't exist, otherwise it will return the existing database.

Syntax

Basic syntax of use DATABASE statement is as follows:

use DATABASE_NAME

Example

If you want to create a database with name <mydb>, then use DATABASE statement would be as follows:

>**use mydb**

switched to db mydb

To check your currently selected database, use the command db

>**db**

mydb

If you want to check your databases list, use the command show dbs.

>**show dbs**

local 0.78125GB

test 0.23012GB

Your created database (mydb) is not present in list. To display database, you need to insert at least one document into it.

>**db.movie.insert({"name":"tutorials point"})**

In MongoDB default database is test. If you didn't create any database, then collections will be stored in test database.

The dropDatabase() Method

MongoDB db.dropDatabase() command is used to drop a existing database.

Syntax

db.dropDatabase()

The createCollection() Method

MongoDB db.createCollection(name, options) is used to create collection.

Syntax : **db.createCollection(name, options)**

In the command, name is name of collection to be created. Options is a document and is used to specify configuration of collection.

Parameter Type	Description
Name	String Name of the collection to be created
Options	Document (Optional) Specify options about memory Size and indexing.

The drop() Method

MongoDB's db.collection.drop() is used to drop a collection from the database.

Syntax

db.COLLECTION_NAME.drop().

MongoDB supports many datatypes. Some of them are:

- **String**: This is the most commonly used datatype to store the data. String in MongoDB must be UTF-8 valid.
- **Integer**: This type is used to store a numerical value. Integer can be 32 bit or 64 bit depending upon your server.
- **Boolean** : This type is used to store a boolean (true/ false) value.
- **Double:** This type is used to store floating point values.
- **Min/Max** Keys: This type is used to compare a value against the lowest and highest BSON elements.
- **Arrays:** This type is used to store arrays or list or multiple values into one key.
- **Timestamp**: ctimestamp. This can be handy for recording when a document has been modified or added.
- **Object**: This datatype is used for embedded documents.
- **Null:** This type is used to store a Null value.
- **Symbol:** This datatype is used identically to a string; however, it's generally reserved for languages that use a specific symbol type.
- **Date**: This datatype is used to store the current date or time in UNIX time format. You can specify your own date time by creating object of Date and passing day, month, year into it.
- **Object ID:** This datatype is used to store the document‟s ID.
- **Binary** data: This datatype is used to store binary data.

- **Code:** This datatype is used to store JavaScript code into the document.
- **Regular** expression: This datatype is used to store regular expression.

MongoDB – Insert Document

The insert() Method

To insert data into MongoDB collection, you need to use MongoDB's insert() or save()method.

Syntax

The basic syntax of insert() command is as follows −

>db.COLLECTION_NAME.insert(document)

MongoDB – Query Document

The find() Method

To query data from MongoDB collection, you need to use MongoDB's find()method.

Syntax

The basic syntax of find() method is as follows:

>db.COLLECTION_NAME.find()

find()method will display all the documents in a non-structured way.

The pretty() Method

To display the results in a formatted way, you can use pretty() method.

Syntax

>db.mycol.find().pretty()

Apart from find() method, there is **findOne()** method, that returns only one document.

RDBMS Where Clause Equivalents in MongoDB

To query the document on the basis of some condition, you can use following operations

Operation	Syntax	Example	RDBMS Equivalent
Equality	{<key>: <value>}	db.mycol.find({"by":"tutorials point"}).pretty()	where by = 'tutorials point'
Less Than	{<key>: {$lt:<value>}}	db.mycol.find({"likes": {$lt:50}}).pretty()	where likes < 50
Less Than Equals	{<key>:{$lte: <value>}}	db.mycol.find({"likes": {$lte:50}}).pretty()	where likes <= 50
Greater Than	{<key>: {$gt:<value>}}	db.mycol.find({"likes": {$gt:50}}).pretty()	where likes > 50
Greater Than Equals	{<key>:{$gte: <value>}}	db.mycol.find({"likes": {$gte:50}}).pretty()	where likes >= 50
Not Equals	{<key>: {$ne:<value>}}	db.mycol.find({"likes": {$ne:50}}).pretty()	where likes != 50

Logical operators:--

AND in MongoDB

Syntax

In the find() method, if you pass multiple keys by separating them by ',' then MongoDB treats it as AND condition. Following is the basic syntax of AND −

>db.mycol.find({key1:value1, key2:value2}).pretty()

OR in MongoDB

Syntax

To query documents based on the OR condition, you need to use $or keyword. Following is the basic syntax of OR −

>db.mycol.find({ $or: [{key1: value1}, {key2:value2}] }).pretty()

Using AND and OR Together

Example

The following example will show the documents that have likes greater than 100 and whose title is either 'MongoDB Overview' or by is 'tutorials point'. Equivalent SQL where clause is 'where likes>10 AND (by = 'tutorials point' OR title = 'MongoDB Overview')'

db.mycol.find({"likes": {$gt:10}, $or: [{"by": "tutorials point"}, {"title": "MongoDB Overview" }]}).pretty()

{ "_id": ObjectId(7df78ad8902c),
"title": "MongoDB Overview",
"description": "MongoDB is no sql database",
"by": "tutorials point",
"url": "http://www.tutorialspoint.com",
"tags": ["mongodb", "database", "NoSQL"],
"likes": "100" }

MongoDB's update()

MongoDB's update() and save() methods are used to update document into a collection. The update() method updates the values in the existing document while the save() method replaces the existing document with the document passed in save() method.

