SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur-603203.

CS3466 - DATABASE MANAGEMENT SYSTEMS LABORATORY

Lab Manual

Regulation 2023

II Year (IV Semester)

2024-25 (Even Semester)

Prepared by

Mrs.G.Santhiya, Assistant Professor(Sr.G) / IT

Mrs.S.Priya, Assistant Professor(O.G) / IT

INSTRUCTIONS FOR ORACLE COMMANDS, SYNTAXES FOR VIVA VOCE

SQL consists o f a small number of high-level commands that let you query a database, and even build new databases.

- Tables are the basic building blocks of a database.
- Columns define the categories of information in the table
- Rows represent individual records in the table.

- **SQL is provided in two modes.**

  Interactive SQL

  This is mode is used to operate directly on a database that is the response to any SQL command can be seen almost immediately on thesame terminal.

  Embedded SQL

  Embedded SQL consists of SQL commands used within programswritten in some other language like COBAL, PASCAL or C

SQL features

1. It is a unified language.
2. It is common language for relational database
3. It is a non-procedural language.

SQL Language commands

1. Data Definition Language [DDL] – Create, Alter, Drop
2. Data Manipulation Language [DML]– Insert, Update, Delete
3. Transaction Control Language [TCL] – Commit, RollBack, Savepoint

ORACLE DATA TYPES

1. Char(n)
2. varchar2(n)
3. Number(p , s)
4. Date
5. Raw(n)

1) **Char(n)** – It is used for fixed length character data of length 'n' at maximum bytesof 255 -n is used for number of character(s)

2) **Varchar2(n)** - It is used for variable length character data . A max. n (column2000 bytes in length) must be specified.

3) **Number(P,S)** – It is used for variable numeric data with Precision P & Scales S.Eg. Salary Number(10,3)

Here, the number values up to 10 digits wide, three of the digits following the decimalpoint.

4) **Date** - It is used for fixed length date & time data - 1-JAN-4712 BC to 31-DEC-4712 AD

6. **Raw(n)** – Binary data of max. n (max. 255 bytes)

7. **Long** - It is used for variable length character data at a maximum of 2^{31} -1 bytes

<u>Rules for naming a TABLE</u>: All the rules for naming a variable in a high levellanguage will apply to table's name also.

1) Must begin with an alphabet (ie) A-Z or a-z

2) May contain letters, numerals and the special characters, _(underscore). It is advisable to avoid the usage of $ and # symbols).
3) Not case sensitive. The length of the table name may extend up to 30 characters in length. Eg. 1) Dept 2)DEPT 3)dept
4) The table name should be unique
5) Should not be an ORACLE reserved word
6) Blank spaces, commas are not allowed.
7) No two columns in the same table have the same column name.

DATA DEFINITION LANGUAGE (DDL)

DDL consists of three SQL commands.

1. CREATE
2. ALTER
3. DROP

Data Manipulation Language (DML)

The DML consists of four SQL commands.

1) INSERT
2) SELECT
3) UPDATE
4) DELETE

TRANSANCTION CONTROL LANGUAGE(TCL)

- A transaction is not made permanent in ORACLE database unless it is committed or until it executes an ALTER, AUDIT, CREATE, DISCONNECT,DROP, NEXT, GRANT, NO AUDIT, QUIT OR REVOKE.

TCL commands are

1. COMMIT
2. ROLLBACK
3. SAVEPOINT

COMMIT:

- It is not necessary to have any privileges to commit current transaction.
- The COMMIT (save with recent changes) command forces SQL to commit pending table changes to the database.
- It is good practice to commit changes to the database as soon as youfinish a work and at frequent intervals.

Syntax:

SQL>COMMIT WORK;(Press enter key)
SQL>COMMIT; (Press enter key)

ROLLBACK

- To undo work done in the current transactions
- Rolling back means undoing any changes to data that have been performedby SQL statements within an uncommitted transaction.
- To roll back with savepoint_id
  - Rollback the current transaction to the specified savepoint.
  - If omitted, the ROLLBACK statement roll back the entire transaction.
  - Savepoint_id is an valid character string.

Syntax:
SQL>ROLLBACK WORK; (Press enter key)
SQL> ROLLBACK; (Press enter key)
Work is optional

SAVEPOINT:
To identify a point in a transaction to which you can later rollback. Savepoints are often used to divide a long transaction into smaller parts.**Syntax:**
SQL>SAVEPOINT <savepoint_id>; (Press enter key)
Example: SQL>SAVEPOINT R;(Press enter key) Output:
Savepoint created.

PRIVILEGE COMMANDS (Data Control Commands)
Privilege commands are

1) Grant
2) Revoke

Some of the privileges & objects are

Privilege	Object
SELECT	Data in a table in or view
INSERT	Rows into a table or view
UPDATE	Values in a table or view
DELETE	Rows from a table or view
ALTER	Column definitions in a table
INDEX	A column in a table or view

Grant: If one user wants to share another user's table the privilege should be givenfirst
Syntax:
SQL>GRANT <privileges> ON <table name> TO <user name> ; (Press enter key)
Granting Privileges: To grant a user the privilege to select from our table name.
Syntax:
SQL> GRANT SELECT ON DEPT TO GANESH;(Press enter key)
Output Result: Grant succeded
Note: Here, GANESH is another user. The above message grant succeeded tellsyou that the privilege has been granted
Passing privileges
When you grant an access privilege, the user who receives the grant normally doesnot receive authority to pass the privilege onto others.
To give user a authority to pass privileges use the clause with GRANT option. SQL>GRANT SELECT ON DEPT TO GANESH WITH GRANT OPTION;(Press enter key)
Output: Grant Succeeded.

REVOKE: To withdraw a privilege you have granted, use the revoke command.
Syntax:
SQL> REVOKE <privileges> ON <table or view> FROM <users>; (Press enter key)

- When you user revoke, the privileges you specify are revoked from the usersyou name and from any other users to whom they have granted those privileges.

Example
SQL>REVOKE SELECT ON DEPT FROM GANESH; (Press enter key)
Output: Revoke Succeeded.

Cursors

A *cursor* is a variable that runs through the tuples of some relation. This relation canbe a stored table, or it can be the answer to some query. By fetching into the cursoreach tuple of the relation, we can write a program to read and process the value of each such tuple. If the relation is stored, we can also update or delete the tuple at the current cursor position.

syntax

```
CURSOR cursor_name IS select_statement;
```

Procedure

A procedure is created with the CREATE OR REPLACE PROCEDURE statement. The simplified syntax for the CREATE OR REPLACE PROCEDURE statement is asfollows:

```
CREATE [OR REPLACE] PROCEDURE procedure_name
[(parameter_name [IN | OUT | IN OUT] type [, ...])]
{IS | AS}
BEGIN
< procedure_body >
END procedure_name;
```

Where,

- *procedure-name* specifies the name of the procedure.
- [OR REPLACE] option allows modifying an existing procedure.
- The optional parameter list contains name, mode and types of the parameters. IN represents that value will be passed from outside and OUTrepresents that this parameter will be used to return a value outside of the procedure.
- *procedure-body* contains the executable part.
- The AS keyword is used instead of the IS keyword for creating a standalone procedure.

Function

A PL/SQL function is same as a procedure except that it returns a value. Therefore,all the discussions of the previous chapter are true for functions too.
Creating a Function
A standalone function is created using the CREATE FUNCTION statement. The simplified syntax for the CREATE OR REPLACE PROCEDURE statement is asfollows:

```
CREATE [OR REPLACE] FUNCTION function_name
[(parameter_name [IN | OUT | IN OUT] type [, ...])]
RETURN return_datatype
{IS | AS}
BEGIN
< function_body > END
```

[function_name];Where,

- *function-name* specifies the name of the function.
- [OR REPLACE] option allows modifying an existing function.

- The optional parameter list contains name, mode and types of the parameters. IN represents that value will be passed from outside and OUTrepresents that this parameter will be used to return a value outside of the procedure.
- The function must contain a **return** statement.
- *RETURN* clause specifies that data type you are going to return from the function.
- *function-body* contains the executable part.
- The AS keyword is used instead of the IS keyword for creating a standalone function.

Triggers

Triggers are stored programs, which are automatically executed or fired when some events occur. Triggers are,in fact, written to be executed in response to any of the following events:

- A database manipulation (DML) statement (DELETE, INSERT, or UPDATE).

- A database definition (DDL) statement (CREATE, ALTER, or DROP).

- A database operation (SERVERERROR, LOGON, LOGOFF, STARTUP, or SHUTDOWN).

Triggers could be defined on the table, view, schema, or database with which the event is associated.