MongoDB Update() Method

The update() method updates the values in the existing document.

Syntax

The basic syntax of update() method is as follows:

>db.COLLECTION_NAME.update(SELECTIOIN_CRITERIA, UPDATED_DATA)

MongoDB Save() Method

The save() method replaces the existing document with the new document passed in the save() method.

Syntax

The basic syntax of MongoDB save() method is −

>db.COLLECTION_NAME.save({_id:ObjectId(),NEW_DATA}).

The remove() Method

MongoDB's remove() method is used to remove a document from the collection. remove() method accepts two parameters. One is deletion criteria and second is justOne flag.

- deletion criteria: (Optional) deletion criteria according to documents will be removed.
- justOne: (Optional) if set to true or 1, then remove only one document.

Syntax

Basic syntax of remove() method is as follows:

>db.COLLECTION_NAME.remove(DELLETION_CRITTERIA)

Remove Only One

If there are multiple records and you want to delete only the first record, then set justOne parameter in remove() method.

>db.COLLECTION_NAME.remove(DELETION_CRITERIA,1)

Remove All Documents

If you don't specify deletion criteria, then MongoDB will delete whole documents from the collection. This is equivalent of SQL's truncate command.

>db.mycol.remove()

>db.mycol.find()

The Limit() Method

To limit the records in MongoDB, you need to use limit() method. The method accepts one number type argument, which is the number of documents that you want to be displayed.

Syntax

The basic syntax of limit() method is as follows:

>db.COLLECTION_NAME.find().limit(NUMBER)

MongoDB Skip() Method

Apart from limit() method, there is one more method skip() which also accepts number type argument and is used to skip the number of documents.

Syntax

The basic syntax of skip() method is as follows:

>db.COLLECTION_NAME.find().limit(NUMBER).skip(NUMBER)

The sort() Method

To sort documents in MongoDB, you need to use sort() method. The method accepts a document containing a list of fields along with their sorting order. To specify sorting order 1 and -1 are used. 1 is used for ascending order while -1 is used for descending order.

Syntax

The basic syntax of sort() method is as follows:

>db.COLLECTION_NAME.find().sort({KEY:1})

Installation steps in Fedora:

->download the software "**mongodb-linux-x86_64-3.4.9.tgz**"

Copy to Download

[root@localhost Downloads]# **tar -xvzf mongodb-linux-x86_64-3.4.9.tgz**

[root@localhost Downloads]# **cd mongodb-linux-x86_64-3.4.9/**

[root@localhost mongodb-linux-x86_64-3.4.9]# **cd bin**

[root@localhost bin]# **./mongod -dbpath /home/admin/**

[root@localhost bin]# **./mongo**

Installation steps in Windows:

1. Install MongoDB setup
2. Open "C:\Program Files (x86)\MongoDB\Server\3.0\bin"
3. **mongod.exe** ==> Server file || **mongo.exe** ==> Client file
4. Create Folder like **"D:\TE\data\db"**
5. **Run MongoDB Server**
   -> Open Command prompt as Administrator
   -> cd C:\Program Files (x86)\MongoDB\Server\3.0\bin
   -> **mongod.exe --dbpath "D:\TEB\data\db"**

6. **Run MongoDB Client**

-> Open Second Command prompt

-> cd C:\Program Files (x86)\MongoDB\Server\3.0\bin

-> **mongo.exe**

Conclusion : *Thus we have studied new concept NOSQL-MongoDB.*

FAQ :

1. What makes MongoDB the best?
2. If you remove an object attribute, is it deleted from the database? Explain with example.
3. How does MongoDB provide consistency?
4. Define MongoDB.
5. What are the key features of mongodb?
6. Which command is use to create database? Explain with example
7. Which command is use to drop database? Explain with example
8. What is the use of pretty() method? Explain with example
9. Which method is used to remove the document form the collection? Explain with example

Assignment No.	**10**
Title	Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 10

Aim : Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)

Objectives : Learn the concept of MONGO DB

Theory : **MongoDB** is a cross-platform, document oriented database that provides, high performance, high availability, and easy scalability. MongoDB works on concept of collection and document.

Database
Database is a physical container for collections. Each database gets its own set of files on the file system. A single MongoDB server typically has multiple databases.

Collection
Collection is a group of MongoDB documents. It is the equivalent of an RDBMS table. A collection exists within a single database. Collections do not enforce a schema. Documents within a collection can have different fields. Typically, all documents in a collection are of similar or related purpose.

Document
A document is a set of key-value pairs. Documents have dynamic schema. Dynamic schema means that documents in the same collection do not need to have the same set of fields or structure, and common fields in a collection's documents may hold different types of data.

The following table shows the relationship of RDBMS terminology with MongoDB .

RDBMS	MongoDB
Database	Database
Table	Collection
Tuple/Row	Document
column	Field
Table Join	Embedded Documents
Primary Key	Primary Key (Default key _id provided by mongodb itself)
Database Server and Client	
Mysqld/Oracle	mongod
mysql/sqlplus	mongo

CRUD is the basic operation of Mongodb ,it stands CREATE , READ , UPDATE, DELETE.

MongoDB – 1. Create Collection

The createCollection() Method

MongoDB db.createCollection(name, options) is used to create collection.

Basic syntax of createCollection() command is as follows:

db.createCollection(name, options)

In the command, name is name of collection to be created. Options are a document and are used to specify configuration of collection.

Parameter	Type	Description
Name	String	Name of the collection to be created
Options	Document	(Optional) Specify options about memory size and indexing

Options parameter is optional, so you need to specify only the name of the collection. Following is the list of options you can use:

Field	Type	Description
capped	Boolean	(Optional) If true, enables a capped collection. Capped collection is a fixed size collection that automatically overwrites its oldest entries when it reaches its maximum size. **If you specify true, you need to specify size parameter also.**
autoIndexID	Boolean	(Optional) If true, automatically create index on _id field. Default value is false.
size	number	(Optional) Specifies a maximum size in bytes for a capped collection. **If capped is true, then you need to specify this field also.**
max	number	(Optional) Specifies the maximum number of documents allowed in the capped collection.

While inserting the document, MongoDB first checks size field of capped collection, then it

checks max field.

Examples

Basic syntax of createCollection() method without options is as follows:

>use test

switched to db test

>db.createCollection("mycollection")

{ "ok" : 1 }

>

You can check the created collection by using the command show collections.

>show collections

mycollection

system.indexes

2. READ-The find() Method

To query data from MongoDB collection, you need to use MongoDB's find()method.

Syntax

The basic syntax of find() method is as follows:

>db.COLLECTION_NAME.find()

find()method will display all the documents in a non-structured way.

The pretty() Method

To display the results in a formatted way, you can use pretty() method.

Syntax

>db.mycol.find().pretty()

Example

>db.mycol.find().pretty()

{

"_id": ObjectId(7df78ad8902c),

"title": "MongoDB Overview",

"description": "MongoDB is no sql database",

"by": "tutorials point",

"url": "http://www.tutorialspoint.com",

"tags": ["mongodb", "database", "NoSQL"],

"likes": "100"

}

>

Apart from find() method, there is findOne() method, that returns only one document.

3. UPDATE

MongoDB's update() and save() methods are used to update document into a collection.

The update() method updates the values in the existing document while the save() method replaces the existing document with the document passed in save() method.

MongoDB Update() Method

The update() method updates the values in the existing document.

The basic syntax of update() method is as follows:

>db.COLLECTION_NAME.update(SELECTIOIN_CRITERIA, UPDATED_DATA)

Example

Consider the mycol collection has the following data.

{ "_id" : ObjectId(5983548781331adf45ec5), "title":"MongoDB Overview"}

{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}

{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}

Following example will set the new title 'New MongoDB Tutorial' of the documents whose title is 'MongoDB Overview'.

```
>db.mycol.update({'title':'MongoDB Overview'},{$set:{'title':'New MongoDB Tutorial'}})
```

>db.mycol.find()

{ "_id" : ObjectId(5983548781331adf45ec5), "title":"New MongoDB Tutorial"}

{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}

{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}

>

By default, MongoDB will update only a single document. To update multiple documents, you need to set a parameter 'multi' to true.

```
>db.mycol.update({'title':'MongoDB Overview'},
{$set:{'title':'New MongoDB Tutorial'}},{multi:true})
```

MongoDB Save() Method

The save() method replaces the existing document with the new document passed in the save() method.

The basic syntax of MongoDB save() method is −

>db.COLLECTION_NAME.save({_id:ObjectId(),NEW_DATA})

Example

Following example will replace the document with the _id '5983548781331adf45ec7'.

```
>db.mycol.save(
{
"_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point New
Topic",
"by":"Tutorials Point"
} )
>db.mycol.find()
{ "_id" : ObjectId(5983548781331adf45ec5), "title":"Tutorials Point New Topic",
"by":"Tutorials Point"}
{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}
{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}
```

4.DELETE-The remove() Method

MongoDB's remove() method is used to remove a document from the collection.

remove() method accepts two parameters. One is deletion criteria and second is justOne flag.

- deletion criteria: (Optional) deletion criteria according to documents will be removed.
- justOne: (Optional) if set to true or 1, then remove only one document.

Basic syntax of remove() method is as follows:

>**db.COLLECTION_NAME.remove(DELLETION_CRITTERIA)**

Example

Consider the mycol collection has the following data.

```
{ "_id" : ObjectId(5983548781331adf45ec5), "title":"MongoDB Overview"}
```

{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}

{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}

Following example will remove all the documents whose title is 'MongoDB Overview'.

>db.mycol.remove({'title':'MongoDB Overview'})

>db.mycol.find()

{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}

{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}

LOGICAL OPERATORS:

AND in MongoDB

Syntax

In the find() method, if you pass multiple keys by separating them by ',' then MongoDB treats it as AND condition. Following is the basic syntax of AND −

>db.mycol.find({key1:value1, key2:value2}).pretty()

Example

Following example will show all the tutorials written by 'tutorials point' and whose title is 'MongoDB Overview'.

>db.mycol.find({"by":"tutorials point","title": "MongoDB Overview"}).pretty()

{

"_id": ObjectId(7df78ad8902c),

"title": "MongoDB Overview",

"description": "MongoDB is no sql database",

"by": "tutorials point",

"url": "http://www.tutorialspoint.com",

"tags": ["mongodb", "database", "NoSQL"],

"likes": "100"

}>

For the above given example, equivalent where clause will be ' where by='tutorials point' AND title = 'MongoDB Overview' '. You can pass any number of key, value pairs in find clause.