Benefits of Triggers

Triggers can be written for the following purposes:

- Generating some derived column values automatically
- Enforcing referential integrity
- Event logging and storing information on table access
- Auditing
- Synchronous replication of tables
- Imposing security authorizations
- Preventing invalid transactions

Creating Triggers

The syntax for creating a trigger is:

```
CREATE [OR REPLACE ] TRIGGER trigger_name
{BEFORE | AFTER | INSTEAD OF }
{INSERT [OR] | UPDATE [OR] | DELETE}
[OF col_name]
ON table_name
[REFERENCING OLD AS o NEW AS n]
[FOR EACH ROW]
WHEN (condition)
DECLARE
Declaration-statements
BEGIN
Executable-statements
EXCEPTION
Exception-handling-statements
END;
```

Where,

- CREATE [OR REPLACE] TRIGGER trigger_name: Creates or replaces an existingtrigger with the *trigger_name*.
- {BEFORE | AFTER | INSTEAD OF}: This specifies when the trigger would be executed. The INSTEAD OF clause is used for creating trigger on a view.
- {INSERT [OR] | UPDATE [OR] | DELETE}: This specifies the DML operation.
- [OF col_name]: This specifies the column name that would be updated.
- [ON table_name]: This specifies the name of the table associated with the trigger.
- [REFERENCING OLD AS o NEW AS n]: This allows you to refer new and old valuesfor various DML statements, like INSERT, UPDATE, and DELETE.
- [FOR EACH ROW]: This specifies a row level trigger, i.e., the trigger would be executed for each row being affected. Otherwise the trigger will execute just once whenthe SQL statement is executed, which is called a table level trigger.
- WHEN (condition): This provides a condition for rows for which the trigger would fire.This clause is valid only for row level triggers.

Ex No. 1 **SQL – Structured Query Language**
Date:

Aim: To create database tables and views using Oracle.

Procedure:

1) CREATE: This command helps to create a table
Syntax: SQL> CREATE TABLE <table-name> (Column-element1 datatype, column-element2 datatype….)
Eg. SQL> CREATE TABLE DEPT(deptno number(2), deptname varchar2(5), locchar2(8)); (Press enter key)
If you want to see the structure of the table
SQL> DESCRIBE <table-name> (Press enter key)
SQL>DESC <table-name> (Press enter key)
2) ALTER – used to add a new column or modify the width of an existing column in atable
Syntax: 1) With MODIFY command (MODIFY –oracle reserved word)
SQL> ALTER <table-name> MODIFY (column-definitions) (Press Enter Key)
Example
SQL>ALTER TABLE DEPT MODIFY(DEPTNAME VARCHAR2(20)); (Press enter key)
Syntax: 2) With ADD command (ADD – Oracle Reserved word) is used to add column/s) in a table.
SQL>ALTER TABLE <table-name> ADD(column-definitions); (Press enter key)
Example;
SQL>ALTER TABLE EMP ADD(ADDRESS CHAR(30)); (Press enter key)
-Column to be modified must be empty to decrease precision or scale
3) DROP: To delete the table values with structure
Syntax: SQL> DROP TABLE <tablename>; (press enter key)
Example : SQL>DROP TABLE DEPT;

OUTPUT

```
Oracle SQL*Plus
File  Edit  Search  Options  Help
SQL>  create table emp(empno number(12) primary key, empname varchar2(30),dept varchar2(30), desg va
rchar2(30))
  2  /

Table created.

SQL> desc emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                     NOT NULL NUMBER(12)
 EMPNAME                                            VARCHAR2(30)
 DEPT                                               VARCHAR2(30)
 DESG                                               VARCHAR2(30)

SQL> alter table emp add(phoneno number(30));

Table altered.

SQL> desc emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                     NOT NULL NUMBER(12)
 EMPNAME                                            VARCHAR2(30)
 DEPT                                               VARCHAR2(30)
 DESG                                               VARCHAR2(30)
 PHONENO                                            NUMBER(30)

SQL> alter table emp modify(phoneno number(20));

Table altered.

SQL> desc emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                     NOT NULL NUMBER(12)
 EMPNAME                                            VARCHAR2(30)
 DEPT                                               VARCHAR2(30)
 DESG                                               VARCHAR2(30)
 PHONENO                                            NUMBER(20)

SQL> |
```

Viva Questions:

1. What is a database?
2. What are the different types of databases?
3. What is the difference between a database and a database management system (DBMS)?
4. Define a relational database.
5. What is a schema?
6. What are tables, rows, and columns in a database?

Result:

Thus the above experiment was successfully completed.

Ex No. 2 **Data Manipulation Language (DML)**
Date:

Aim: To perform insert, update, delete and query operations in database tables.

Procedure:

1) INSERT
SQL> INSERT INTO table-name VALUES (a list of data values); (Press enter key)
Example : Method-1
SQL>INSERT INTO EMP VALUES(396,'RAMA',300,5000,200,'6-JUN-59'); (press enter key)
Note: Date and character data-type values should be enclosed in quotes
Example: Method-2
If we want to insert only empno and age the command would be SQL>INSERT INTO EMP(ENAME, AGE) VALUES(396,38); (Press enter key)
Example : Method-3
We can insert into one table by copying rows another table, by using "select" statement.
SQL> INSERT INTO EMP(ENAME,JOB,SAL,COMM) SELECT ENAE, JOB,SAL, COMM FROM EMP WHERE DESIGN ="SALESMAN"; (Press enter key)
Method-4
SQL>INSERT INTO <table-name> values('&empno','&empname', ----------); (press enter key)

QUERY –A query is a request for information.

2) SELECT
Syntax
SQL>SELECT column-name1, column-name2 _____ FROM table-name1, table-name2 _ _ _ ;(Press enter key)
Example
SQL> SELECT EMPNAME, AGE FROM EMP; (Press enter key)

OUTPUT	EMPNAME	AGE
	RAMESH	24
	SURESH	20
	SATISH	30

SQL>SELECT * FROM EMP; (Press enter key)
->displays all rows and columns in the table 'emp"
OUTPUT

EMPNO	EMPNAME	AGE	SALARY
1001	RAMESH	24	10000
1002	SURESH	20	8000
		:	
		:	

CHANGING COLUMN ORDER: The order of column name in a select command determines the order in which the columns are displayed.
Example 1: SQL> SELECT EMPNO,AGE FROM EMP;
Example 2: SQL> SELECT AGE,EMPNO FROM EMP;
SQL> SELECT JOB FROM EMP; (Press Enter key)
Output

JOB
ASSISTANT
SUPDT
ASSISTANT
HELPER
MECHANIC
SUPDT
CLERK

To eliminate duplicate rows in the result, include the distinct clause in the'select' command

SQL>SELECT DISTINCT JOB FROM EMP;(Press enter key)

JOB
ASSISTANT
SUPDT
HELPER
MECHANIC
CLERK

SELECT command with WHERE clause

Syntax:

SELECT columns FROM table-name WHERE logical conditions to be met; (PressEnter key)

Example:

SQL>SELECT ENAME FROM EMP WHERE DEPT='CSG'; (Press enter key)

UPDATE

- To change the value entered in the given table
- SET clause and optional WHERE clause.
- To update one or many rows in a table

Method -1 WHERE clause

Syntax:

SQL>UPDATE tablename SET field = value, field= value, WHERE logical expressions; (Press enter key)

Example

SQL>UPDATE EMP SET AGE=45 WHERE ENAME="RAJA"; (Press enter key)

Method-2 Arithmetic Operations

Example

SQL>UPDATE EMP SET SALARY = SALARY *0.25 + SALARY; (Press enter key)

Method-3 UPDATE with another table

Example

SQL>UPDATE EMP SET SALARY = SALARY* 1.15 WHERE ENAME IN (SELECT ENAME FROM BONUS); (Press enter key)

DELETE

- Used to delete rows from a table
- Contains FROM clause followed by optional WHERE clause
- One or more rows can be deleted at a time. Deletion of single column elementis not possible

Method-1: To delete a particular column with WHERE clause

Syntax:

SQL>DELETE FROM table-name WHERE <logical conditions>; (Press Enter Key)

Example:

SQL>DELETE FROM EMP WHERE CODE=5; (Press enter key)
Method-2: To delete all rows in a table.
Example: SQL> DELETE FROM EMP; (Press Enter Key)