OR in MongoDB

Syntax : To query documents based on the OR condition, you need to use $or keyword. Following is the basic syntax of OR −

>db.mycol.find({ $or: [{key1: value1}, {key2:value2}] }).pretty()

Example will show all the tutorials written by 'tutorials point' or whose title is 'MongoDB Overview'.

>db.mycol.find({$or:[{"by":"tutorials point"},{"title": "MongoDB Overview"}]}).pretty()

{ "_id": ObjectId(7df78ad8902c),
"title": "MongoDB Overview",
"description": "MongoDB is no sql database",
"by": "tutorials point",
"url": "http://www.tutorialspoint.com",
"tags": ["mongodb", "database", "NoSQL"],
"likes": "100" }

Using AND and OR Together Example

The following example will show the documents that have likes greater than 100 and whose title is either 'MongoDB Overview' or by is 'tutorials point'. Equivalent SQL where clause is 'where likes>10 AND (by = 'tutorials point' OR title = 'MongoDB Overview')'

>**db.mycol.find({"likes": {$gt:10}, $or: [{"by": "tutorials point"},{"title": "MongoDB Overview"}]}).pretty()**

{
"_id": ObjectId(7df78ad8902c),
"title": "MongoDB Overview",
"description": "MongoDB is no sql database",
"by": "tutorials point",
"url": "http://www.tutorialspoint.com",
"tags": ["mongodb", "database", "NoSQL"],
"likes": "100" }

Conclusion: Thus we have studied MongoDB Queries using CRUD operations.

FAQ:-

1. Explain CREATE Operation with example.
2. Explain AND Operator with example.
3. Explain DELETE function in Mongodb.
4. Explain DELETE function in Mongodb.
5. Explain FIND function in Mongodb.
6. Explain OR Operator with example.

Assignment No.	**11**
Title	Implement aggregation and indexing with suitable example using MongoDB.
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 11

Aim : Implement aggregation and indexing with suitable example using MongoDB.

Objectives : Learn the concept of MongoDB

Theory : MongoDB is an open-source document database and leading NoSQL database. MongoDB is written in C++. This tutorial will give you great understanding on MongoDB concepts needed to create and deploy a highly scalable and performance-oriented database.

Aggregations operations process data records and return computed results. Aggregation operations group values from multiple documents together, and can perform a variety of operations on the grouped data to return a single result. In SQL count(*) and with group by is an equivalent of mongodb aggregation.
The aggregate() Method For the aggregation in MongoDB, you should use aggregate() method.

Basic syntax of aggregate() method is as follows:

>db.COLLECTION_NAME.**aggregate**(AGGREGATE_OPERATION)

Example

In the collection you have the following data:

{

_id: ObjectId(7df78ad8902c)

title: 'MongoDB Overview',

description: 'MongoDB is no sql database',

by_user: 'tutorials point',

url: 'http://www.tutorialspoint.com',

tags: ['mongodb', 'database', 'NoSQL'],

likes: 100

},

{

_id: ObjectId(7df78ad8902d)

title: 'NoSQL Overview',

description: 'No sql database is very fast',

by_user: 'tutorials point',

url: 'http://www.tutorialspoint.com',

tags: ['mongodb', 'database', 'NoSQL'],

likes: 10

},

{

_id: ObjectId(7df78ad8902e)

title: 'Neo4j Overview',

description: 'Neo4j is no sql database',

by_user: 'Neo4j',

url: 'http://www.neo4j.com',

tags: ['neo4j', 'database', 'NoSQL'],

likes: 750

},

Now from the above collection, if you want to display a list stating how many tutorials are written by each user, then you will use the following aggregate() method:

> db.mycol.aggregate([{$group : {_id : "$by_user", num_tutorial : {$sum :1}}}])

{

"result" : [

{

"_id" : "tutorials point", "num_tutorial" : 2

},

{

"_id" : "Neo4j","num_tutorial" : 1

}],

"ok" : 1

}>

Sql equivalent query for the above use case will be select by_user, count(*) from mycol group by by_user.

Expression	Description	Example
$sum	Sums up the defined value from all documents in the collection.	db.mycol.aggregate([{$group : {_id : "$by_user", num_tutorial : {$sum : "$likes"}}}])
$avg	Calculates the average of all given values from all documents in the collection.	db.mycol.aggregate([{$group : {_id : "$by_user", num_tutorial : {$avg : "$likes"}}}])
$min	Gets the minimum of the corresponding values from all documents in the collection.	db.mycol.aggregate([{$group : {_id : "$by_user", num_tutorial : {$min : "$likes"}}}])
$max	Gets the maximum of the corresponding values from all documents in the collection.	db.mycol.aggregate([{$group : {_id : "$by_user", num_tutorial : {$max : "$likes"}}}])
$push	Inserts the value to an array in the resulting document.	db.mycol.aggregate([{$group : {_id : "$by_user", url : {$push: "$url"}}}])
$addToSet	Inserts the value to an array in the resulting document but does not create duplicates.	db.mycol.aggregate([{$group : {_id : "$by_user", url : {$addToSet : "$url"}}}])
$first	Gets the first document from the source documents according to the grouping. Typically this makes only sense together with some previously applied "$sort"-stage.	db.mycol.aggregate([{$group : {_id : "$by_user", first_url : {$first : "$url"}}}])
$last	Gets the last document from the source documents according to the grouping. Typically this makes only sense together with some previously applied "$sort"-stage.	db.mycol.aggregate([{$group : {_id : "$by_user", last_url : {$last : "$url"}}}])

Pipeline Concept

In UNIX command, shell pipeline means the possibility to execute an operation on some input and use the output as the input for the next command and so on. MongoDB also supports same concept in

aggregation framework. There is a set of possible stages and each of those is taken as a set of documents as an input and produces a resulting set of documents (or the final resulting JSON document at the end of the pipeline). This can then in turn be used for the next stage and so on.

Following are the possible stages in aggregation framework:

- $project: Used to select some specific fields from a collection.
- $match: This is a filtering operation and thus this can reduce the amount of documents that are given as input to the next stage.

$group: This does the actual aggregation as discussed above.

- $sort: Sorts the documents.
- $skip: With this, it is possible to skip forward in the list of documents for a given amount of documents.
- $limit: This limits the amount of documents to look at, by the given number starting from the current positions.
- $unwind: This is used to unwind document that are using arrays. When using an array, the data is kind of pre-joined and this operation will be undone with this to have individual documents again. Thus with this stage we will increase the amount of documents for the next stage.

Indexes support the efficient resolution of queries. Without indexes, MongoDB must scan every document of a collection to select those documents that match the query statement This scan is highly inefficient and require MongoDB to process a large volume of data.

Indexes are special data structures, that store a small portion of the data set in an easy -to-traverse form. The index stores the value of a specific field or set of fields, ordered by the value of the field as specified in the index.

The ensureIndex() Method

To create an index you need to use ensureIndex() method of MongoDB. The basic syntax of ensureIndex() method is as follows().

```
>db.COLLECTION_NAME.ensureIndex({KEY:1})
```

Here key is the name of the file on which you want to create index and 1 is for ascending order. To create index in descending order you need to use -1.

Example

```
>db.mycol.ensureIndex({"title":1})
```

In **ensureIndex()** method you can pass multiple fields, to create index on multiple fields.

```
>db.mycol.ensureIndex({"title":1,"description":-1})
```

ensureIndex() method also accepts list of options (which are optional). Following is the list:

Parameter	Type	Description
background	Boolean	Builds the index in the background so that building an index does not block other database activities. Specify true to build in the background. The default value is **false**.
unique	Boolean	Creates a unique index so that the collection will not accept insertion of documents where the index key or keys match an existing value in the index. Specify true to create a unique index. The default value is **false**.
name	String	The name of the index. If unspecified, MongoDB generates an index name by concatenating the names of the indexed fields and the sort order.
dropDups	Boolean	Creates a unique index on a field that may have duplicates. MongoDB indexes only the first occurrence of a key and removes all documents from the collection that contain subsequent occurrences of that key. Specify true to create unique index. The default value is **false**.
sparse	Boolean	If true, the index only references documents with the specified field. These indexes use less space but behave differently in some situations (particularly sorts). The default value is **false**.
expireAfterSeconds	Integer	Specifies a value, in seconds, as a TTL to control how long MongoDB retains documents in this collection.
v	Index Version	The index version number. The default index version depends on the version of MongoDB running when creating the index.
weights	Document	The weight is a number ranging from 1 to 99,999 and denotes the significance of the field relative to the other indexed fields in terms of the score.

weights	Document	The weight is a number ranging from 1 to 99,999 and denotes the significance of the field relative to the other indexed fields in terms of the score.
default_language	String	For a text index, the language that determines the list of stop words and the rules for the stemmer and tokenizer. The default value is **english**.
language_override	String	For a text index, specify the name of the field in the document that contains, the language to override the default language. The default value is language.

Conclusion: - *Thus we have studied use and implementation of aggregation function &indexing function.*

FAQ : -

1. Enlist various aggregation operations.
2. Explain MIN function with example.
3. Explain PUSH function with example.
4. Explain SUM & AVG function with example.

Assignment No.	**12**
Title	Implement Map reduces operation with suitable example using MongoDB
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 12

Aim : Implement Map reduces operation with suitable example using MongoDB

Objectives : Learn the concept of NOSQL MongoDB

Theory :

As per the MongoDB documentation, MapReduce is a data processing paradigm for condensing large volumes of data into useful aggregated results. MongoDB uses mapReduce command for map-reduce operations. MapReduce is generally used for processing large data sets.

MapReduce Command

Following is the syntax of the basic mapReduce command

```
>db.collection.mapReduce (
        function() {  emit(key,value); },  //map function
        function(key,values) {return reduceFunction},
        {  //reduce function
                out: collection,
                query: document,
                sort: document,
                limit: number
        } )
```

The map-reduce function first queries the collection, then maps the result documents to emit key-value pairs, which is then reduced based on the keys that have multiple values.