OUTPUT:

```
Oracle SQL*Plus
File  Edit  Search  Options  Help
SQL> INSERT INTO EMP VALUES(5007,'DAVID','MANUFACTURING','WELDER',92328939328);

1 row created.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME              DEPT       DESG                    PHONENO
---------- -------------------- ---------- -------------------- ----------
      5001 ARUN                 PRODUCTION SUPERVISOR           9238203820
      5007 DAVID                MANUFACTUR WELDER               9.2329E+10
                                ING


SQL> INSERT INTO EMP(EMPNO, EMPNAME) VALUES(5010,'BALA');

1 row created.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME              DEPT       DESG                    PHONENO
---------- -------------------- ---------- -------------------- ----------
      5001 ARUN                 PRODUCTION SUPERVISOR           9238203820
      5007 DAVID                MANUFACTUR WELDER               9.2329E+10
                                ING

      5010 BALA

SQL> INSERT INTO EMP VALUES(&EMPNO,&EMPNAME,&DEPT,&DESG,&PHONENO);
Enter value for empno: 5020
Enter value for empname: 'SAMSON'
Enter value for dept: 'DESPATCH'
Enter value for desg: 'PACKER'
Enter value for phoneno: 9337339373
old   1: INSERT INTO EMP VALUES(&EMPNO,&EMPNAME,&DEPT,&DESG,&PHONENO)
new   1: INSERT INTO EMP VALUES(5020,'SAMSON','DESPATCH','PACKER',9337339373)

1 row created.

SQL> |
start   Oracle SQL*Plus   OTHER-SQL-COMMA...   11:20 AM
```

```
SQL> select * from test;

    REGNO NAME                           MARK1      MARK2
---------- ------------------------------ ---------- ----------
     5001 ARUN                                 60         40
     5040 SANKAR                               65         40
     5005 DHILIP                               40         40

SQL> INSERT INTO EMP(EMPNO,EMPNAME) SELECT REGNO, NAME FROM TEST WHERE REGNO=5040;

1 row created.

SQL> SELECT * FROM EMP;

    EMPNO EMPNAME            DEPT       DESG                 PHONENO
---------- -------------------- ---------- -------------------- ----------
     5001 ARUN                PRODUCTION SUPERVISOR          9238203820
     5007 DAVID               MANUFACTUR WELDER              9.2329E+10
                              ING

     5010 BALA
     5020 SAMSON              DESPATCH   PACKER              9337339373
     5040 SANKAR

SQL> |
```

```
SQL> SELECT * FROM EMP;

     EMPNO EMPNAME              DEPT       DESG                   PHONENO
---------- -------------------- ---------- -------------------- ----------
      5001 ARUN                 PRODUCTION SUPERVISOR           9238203820
      5007 DAVID                MANUFACTUR WELDER               9.2329E+10
                                ING

      5010 BALA
      5020 SAMSON               DESPATCH   PACKER               9337339373
      5040 SANKAR

SQL> SELECT EMPNAME,PHONENO FROM EMP;

EMPNAME                 PHONENO
-------------------- ----------
ARUN                 9238203820
DAVID                9.2329E+10
BALA
SAMSON               9337339373
SANKAR

SQL> SELECT DEPT,EMPNAME,PHONENO FROM EMP;

DEPT       EMPNAME                 PHONENO
---------- -------------------- ----------
PRODUCTION ARUN                 9238203820
MANUFACTUR DAVID                9.2329E+10
ING

           BALA
DESPATCH   SAMSON               9337339373
           SANKAR

SQL> UPDATE EMP SET DEPT='DESPATCH' WHERE EMPNAME='SANKAR';

1 row updated.
```

```
SQL> UPDATE EMP SET DEPT='DESPATCH' WHERE EMPNAME='SANKAR';

1 row updated.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME              DEPT       DESG                   PHONENO
---------- -------------------- ---------- -------------------- ----------
      5001 ARUN                 PRODUCTION SUPERVISOR           9238203820
      5007 DAVID                MANUFACTUR WELDER               9.2329E+10
                                ING

      5010 BALA
      5020 SAMSON               DESPATCH   PACKER               9337339373
      5040 SANKAR               DESPATCH

SQL> SELECT DISTINCT DEPT FROM EMP;

DEPT
----------
DESPATCH
MANUFACTUR
ING

PRODUCTION


SQL>
```

Page: 1 of 1 | Words: 0

```
SQL> SELECT * FROM EMP;

     EMPNO EMPNAME               DEPT       DESG                    PHONENO
---------- -------------------- ---------- -------------------- ----------
      5001 ARUN                 PRODUCTION SUPERVISOR           9238203820
      5007 DAVID                MANUFACTUR WELDER               9.2329E+10
                                ING

      5010 BALA
      5020 SAMSON               DESPATCH   PACKER               9337339373
      5040 SANKAR               DESPATCH

SQL> SELECT * FROM TEST;

     REGNO NAME                                MARK1      MARK2
---------- ------------------------------ ---------- ----------
      5001 ARUN                                   60         40
      5040 SANKAR                                 65         40
      5005 DHILIP                                 40         40

SQL> UPDATE EMP SET DESG='SUPERVISOR' WHERE EMPNAME IN (SELECT NAME FROM TEST WHERE MARK1=65);

1 row updated.

SQL> SELECT * FROM EMP
  2  /

     EMPNO EMPNAME               DEPT       DESG                    PHONENO
---------- -------------------- ---------- -------------------- ----------
      5001 ARUN                 PRODUCTION SUPERVISOR           9238203820
      5007 DAVID                MANUFACTUR WELDER               9.2329E+10
                                ING

      5010 BALA
      5020 SAMSON               DESPATCH   PACKER               9337339373
      5040 SANKAR               DESPATCH   SUPERVISOR

SQL> |
```

```
SQL> SELECT * FROM TEST;

     REGNO NAME                                MARK1      MARK2
---------- ------------------------------ ---------- ----------
      5001 ARUN                                   60         40
      5040 SANKAR                                 65         40
      5005 DHILIP                                 40         40

SQL> DELETE FROM TEST WHERE NAME= 'DHILIP';

1 row deleted.

SQL> CREATE TABLE TEST1 AS SELECT * FROM TEST;

Table created.

SQL> SELECT * FROM TEST;

     REGNO NAME                                MARK1      MARK2
---------- ------------------------------ ---------- ----------
      5001 ARUN                                   60         40
      5040 SANKAR                                 65         40

SQL> SELECT * FROM TEST1;

     REGNO NAME                                MARK1      MARK2
---------- ------------------------------ ---------- ----------
      5001 ARUN                                   60         40
      5040 SANKAR                                 65         40

SQL> DELETE FROM TEST1;

2 rows deleted.

SQL> SELECT * FROM TEST1;

no rows selected

SQL>
```

Viva Questions:

1. What is DML in SQL, and why is it important?
2. What are the key DML commands in SQL?
3. How is DML different from DDL (Data Definition Language)?
4. Can DML operations be rolled back? Why?
5. What is the purpose of the INSERT command?

Result:

Thus the above experiment was successfully completed.

Ex No. 3 Data Control Language (DCL) and Transaction Control Language (TCL)

Date:

Aim: To demonstrate DCL and TCL commands

Procedure:

TCL commands

1) Create a table
2) Insert records into the table
3) Using SELECT command check the inserted records
4) Type the command rollback and press enter key
5) Again check the records in the table using SELECT command. Insertedrecords will not be there in the table.
6) Now one record into the table and then place a savepoint using SAVEPOINT command.
7) Now insert two records and then execute a rollback.
8) Check the records in the table using SELECT command. You will have onerecord in the table. Last two records inserted will not be there.
9) Now one record into the table and then execute COMMIT command. 10)Now if you execute roll back no records will be deleted. Because COMMIT command will save all the previous transactions.

DCL commands

1) Let A be a super user and B be a ordinary user.
2) 'A' Log in as super user
3) Using Grand command grant SELECT privilege to user B
4) 'B' Log in as ordinary user and can use Select command to display the records of super user A
5) If B tries to use update command (or any command other than SELECT command) then error message indicating insufficient privileges will be displayed.
6) Superuser A can execute any command on the table of ordinary user.
7) Superuser can revoke the privileges granted to Ordinary user using REVOKE command.