In the above syntax −

- map is a javascript function that maps a value with a key and emits a key-value pair
- reduce is a javascript function that reduces or groups all the documents having the same key
- out specifies the location of the map-reduce query result
- query specifies the optional selection criteria for selecting documents
- sort specifies the optional sort criteria
- limit specifies the optional maximum number of documents to be returned Using MapReduce

Consider the following document structure storing user posts. The document stores user_name of the user and the status of post.

```
{"post_text": "tutorialspoint is an awesome website for tutorials" ,
        "user_name": "mark",
        "status":"active" }
```

We will use a mapReduce function on our posts collection to select all the active posts, group them on the basis of user_name and then count the number of posts by each user using the following code

```
>db.posts.mapReduce(
        function() { emit(this.user_id,1); },
        function(key, values) {return Array.sum(values)}, {
        query:{status:"active"},
        out:"post_total" })
```

The above mapReduce query outputs the following result −

{
"result" : "post_total",
"timeMillis" : 9,"counts" :
{
"input" : 4,
"emit" : 4,
"reduce" : 2,
"output" : 2
},
"ok" : 1,
}

The result shows that a total of 4 documents matched the query (status:"active"), the map function emitted 4 documents with key-value pairs and finally the reduce function grouped mapped documents having the same keys into 2.

To see the result of this mapReduce query, use the find operator −

>**db.posts.mapReduce (function() { emit(this.user_id,1); }, function(key, values) {return Array.sum(values)}, {query:{status:"active"}, out:"post_total"}).find()**

The above query gives the following result which indicates that both users tom and mark have two posts in active states −

{ "_id" : "tom", "value" : 2 }

{ "_id" : "mark", "value" : 2 }

In a similar manner, MapReduce queries can be used to construct large complex aggregation queries. The use of custom Javascript functions make use of MapReduce which is very flexible and powerful.

Conclusion: *Thus we have studied Map reduce function.*

FAQ : -

1. Define and Explain mapreduce in MongoDB with examples.
2. Why to use Mapreduce in MongoDB
3. Explain the structure of ObjectID in MongoDB.
4. What are NoSQL databases? What are the different types of NoSQL databases?

Assignment No.	**13**
Title	Design and Implement any 5 query using MongoDB
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 13

Aim : Design and Implement any 5 query using MongoDB

Objectives : Learn the concept of MONGO DB

Theory : **MongoDB** is a cross-platform, document oriented database that provides, high performance, high availability, and easy scalability. MongoDB works on concept of collection and document.

MongoDB – Projection

In MongoDB, projection means selecting only the necessary data rather than selecting whole of the data of a document. If a document has 5 fields and you need to show only 3, then select only 3 fields from them.

The find() Method

MongoDB's find() method, explained in MongoDB Query Document accepts second optional parameter that is list of fields that you want to retrieve. In MongoDB, when you execute find() method, then it displays all fields of a document. To limit this, you need to set a list of fields with value 1 or 0. 1 is used to show the field while 0 is used to hide the fields.

Syntax

The basic syntax of find() method with projection is as follows:

>db.COLLECTION_NAME.find({},{KEY:1})

Example

Consider the collection **mycol** has the following data

{ "_id" : ObjectId(5983548781331adf45ec5), "title":"MongoDB Overview"}

{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}

{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}

Following example will display the title of the document while querying the document.

>db.mycol.find({},{"title":1,_id:0})

{"title":"MongoDB Overview"}

{"title":"NoSQL Overview"}

{"title":"Tutorials Point Overview"}

The Limit() Method

To limit the records in MongoDB, you need to use limit() method. The method accepts one number type argument, which is the number of documents that you want to be displayed.

Syntax

The basic syntax of limit() method is as follows:

>db.COLLECTION_NAME.find().limit(NUMBER)

Example

Consider the collection myycol has the following data.

{ "_id" : ObjectId(5983548781331adf45ec5), "title":"MongoDB Overview"}

{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}

{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}

Following example will display only two documents while querying the document.

>db.mycol.find({},{"title":1,_id:0}).limit(2)

{"title":"MongoDB Overview"}

{"title":"NoSQL Overview"}

If you don't specify the number argument in limit() method then it will display all documents from the collection.

MongoDB Skip( ) Method

Apart from limit() method, there is one more method skip() which also accepts number type argument and is used to skip the number of documents.

Syntax

The basic syntax of skip() method is as follows:

>db.COLLECTION_NAME.find().limit(NUMBER).skip(NUMBER)

Example

Following e.g. will display only the second document. The default value in skip() method is 0.

>db.mycol.find({},{"title":1,_id:0}).limit(1).skip(1)

{"title":"NoSQL Overview"}

The sort( ) Method

To sort documents in MongoDB, you need to use sort() method. The method accepts a document containing a list of fields along with their sorting order. To specify sorting order 1 and -1 are used. 1 is used for ascending order while -1 is used for descending order.

Syntax

The basic syntax of sort() method is as follows:

>db.COLLECTION_NAME.find().sort({KEY:1})

Example

Consider the collection myycol has the following data.

{ "_id" : ObjectId(5983548781331adf45ec5), "title":"MongoDB Overview"}

{ "_id" : ObjectId(5983548781331adf45ec6), "title":"NoSQL Overview"}

{ "_id" : ObjectId(5983548781331adf45ec7), "title":"Tutorials Point Overview"}

Following example will display the documents sorted by title in the descending order.

```
>db.mycol.find({},{"title":1,_id:0}).sort({"title":-1})
{"title":"Tutorials Point Overview"}
{"title":"NoSQL Overview"}
{"title":"MongoDB Overview"}
```

FAQ:-

1. Explain Projection Operation with example.
2. Explain SKIP method with example.
3. Explain Limit Method in Mongodb.
4. Explain Sort Method in Mongodb.
5. Explain distinct function in Mongodb.

Assignment No.	**14**
Title	Create simple objects and array objects using JSON
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 14

Aim : Create simple objects and array objects using JSON.

Objectives : Learn the concept of JSON

Theory : **What is JSON**

JSON is an open standard for exchanging data on the web. It supports data structures like object and array. So it is easy to write and read data from JSON.

- JSON stands for JavaScript Object Notation.
- JSON is an open standard data-interchange format.
- JSON is lightweight and self describing.
- JSON is originated from JavaScript.
- JSON is easy to read and write.
- JSON is language independent.
- JSON supports data structures such as array and objects.

Features of JSON

- Simplicity
- Openness
- Self Describing
- Internationalization
- Extensibility
- Interoperability
- Light-weight

Why use JSON?

- **Standard Structure:** JSON objects are having a standard structure that makes developers job easy to read and write code, because they know what to expect from JSON.
- **Light weight:** When working with AJAX, it is important to load the data quickly and asynchronously without requesting the page re-load. Since JSON is light weighted, it becomes easier to get and load the requested data quickly.
- **Scalable:** JSON is language independent, which means it can work well with most of the modern programming language. Let‟s say if we need to change the server side language, in that case it would be easier for us to go ahead with that change as JSON structure is same for all the languages.

JSON Example

File: first.json

```
{"employees":[
  {"name":"Sonoo", "email":"sonoojaiswal1987@gmail.com"},
  {"name":"Rahul", "email":"rahul32@gmail.com"},
  {"name":"John", "email":"john32bob@gmail.com"}
]}
```

XML Example

```
<employees>
        <employee>
                <name>Vimal</name>
                <email>vjaiswal1987@gmail.com</email>
        </employee>
        <employee>
                <name>Rahul</name>
                <email>rahul12@gmail.com</email>
        </employee>
        <employee>
                <name>Jai</name>
                <email>jai87@gmail.com</email>
        </employee>
</employees>
```

JSON Example

JSON example can be created by object and array.

Each object can have different data such as text, number, boolean etc.

JSON data structure types and how to read them:

- JSON objects
- JSON objects in array
- Nesting of JSON objects

JSON vs XML

A list of differences between JSON and XML are given below

JSON Object Example

- **A JSON object contains data in the form of key/value pair.**
- The keys are strings and the values are the JSON types.
- Keys and values are separated by colon.
- Each entry (key/value pair) is separated by comma.
- The { (curly brace) represents the JSON object.

```
{
   "employee":
   {
      "name":       "sonoo",
      "salary":      56000,
      "married":    true
    }
}
```

No.	JSON	XML
1)	JSON stands for JavaScript Object Notation.	XML stands for eXtensible Markup Language.
2)	JSON is simple to read and write.	XML is less simple than JSON.
3)	JSON is easy to learn.	XML is less easy than JSON.
4)	JSON is data-oriented.	XML is document-oriented.
5)	JSON doesn't provide display capabilities.	XML provides the capability to display data because it is a markup language.
6)	JSON supports array.	XML doesn't support array.
7)	JSON is less secured than XML.	XML is more secured.
8)	JSON files are more human readable than XML.	XML files are less human readable.
9)	JSON supports only text and number data type.	XML support many data types such as text, number, images, charts, graphs etc. Moreover, XML offeres options for transferring the format or structure of the data with actual data.

JSON Array example

The [(square bracket) represents the JSON array. A JSON array can have values and objects.

["Sunday", "Monday", "Tuesday", "Wednesday", "Thursday", "Friday", "Saturday"]

```
[
      {"name":"Ram", "email":"Ram@gmail.com"},
      {"name":"Bob", "email":"bob32@gmail.com"}
]
```

JSON Example :

```
{       "menu": {
                        "id": "file",
                        "value": "File",
                        "popup": {
                          "menuitem": [
                                {"value": "New", "onclick": "CreateDoc()"},
                                {"value": "Open", "onclick": "OpenDoc()"},
                                {"value": "Save", "onclick": "SaveDoc()"}
                                    ]
  }             }                   }
```

JSON Nested Object Example

```
{
    "firstName": "Sonoo",
    "lastName": "Jaiswal",
    "age": 27,
    "address" : {
        "streetAddress": "Plot-6, Mohan Nagar",
        "city": "Ghaziabad",
        "state": "UP",
        "postalCode": "201007"
    }
 }
```

JSON Array of Objects

```
{"employees":[
   {"name":"Ram", "email":"ram@gmail.com", "age":23},

   {"name":"Shyam", "email":"shyam23@gmail.com", "age":28},

   {"name":"John", "email":"john@gmail.com", "age":33},

   {"name":"Bob", "email":"bob32@gmail.com", "age":41}

]}
```

Java JSON

The **json.simple** library allows us to read and write JSON data in Java.

In other words, we can **encode and decode JSON object** in java using json.simple library.

The **org.json.simple package** contains important classes for **JSON API**.