OUTPUT

```
SQL> SELECT * FROM EMP;

     EMPNO EMPNAME         DEPT            DESG               PHONENO
---------- --------------- --------------- --------------- ----------
      5001 ARUN            PRODUCTION      SUPERVISOR      9238203820
      5007 DAVID           MANUFACTURING   WELDER          9.2329E+10
      5010 BALA
      5020 SAMSON          DESPATCH        PACKER          9337339373
      5040 SANKAR          DESPATCH        SUPERVISOR

SQL> INSERT INTO EMP VALUES(5050,'JOKER','BILLING','CLERK',9234234838);

1 row created.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME         DEPT            DESG               PHONENO
---------- --------------- --------------- --------------- ----------
      5001 ARUN            PRODUCTION      SUPERVISOR      9238203820
      5007 DAVID           MANUFACTURING   WELDER          9.2329E+10
      5010 BALA
      5020 SAMSON          DESPATCH        PACKER          9337339373
      5040 SANKAR          DESPATCH        SUPERVISOR
      5050 JOKER           BILLING         CLERK           9234234838

6 rows selected.

SQL> ROLLBACK;

Rollback complete.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME         DEPT            DESG               PHONENO
---------- --------------- --------------- --------------- ----------
      5001 ARUN            PRODUCTION      SUPERVISOR      9238203820
      5007 DAVID           MANUFACTURING   WELDER          9.2329E+10
      5010 BALA
      5020 SAMSON          DESPATCH        PACKER          9337339373
      5040 SANKAR          DESPATCH        SUPERVISOR

SQL>
```

```
Rollback complete.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME         DEPT            DESG               PHONENO
---------- --------------- --------------- --------------- ----------
      5001 ARUN            PRODUCTION      SUPERVISOR      9238203820
      5007 DAVID           MANUFACTURING   WELDER          9.2329E+10
      5010 BALA
      5020 SAMSON          DESPATCH        PACKER          9337339373
      5040 SANKAR          DESPATCH        SUPERVISOR

SQL> INSERT INTO EMP VALUES(5060,'RAM','QUALITY CONTROL','ENGINEER',9483837483);

1 row created.

SQL> SAVEPOINT S1;

Savepoint created.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME         DEPT            DESG               PHONENO
---------- --------------- --------------- --------------- ----------
      5001 ARUN            PRODUCTION      SUPERVISOR      9238203820
      5007 DAVID           MANUFACTURING   WELDER          9.2329E+10
      5010 BALA
      5020 SAMSON          DESPATCH        PACKER          9337339373
      5040 SANKAR          DESPATCH        SUPERVISOR
      5060 RAM             QUALITY CONTROL ENGINEER        9483837483

6 rows selected.

SQL> DELETE FROM EMP WHERE EMPNO=5060;

1 row deleted.
```

```
SQL> SAVEPOINT S2;

Savepoint created.

SQL> DELETE FROM EMP WHERE EMPNO=5060;

1 row deleted.

SQL> ROLLBACK TO S2;

Rollback complete.

SQL> SELECT * FROM EMP;

     EMPNO EMPNAME         DEPT            DESG               PHONENO
---------- --------------- --------------- --------------- ----------
      5001 ARUN            PRODUCTION      SUPERVISOR      9238203820
      5007 DAVID           MANUFACTURING   WELDER          9.2329E+10
      5010 BALA
      5020 SAMSON          DESPATCH        PACKER          9337339373
      5040 SANKAR          DESPATCH        SUPERVISOR
      5060 RAM             QUALITY CONTROL ENGINEER        9483837483

6 rows selected.

SQL>
```

```
SQL> SHOW USER
USER is "PRINCE"
SQL> CONNECT LEO/LEO@DBSERVER
Connected.
SQL> SELECT * FROM PRINCE.STUDENT;
SELECT * FROM PRINCE.STUDENT
                      *
ERROR at line 1:
ORA-00942: table or view does not exist


SQL> CONNECT PRINCE/JAMES@DBSERVER;
Connected.
SQL> GRANT SELECT ON STUDENT TO LEO;

Grant succeeded.

SQL> CONNECT LEO/LEO@DBSERVER;
Connected.
SQL> SELECT * FROM PRINCE.STUDENT;

     REGNO NAME                           DEPT                     M1         M2
---------- ------------------------------ --------------- ---------- ----------
        M3         M4         M5      TOTAL    AVERAGE RESU G       RANK
---------- ---------- ---------- ---------- ---------- ---- - ----------
4.2209E+10 Annie                          MCA                      65         76
        80         68         67        356       71.2                 2

4.2209E+10 Prince                         MCA


4.2209E+10 Divya S                        MCA                      61         77
        66         79         68        351       70.2                 3


     REGNO NAME                           DEPT                     M1         M2
---------- ------------------------------ --------------- ---------- ----------
        M3         M4         M5      TOTAL    AVERAGE RESU G       RANK
---------- ---------- ---------- ---------- ---------- ---- - ----------
4.2209E+10 Elayaraja T                    MCA                      51         63
        60         71         53        298       59.6                 7

4.2209E+10 Ezhilarasan D                  MCA                      61         72
        65         74         59        331       66.2                 5

4.2209E+10 Shanmuga Priya                 IT



12 rows selected.

SQL> UPDATE PRINCE.STUDENT SET NAME='Divya S';
UPDATE PRINCE.STUDENT SET NAME='Divya S'
              *
ERROR at line 1:
ORA-01031: insufficient privileges


SQL> |
```

Viva Questions:

1. What is Data Control Language (DCL) in SQL?
2. Explain the GRANT command. How is it used to assign permissions?
3. What types of permissions can be granted using the GRANT command (e.g., SELECT, INSERT)?
4. What is the REVOKE command, and how does it differ from GRANT?
5. If a user has multiple roles with conflicting permissions, which permissions take precedence?

Result:

Thus the above experiment was successfully completed.

Ex. No. 4 **JOINS AND NESTED QUERIES**
Date:
Aim: To demonstrate Joins and Nested Queries

Procedure
In nested queries, a query is written inside a query. The result of inner query is usedin execution of outer query. We will use STUDENT, COURSE, STUDENT_COURSEtables for understanding nested queries.

STUDENT

S_ID	S_NAME	S_ADDRESS	S_PHONE	S_AGE
S1	RAM	DELHI	9455123451	18
S2	RAMESH	GURGAON	9652431543	18
S3	SUJIT	ROHTAK	9156253131	20
S4	SURESH	DELHI	9156768971	18

COURSE

C_ID	C_NAME
C1	DSA
C2	Programming
C3	DBMS

STUDENT_COURSE

S_ID	C_ID
S1	C1
S1	C3
S2	C1
S3	C2
S4	C2
S4	C3

There are mainly two types of nested queries:

Independent Nested Queries: In independent nested queries, query execution starts from innermost query to outermost queries. The execution of inner query is independent of outer query, but the result of inner query is used in execution of outer query. Various operators like IN, NOT IN, ANY, ALL etc are used in writing independent nested queries.

IN: If we want to find out S_ID who are enrolled in C_NAME ‘DSA’ or ‘DBMS’, we can write it with the help of independent nested query and IN operator. From COURSE table, we can find out C_ID for C_NAME ‘DSA’ or DBMS’ and we can use these C_IDs for finding S_IDs from STUDENT_COURSE TABLE.

STEP 1: Finding C_ID for C_NAME =’DSA’ or ‘DBMS’

Select C_ID from COURSE where C_NAME = ‘DSA’ or C_NAME = ‘DBMS’

STEP 2: Using C_ID of step 1 for finding S_ID

Select S_ID from STUDENT_COURSE where C_ID IN

(SELECT C_ID from COURSE where C_NAME = ‘DSA’ or C_NAME=’DBMS’);

The inner query will return a set with members C1 and C3 and outer query will return those S_IDs for which C_ID is equal to any member of set (C1 and C3 in this case). So, it will return S1, S2 and S4.

Note: If we want to find out names of STUDENTs who have either enrolled in ‘DSA’ or ‘DBMS’, it can be done as:

Select S_NAME from STUDENT where S_ID IN

(Select S_ID from STUDENT_COURSE where C_ID IN

(SELECT C_ID from COURSE where C_NAME=’DSA’ or C_NAME=’DBMS’));

NOT IN: If we want to find out S_IDs of STUDENTs who have neither enrolled in ‘DSA’ nor in ‘DBMS’, it can be done as:

Select S_ID from STUDENT where S_ID NOT IN

(Select S_ID from STUDENT_COURSE where C_ID IN

(SELECT C_ID from COURSE where C_NAME=’DSA’ or C_NAME=’DBMS’));

The innermost query will return a set with members C1 and C3. Second inner query will return those S_IDs for which C_ID is equal to any member of set (C1 and C3 in this case) which are S1, S2 and S4. The outermost query will return those S_IDs where S_ID is not a member of set (S1, S2 and S4). So it will return S3.

Co-related Nested Queries: In co-related nested queries, the output of inner query depends on the row which is being currently executed in outer query. e.g.; If we want to find out S_NAME of STUDENTs who are enrolled in C_ID ‘C1’, it can be done with the help of co-related nested query as:
Select S_NAME from STUDENT S where EXISTS

(select * from STUDENT_COURSE SC where S.S_ID=SC.S_ID and SC.C_ID=’C1’);

For each row of STUDENT S, it will find the rows from STUDENT_COURSE where S.S_ID = SC.S_ID and SC.C_ID=’C1’. If for a S_ID from STUDENT S, atleast a row exists in STUDENT_COURSE SC with C_ID=’C1’, then inner query will return true and corresponding S_ID will be returned as output.