- JSONValue
- JSONObject
- JSONArray
- JsonString
- JsonNumber

Install json.simple

To install json.simple, you need to set classpath of json-simple.jar.

Download **json-simple.jar** (https://www.javatpoint.com/jsonpages/json-simple-1.1.1.jar)

FAQ:-

1. Explain JSON with example.
2. Explain difference between JSON vs XML.
3. List JSON data structure types.
4. Explain JSON Object.
5. Explain JSON Array Object.

Assignment No.	**15**
Title	Encode and Decode JSON Objects using Java / Perl / PHP / Python / Ruby.
Roll No.	
Class	T.E. (C.E.)
Date	
Subject	**Database Management System Laboratory**
Signature	

Assignment No. 15

Aim : Encode and Decode JSON Objects using Java / Perl / PHP / Python / Ruby.

Objectives : Learn the concept of JSON

Theory : **What is JSON**

JSON is an open standard for exchanging data on the web. It supports data structures like object and array. So it is easy to write and read data from JSON.

- JSON stands for JavaScript Object Notation.
- JSON is an open standard data-interchange format.
- JSON is lightweight and self describing.
- JSON is originated from JavaScript.
- JSON is easy to read and write.
- JSON is language independent.
- JSON supports data structures such as array and objects.

Install json.simple

To install json.simple, you need to set classpath of json-simple.jar.

Download **json-simple.jar** (https://www.javatpoint.com/jsonpages/json-simple-1.1.1.jar)

Environment

Before you start with encoding and decoding JSON using Java, you need to install any of the JSON modules available. For this assignment we have downloaded and installed JSON simple and have added the location of **json-simple-1.1.1.jar** file to the environment variable CLASSPATH.

Mapping between JSON and Java entities

JSON.simple maps entities from the left side to the right side while decoding or parsing, and maps entities from the right to the left while encoding.

JSON	Java
string	java.lang.String
number	java.lang.Number
true|false	java.lang.Boolean
null	null
array	java.util.List
object	java.util.Map

On decoding, the default concrete class of *java.util.List* is *org.json.simple.JSONArray* and the default concrete class of *java.util.Map* is *org.json.simple.JSONObject*.

Encoding JSON in Java

Following is a simple example to encode a JSON object using Java JSONObject which is a subclass of java.util.HashMap. No ordering is provided. If you need the strict ordering of elements, use JSONValue.toJSONString (map) method with ordered map implementation such as java.util.LinkedHashMap.

```
import org.json.simple.JSONObject;

class JsonEncodeDemo {

   public static void main(String[] args){
      JSONObject obj = new JSONObject();

      obj.put("name", "foo");
      obj.put("num", new Integer(100));
      obj.put("balance", new Double(1000.21));
      obj.put("is_vip", new Boolean(true));

      System.out.print(obj);
   }
}
```

On compiling and executing the above program the following result will be generated −

{"balance": 1000.21, "num":100, "is_vip":true, "name":"foo"}

Following is another example that shows a JSON object streaming using Java JSONObject −

```
import org.json.simple.JSONObject;

class JsonEncodeDemo {

   public static void main(String[] args){

      JSONObject obj = new JSONObject();

      obj.put("name","foo");
      obj.put("num",new Integer(100));
      obj.put("balance",new Double(1000.21));
      obj.put("is_vip",new Boolean(true));

      StringWriter out = new StringWriter();
      obj.writeJSONString(out);

      String jsonText = out.toString();
      System.out.print(jsonText);
   }
}
```

On compiling and executing the above program, the following result is generated −

{"balance": 1000.21, "num":100, "is_vip":true, "name":"foo"}

Decoding JSON in Java

The following example makes use of **JSONObject** and **JSONArray** where JSONObject is a java.util.Map and JSONArray is a java.util.List, so you can access them with standard operations of Map or List.

```
import org.json.simple.JSONObject;
import org.json.simple.JSONArray;
import org.json.simple.parser.ParseException;
import org.json.simple.parser.JSONParser;

class JsonDecodeDemo {

   public static void main(String[] args){

      JSONParser parser = new JSONParser();
      String s = "[0,{\"1\":{\"2\":{\"3\":{\"4\":[5,{\"6\":7}]}}}}]";

      try{
         Object obj = parser.parse(s);
         JSONArray array = (JSONArray)obj;

         System.out.println("The 2nd element of array");
         System.out.println(array.get(1));
         System.out.println();

         JSONObject obj2 = (JSONObject)array.get(1);
         System.out.println("Field \"1\"");
         System.out.println(obj2.get("1"));

         s = "{}";
         obj = parser.parse(s);
         System.out.println(obj);

         s = "[5,]";
         obj = parser.parse(s);
         System.out.println(obj);

         s = "[5,,2]";
         obj = parser.parse(s);
         System.out.println(obj);
      }catch(ParseException pe){

         System.out.println("position: " + pe.getPosition());
         System.out.println(pe);
      }
   }
}
```

On compiling and executing the above program, the following result will be generated −

The 2nd element of array
{"1":{"2":{"3":{"4":[5,{"6":7}]}}}}
Field "1"
{"2":{"3":{"4":[5,{"6":7}]}}}
{}
[5]
[5,2]

FAQ:-

1. Which JSON modules available need to download to run JSON program?
2. Explain Encode JSON in Java .
3. Explain Decode JSON in Java .
4. How to create JSON Object in Java?