JOIN OPERATIONS
A SQL Join statement is used to combine data or rows from two or more tables based on a common field between them. Different types of Joins are:

INNER JOIN
LEFT JOIN
RIGHT JOIN
FULL JOIN
Consider the two tables below:

Student

ROLL_NO	NAME	ADDRESS	PHONE	Age
1	HARSH	DELHI	XXXXXXXXXX	18
2	PRATIK	BIHAR	XXXXXXXXXX	19
3	RIYANKA	SILIGURI	XXXXXXXXXX	20
4	DEEP	RAMNAGAR	XXXXXXXXXX	18
5	SAPTARHI	KOLKATA	XXXXXXXXXX	19
6	DHANRAJ	BARABAJAR	XXXXXXXXXX	20
7	ROHIT	BALURGHAT	XXXXXXXXXX	18
8	NIRAJ	ALIPUR	XXXXXXXXXX	19

StudentCourse

COURSE_ID	ROLL_NO
1	1
2	2
2	3
3	4
1	5
4	9
5	10
4	11

The simplest Join is INNER JOIN.

INNER JOIN: The INNER JOIN keyword selects all rows from both the tables as long as the condition satisfies. This keyword will create the result-set by combining all rows from both the tables where the condition satisfies i.e value of the common field will be same.
Syntax:
SELECT table1.column1,table1.column2,table2.column1,....
FROM table1
INNER JOIN table2
ON table1.matching_column = table2.matching_column;

table1: First table.
table2: Second table
matching_column: Column common to both the tables.
Note: We can also write JOIN instead of INNER JOIN. JOIN is same as INNER JOIN.

Example Queries(INNER JOIN)

This query will show the names and age of students enrolled in different courses.
SELECT StudentCourse.COURSE_ID, Student.NAME, Student.AGE FROM Student
INNER JOIN StudentCourse
ON Student.ROLL_NO = StudentCourse.ROLL_NO;
Output:

COURSE_ID	NAME	Age
1	HARSH	18
2	PRATIK	19
2	RIYANKA	20
3	DEEP	18
1	SAPTARHI	19

LEFT JOIN: This join returns all the rows of the table on the left side of the join and matching rows for the table on the right side of join. The rows for which there is no matching row on right side, the result-set will contain null. LEFT JOIN is also known as LEFT OUTER JOIN.

Syntax:

```
SELECT table1.column1,table1.column2,table2.column1,....
FROM table1
LEFT JOIN table2
ON table1.matching_column = table2.matching_column;
```

table1: First table.
table2: Second table
matching_column: Column common to both the tables.
Note: We can also use LEFT OUTER JOIN instead of LEFT JOIN, both are same.

Example Queries(LEFT JOIN):

```
SELECT Student.NAME,StudentCourse.COURSE_ID
FROM Student
LEFT JOIN StudentCourse
ON StudentCourse.ROLL_NO = Student.ROLL_NO;
```

Output:

NAME	COURSE_ID
HARSH	1
PRATIK	2
RIYANKA	2
DEEP	3
SAPTARHI	1
DHANRAJ	*NULL*
ROHIT	*NULL*
NIRAJ	*NULL*

RIGHT JOIN: RIGHT JOIN is similar to LEFT JOIN. This join returns all the rows of the table on the right side of the join and matching rows for the table on the left side of join. The rows for which there is no matching row on left side, the result-set will contain null. RIGHT JOIN is also known as RIGHT OUTER JOIN.

Syntax:

```
SELECT table1.column1,table1.column2,table2.column1,....
FROM table1
RIGHT JOIN table2
ON table1.matching_column = table2.matching_column;
```

table1: First table.
table2: Second table
matching_column: Column common to both the tables**.**

<u>Viva Questions:</u>

1. **What are JOINS in SQL, and why are they used?**
2. **Name and explain the different types of JOINS in SQL (e.g., INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL OUTER JOIN).**
3. **How does INNER JOIN differ from OUTER JOIN? Provide an example query for both.**
4. **What is a SELF JOIN, and when would you use it? Provide a real-world example.**
5. **Can you perform a JOIN across multiple tables? How would you write a query for this?**

Result : Thus the above experiment was successfully completed.

Ex. No. 5 **High level language extensions – PL/SQL**
Date:

Aim: To write simple program using PL/SQL

Procedure:

```
CREATE TABLE T1(

        e INTEGER,f
        INTEGER
);

DELETE FROM T1;
INSERT INTO T1 VALUES(1, 3);
INSERT INTO T1 VALUES(2, 4);

/* Above is plain SQL; below is the PL/SQL program. */DECLARE
        a  NUMBER;
        b  NUMBE
R;
BEGIN
        SELECT e,f INTO a,b FROM T1 WHERE e>1;INSERT
        INTO T1 VALUES(b,a);
END;
.
run;
```

Fortuitously, there is only one tuple of T1that has first component greater than 1, namely (2,4). The INSERTstatement thus inserts (4,2) into T1.

OUTPUT:

```
SQL> CREATE TABLE T1(
  2       e NUMBER(3),
  3       f NUMBER(3));

Table created.

SQL> DELETE FROM T1;

0 rows deleted.

SQL> INSERT INTO T1 VALUES(1, 3);

1 row created.

SQL> INSERT INTO T1 VALUES(2, 4);

1 row created.

SQL> ED
Wrote file afiedt.buf

  1* INSERT INTO T1 VALUES(2, 4)
SQL> ED;
Wrote file afiedt.buf

  1  DECLARE
  2       a NUMBER;
  3       b NUMBER;
  4  BEGIN
  5       SELECT e,f INTO a,b FROM T1 WHERE e>1;
  6       INSERT INTO T1 VALUES(b,a);
  7* END;
SQL> /

PL/SQL procedure successfully completed.

SQL> |
```

```
SQL> ED;
Wrote file afiedt.buf

  1  DECLARE
  2      a NUMBER;
  3      b NUMBER;
  4  BEGIN
  5      SELECT e,f INTO a,b FROM T1 WHERE e>1;
  6      INSERT INTO T1 VALUES(b,a);
  7* END;
SQL> SELECT * FROM T1;

         E          F
---------- ----------
         1          3
         2          4
         4          2

SQL> |
```

EXECUTING COMMANDS STORED IN FILE

```
SQL> INSERT INTO T1 VALUES(1,3);

1 row created.

SQL>  INSERT INTO T1 VALUES(2,4);

1 row created.

SQL> @TEST.SQL
  1  DECLARE
  2  a NUMBER;
  3  b NUMBER;
  4  BEGIN
  5  SELECT e,f INTO a,b FROM T1 WHERE e>1;
  6  INSERT INTO T1 VALUES(b,a);
  7* END;

PL/SQL procedure successfully completed.

SQL> SELECT * FROM T1;

         E          F
---------- ----------
         1          3
         2          4
         4          2

SQL>
```

Viva Questions

1. What is PL/SQL, and how does it differ from standard SQL?
2. What are the main advantages of using PL/SQL in database programming?
3. Describe the structure of a PL/SQL block. What are the main sections, and which are optional?
4. What are PL/SQL control structures? Name and explain the types of control structures available in PL/SQL.
5. How does PL/SQL handle date and time values? Name some commonly used date and time functions in PL/SQL and their purposes.

RESULT:

Thus the above experiment was successfully completed.

Ex No. 6 Write a PL/SQL block to satisfy some conditions by accepting input from the user.
Date:

Aim: To Write a PL/SQL block to satisfy some conditions by accepting input from the user

Syntax of taking input from the user:
<variablename>:=:<variablename>;

Just by writing only this statement we will able to take input from user.

Example:

First write the given code in your SQL command prompt

```
        declare
        i  integer;
        j  integer;
        s  integer;
        begin
        i:=:i; ------- observe this statement. This statement will tell the machine to take input of i
        through user.
        j:=:j; ------- observe this statement. This statement will tell the machine to take input of j
        through user.
        s:=i+j;
        dbms_output.put_line('sum of '||i||' and '||j||' is '||s);
end;
```

Ex No. 7 Write a PL/SQL block that handles all types of exceptions.
Date:

<u>Aim:</u> To a PL/SQL block that handles all types of exceptions
Syntax for Exception Handling

The general syntax for exception handling is as follows. Here you can list down as many exceptions as you can handle. The default exception will be handled using *WHEN others THEN* –

```
DECLARE
   <declarations section>
BEGIN
   <executable command(s)>
EXCEPTION
   <exception handling goes here >
   WHEN exception1 THEN
      exception1-handling-statements
   WHEN exception2  THEN
      exception2-handling-statements
   WHEN exception3 THEN
      exception3-handling-statements
   ........
   WHEN others THEN
      exception3-handling-statements
END;
```

Example

Let us write a code to illustrate the concept. We will be using the CUSTOMERS table we had createdand used in the previous chapters –

PL SQL CODE CODE:

```
DECLARE
   c_id customers.id%type := 8;
   c_name customerS.Name%type;
   c_addr customers.address%type;
BEGIN
   SELECT name, address INTO c_name, c_addr
   FROM customers
   WHERE id = c_id;
   DBMS_OUTPUT.PUT_LINE ('Name: '|| c_name);
   DBMS_OUTPUT.PUT_LINE ('Address: ' || c_addr);

EXCEPTION
   WHEN no_data_found THEN
      dbms_output.put_line('No such customer!');
   WHEN others THEN
      dbms_output.put_line('Error!');
END;
/
```

When the above code is executed at the SQL prompt, it produces the following result –

No such customer!

PL/SQL procedure successfully completed.

The above program displays the name and address of a customer whose ID is given. Since there is no customer with ID value 8 in our database, the program raises the run-time exception **NO_DATA_FOUND**, which is captured in the **EXCEPTION block**.

Raising Exceptions

Exceptions are raised by the database server automatically whenever there is any internal database error, but exceptions can be raised explicitly by the programmer by using the command RAISE. Following is the simple syntax for raising an exception −

```
DECLARE
   exception_name EXCEPTION;
BEGIN
   IF condition THEN
      RAISE exception_name;
   END IF;
EXCEPTION
   WHEN exception_name THEN
   statement;
END;
```

You can use the above syntax in raising the Oracle standard exception or any user-defined exception. In the next section, we will give you an example on raising a user-defined exception. You can raise the Oracle standard exceptions in a similar way.

User-defined Exceptions

PL/SQL allows you to define your own exceptions according to the need of your program. A user-defined exception must be declared and then raised explicitly, using either a RAISE statement or the procedure **DBMS_STANDARD.RAISE_APPLICATION_ERROR**.

The syntax for declaring an exception is −

DECLARE

my-exception EXCEPTION;

Example

The following example illustrates the concept. This program asks for a customer ID, when the user enters an invalid ID, the exception **invalid_id** is raised.

```
DECLARE
   c_id customers.id%type := &cc_id;
   c_name customerS.Name%type;
   c_addr customers.address%type;
   -- user defined exception
   ex_invalid_id EXCEPTION;
BEGIN
```

```
   IF c_id <= 0 THEN
      RAISE ex_invalid_id;
   ELSE
      SELECT name, address INTO c_name, c_addr
      FROM customers
      WHERE id = c_id;
      DBMS_OUTPUT.PUT_LINE ('Name: '|| c_name);
      DBMS_OUTPUT.PUT_LINE ('Address: ' || c_addr);
   END IF;

EXCEPTION
   WHEN ex_invalid_id THEN
      dbms_output.put_line('ID must be greater than zero!');
   WHEN no_data_found THEN
      dbms_output.put_line('No such customer!');
   WHEN others THEN
      dbms_output.put_line('Error!');
END;
/
```

When the above code is executed at the SQL prompt, it produces the following result −

Enter value for cc_id: -6 (let's enter a value -6)

old 2: c_id customers.id%type := &cc_id;

new 2: c_id customers.id%type := -6;

ID must be greater than zero!

PL/SQL procedure successfully completed.

Pre-defined Exceptions

PL/SQL provides many pre-defined exceptions, which are executed when any database rule is violated by a program. For example, the predefined exception NO_DATA_FOUND is raised when a SELECT INTO statement returns no rows. The following table lists few of the important pre-definedexceptions −

Exception	Oracle Error	SQLCODE	Description
ACCESS_INTO_NULL	06530	-6530	It is raised when a null object is automatically assigned a value.
CASE_NOT_FOUND	06592	-6592	It is raised when none of the choices inthe WHEN clause of a CASE statement is selected, and there is no ELSE clause.
COLLECTION_IS_NULL	06531	-6531	It is raised when a program attempts to apply collection methods other than EXISTS to an uninitialized nested table or varray, or the program attempts to

			assign values to the elements of an uninitialized nested table or varray.
DUP_VAL_ON_INDEX	00001	-1	It is raised when duplicate values are attempted to be stored in a column with unique index.
INVALID_CURSOR	01001	-1001	It is raised when attempts are made to make a cursor operation that is not allowed, such as closing an unopened cursor.
INVALID_NUMBER	01722	-1722	It is raised when the conversion of a character string into a number fails because the string does not representa valid number.
LOGIN_DENIED	01017	-1017	It is raised when a program attempts tolog on to the database with an invalid username or password.
NO_DATA_FOUND	01403	+100	It is raised when a SELECT INTO statement returns no rows.
NOT_LOGGED_ON	01012	-1012	It is raised when a database call is issued without being connected to thedatabase.
PROGRAM_ERROR	06501	-6501	It is raised when PL/SQL has an internal problem.
ROWTYPE_MISMATCH	06504	-6504	It is raised when a cursor fetches valuein a variable having incompatible data type.
SELF_IS_NULL	30625	-30625	It is raised when a member method is invoked, but the instance of the objecttype was not initialized.
STORAGE_ERROR	06500	-6500	It is raised when PL/SQL ran out of memory or memory was corrupted.
TOO_MANY_ROWS	01422	-1422	It is raised when a SELECT INTO statement returns more than one row.
VALUE_ERROR	06502	-6502	It is raised when an arithmetic, conversion, truncation, or sizeconstraint error occurs.
ZERO_DIVIDE	01476	1476	It is raised when an attempt is made to divide a number by zero.

Viva Questions

1. How do you accept user input in a PL/SQL block? What techniques or tools are commonly used for this?
2. What is the difference between using DECLARE variables in PL/SQL and using INPUT directly within SQL statements?
3. Explain how you can handle conditional logic in PL/SQL using IF...ELSE or CASE statements.
4. What happens if a user inputs invalid data? How do you handle exceptions in a PL/SQL block to prevent program crashes?
5. Write or explain a PL/SQL block where the user inputs their age, and based on the age, it outputs whether they are a minor (below 18), an adult (18–60), or a senior citizen (above 60).

Result:

Thus the above program is executed Successfully.

Ex. No. 8 **Use of Cursors, Procedures and Functions**
Date:

Aim: To demonstrate the use of Cursors, Procedures and Functions

Procedure:

Cursor

1. Declare temporary variables to store the fields of the records.
2. Declare the cursor
3. Open the cursor
4. Start a Loop
5. Fetch the field values of record in the cursor to variables
6. Do the required processing.
7. Update the processed record.
8. Repeat the loop until end of the file is reached
9. Stop

Procedures

Procedure to find smallest of two numbers

1. Declare the required number of variables
2. Create a procedure for finding minimum of two numbers
3. From the main program call the procedure with required parameters.
4. Display the output.

Program Using Cursor

```
DECLARE
   c_regno       test.regno%type;
   c_name        test.name%type;
   c_mark1      test.mark1%type;
   c_mark2   test.mark2%type;  i
   number(2);
   /*type  avg  IS  VARRAY(10)  OF  number(6,2);  */
    c_avg number(6,2);
 cursor c_stud is select regno,name,mark1,mark2,avg from test;BEGIN
    OPEN c_stud;
   -- i:=1;
    LOOP
      FETCH c_stud into c_regno,c_name,c_mark1, c_mark2,c_avg;c_avg :=
      (c_mark1 + c_mark2)/2;
      UPDATE test SET avg=c_avg WHERE regno=c_regno;
      EXIT WHEN c_stud%notfound;
    END LOOP;
    CLOSE c_stud;
END;
```

Program Using Procedure

```
DECLARE
        a number;b
        number;   c
        number;
PROCEDURE findMin(x IN number, y IN number, z OUT number) IS
BEGIN
     IF x < y THEN
        z:= x;
     ELSE
        z:= y;
     END IF;
END;

BEGIN
     a:= 23;
     b:= 45;
    findMin(a, b, c);
    dbms_output.put_line(' Minimum of (23, 45) : ' || c);
END;
/
```

OUTPUT:

```
SQL> ed;
Wrote file afiedt.buf

  1  DECLARE
  2    c_regno test.regno%type;
  3    c_name  test.name%type;
  4    c_mark1 test.mark1%type;
  5    c_mark2 test.mark2%type;
  6    i number(2);
  7    /*type avg IS VARRAY(10) OF number(6,2); */
  8     c_avg number(6,2);
  9  cursor c_stud is select regno,name,mark1,mark2,avg from test;
 10  BEGIN
 11     OPEN c_stud;
 12    -- i:=1;
 13     LOOP
 14       FETCH c_stud into c_regno,c_name,c_mark1, c_mark2,c_avg;
 15       c_avg := (c_mark1 + c_mark2)/2;
 16       UPDATE test SET avg=c_avg WHERE regno=c_regno;
 17       EXIT WHEN c_stud%notfound;
 18     END LOOP;
 19     CLOSE c_stud;
 20* END;
SQL> /

PL/SQL procedure successfully completed.

SQL> select * from test;

     REGNO NAME                                 MARK1      MARK2        AVG
---------- ------------------------------ ---------- ---------- ----------
      5001 ARUN                                   60         40         50
      5040 SANKAR                                 65         40       52.5

SQL>
```

PROCEDURE

```
SQL>
  1  BEGIN
  2    dbms_output.enable;
  3    dbms_output.put_line('This is to test');
  4* END;

PL/SQL procedure successfully completed.

SQL> set serveroutput on;
SQL> @ testing.sql;
This is to test
This is to test
This is to test

PL/SQL procedure successfully completed.

SQL>
```

PROCEDURE

proc.sql - Notepad

File Edit Format View Help

```
DECLARE
a number;
b number;
c number;
PROCEDURE findMin(x IN number, y IN number, z OUT number) IS
BEGIN
IF x < y THEN
z:= x;
ELSE
z:= y;
END IF;
END;

BEGIN
a:= 23;
b:= 45;
      findMin(a, b, c);
      dbms_output.put_line(' Minimum of (23, 45) : ' || c);
END;
/
```

```
SQL> set serveroutput on
SQL> @ proc.sql;
Minimum of (23, 45) : 23

PL/SQL procedure successfully completed.
```

FUNCTIONS

```
SQL> ed func.sql;

SQL> CREATE OR REPLACE FUNCTION totalstudents
  2  RETURN number IS
  3   total number(2) := 0;
  4  BEGIN
  5   SELECT count(*) into total FROM test;
  6   RETURN total;
  7  END;
  8  /

Function created.

SQL> @ func.sql;

PL/SQL procedure successfully completed.

SQL> set serveroutput on
SQL> @ func.sql;
Total no. of students: 2

PL/SQL procedure successfully completed.

SQL>
```

Viva Questions:

1. What is a cursor in PL/SQL, and why is it used?
2. Differentiate between explicit cursors and implicit cursors in PL/SQL. Provide examples.
3. What are the steps involved in working with an explicit cursor? *(Hint: Declare, Open, Fetch, Close.)*
4. What is the purpose of the %ROWTYPE attribute in relation to cursors?
5. How do you use a cursor to fetch multiple rows from a table in PL/SQL? Can it handle complex queries?

Result:

Thus the above program is executed successfully.

Ex. No. 9 . Oracle or SQL Server Triggers – Block Level – Form Level Triggers

Date:

Aim: To demonstrate the use of Triggers

Procedure:

1. Create a table named emp with fields for empno, name, department, designation and salary.
2. Create a trigger using CREATE OR REPLACE TRIGGER command.
3. In the trigger write code in such a way that when a new record is inserted orupdated or deleted the trigger shoots up and do the following
4. Find difference between existing salary and new salary
5. Display the Old Salary, New Salary and the Difference between old and new Salaries.
6. Insert a record into the table emp and test whether trigger is executed.

PROGRAM

```
CREATE OR REPLACE TRIGGER display_salary_changes
BEFORE DELETE OR INSERT OR UPDATE ON customersFOR
EACH ROW
WHEN (NEW.ID > 0)
DECLARE
sal_diff number;
BEGIN
sal_diff := :NEW.salary - :OLD.salary;
dbms_output.put_line('Old salary: ' || :OLD.salary);
dbms_output.put_line('New salary: ' || :NEW.salary);
dbms_output.put_line('Salary difference: ' || sal_diff);
END;
/
```

OUTPUT:

```
SQL> ALTER TABLE EMP ADD(SALARY NUMBER(10,2));

Table altered.

SQL> ED;
Wrote file afiedt.buf

  1  CREATE OR REPLACE TRIGGER display_salary_changes BEFORE DELETE OR INSERT OR UPDATE
  2  ON emp
  3  FOR EACH ROW WHEN (NEW.EMPNO > 0)
  4  DECLARE sal_diff number;
  5  BEGIN
  6    sal_diff := :NEW.salary - :OLD.salary;   dbms_output.put_line('Old salary: ' || :OLD.salary);
  7    dbms_output.put_line('New salary: ' || :NEW.salary);
  8    dbms_output.put_line('Salary difference: ' || sal_diff);
  9* END;
SQL> /

Trigger created.

SQL> INSERT INTO EMP VALUES(5055,'KUMAR','MAINTENANCE
  2  ','SUPERVISOR',8389233344,6000);
Old salary:
New salary: 6000
Salary difference:

1 row created.

SQL> |
```

Viva Questions

1. What is a trigger in SQL? How does it differ from a stored procedure?
2. What are the main components of a trigger (e.g., event, condition, action)?
3. What are the types of triggers supported by Oracle or SQL Server?
4. Explain the difference between row-level triggers and statement-level (block-level) triggers.
5. What are form-level triggers, and where are they used

Result:

Thus the above program is executed Sucessfully.

Ex. No. 10 **Embedded SQL or Database Connectivity**

Date:

Aim: To demonstrate embedded SQL or Database connectivity

Procedure:

1. Develop database tables in oracle
2. Design the required screen in Visual Basic with all the required tools and objects(text boxes, labels, combo box, option box)
3. Write the coding for connecting the oracle database table with the visual basic application.
4. Run the application.
5. Verify the database connectivity by adding, deleting and viewing records through Visual Basic application.

Program:

```
Dim cnn1 As
ADODB.ConnectionDim rs As
ADODB.Recordset Dim strcnn
As String

Private Sub
ADD_Click()With rs
    .Fields("empname") = nametxt.Text
    .Fields("dob") = DTPicker1.Value
    .Fields("gender") = maleopt.Value
    .Fields("designation") = desgtxt.Value
    .Fields("dept") = deptcbo.Value
    .Fields("addr") = addrtxt.Text
    .Fields("basic") = basictxt.Text
    .Update
End With
   rs.AddNe

wEnd Sub



Private Sub
   cancelcmd_Click()
   rs.CancelBatch
   cnn1.CommitTrans
End Sub

Private Sub
  clrcmd_Click()
  nametxt.Text = ""
  DTPicker1.Value = ""
  maleopt.Value = False
  desgtxt.Value = ""
  deptcbo.Value = ""
  addrtxt.Text = ""
  basictxt.Text = ""
```

```
End Sub

Private Sub
   delcmd_Click()
   cnn1.BeginTrans
   rs.Delete rs.UpdateBatch
   cnn1.CommitTrans
    MsgBox ("Record
 Deleted")End Sub

Private Sub
  endcmd_Click()End
End Sub

Private Sub
 firstcmd_Click()On Error
 GoTo l1:
     rs.Open "Select * from emp1", cnn1, adOpenKeyset,
adLockBatchOptimisticl1:      rs.MoveFirst
     transfer


End Sub

Private Sub Form_Load()
  Form2.WindowState = 2

  Set cnn1 = New
  ADODB.ConnectionSet rs = New
  ADODB.Recordset
  rs.CursorLocation = adUseClient
  'strcnn = "User ID =leo; Password=leo; Data Source = dbserver; Persist Security Info =False"
strcnn = "Provider=MSDAORA.1;User ID=leo;Password=leo;Data Source=dbserver;Persist
Security Info=False"
  'strcnn = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=Z:\emp.mdb;Persist Security
  Info=False"cnn1.Open strcnn

End Sub


Private Sub
lastcmd_Click()On Error
GoTo l5:
     rs.Open "Select * from emp1", cnn1, adOpenKeyset,
adLockBatchOptimisticl5:      rs.MoveLast
     transfer

End Sub

Private Sub
 modcmd_Click()On Error
 GoTo l3:
     rs.Open "Select * from emp1", cnn1, adOpenKeyset,
adLockBatchOptimisticl3:  cnn1.BeginTrans


End Sub
```

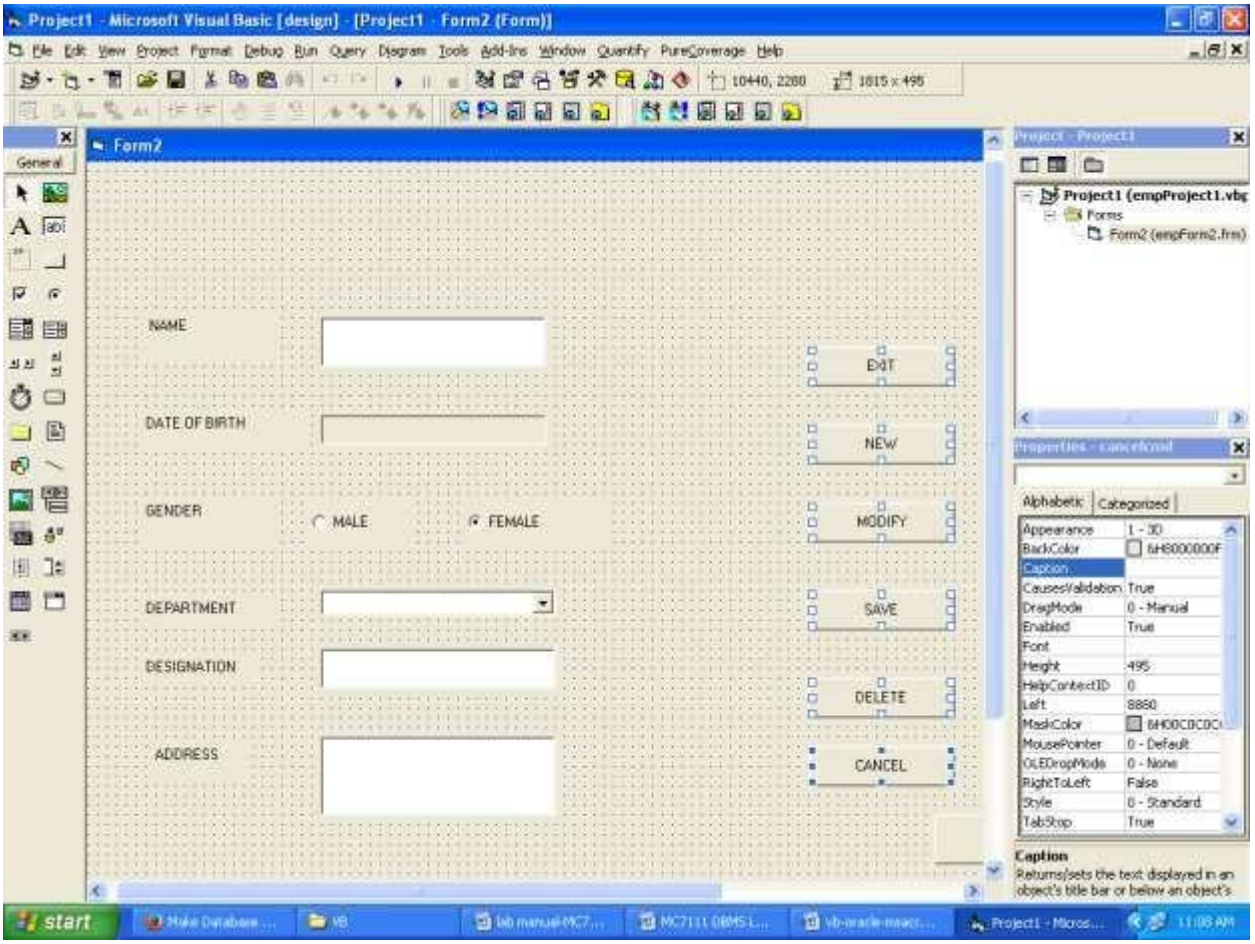
```
Private Sub newcmd_Click()
```

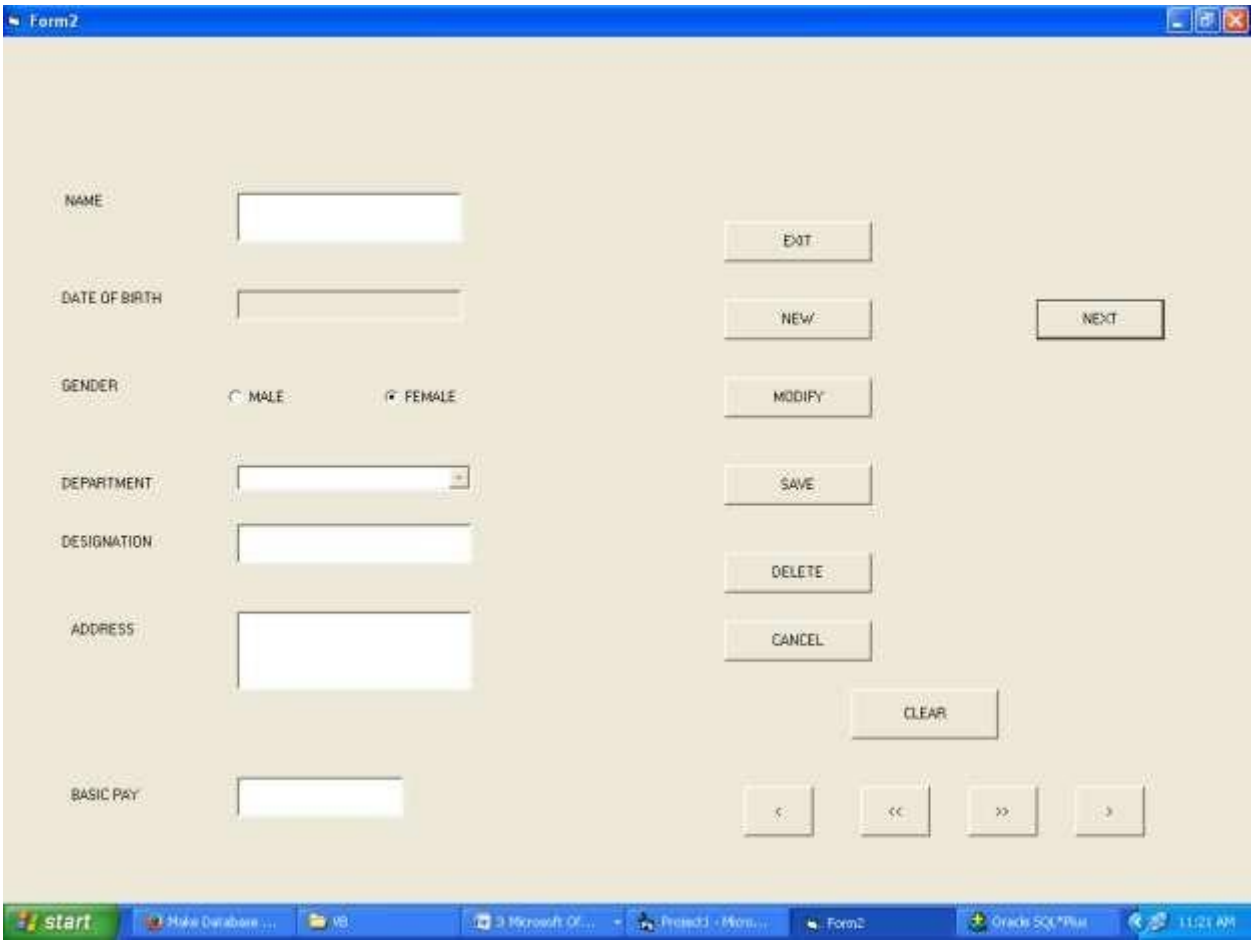
```
On Error GoTo l6:
   rs.Open "Select * from emp1", cnn1, adOpenKeyset, adLockBatchOptimistic

l6: cnn1.BeginTrans
   rs.AddNew

End Sub

Private Sub
 nextcmd_Click()On Error
 GoTo l2:
    rs.Open "Select * from emp1", cnn1, adOpenKeyset,
adLockBatchOptimisticl2:      rs.MoveNext
    transfer
End Sub




Private Sub
prevcmd_Click()On Error
GoTo l4:
    rs.Open "Select * from emp1", cnn1, adOpenKeyset,
adLockBatchOptimisticl4:      rs.MovePrevious
    transfer

End Sub

Private Sub
savecmd_Click()With rs
    .Fields("empname") = nametxt.Text
    .Fields("dob") =
    DTPicker1.ValueIf
    maleopt.Value = True Then
    .Fields("gender") =
    "Male"Else
      .Fields("gender") =
    "Female"End If
        .Fields("designation") = desgtxt.Text
    .Fields("dept") = deptcbo.Text
    .Fields("addr") = addrtxt.Text
    .Fields("basic") = basictxt.Text
    .UpdateBatch
End With
cnn1.CommitTrans
 MsgBox ("Record is saved

successfully")End Sub




Public Sub transfer()
  With rs
   If .EOF = False Then
    nametxt.Text = .Fields("empname")
     DTPicker1.Value = .Fields("dob")
```

```
    If .Fields("gender") <> 0
      Thenmaleopt.Value = True
    Else
      femaleopt.Value = True
    End If
    desgtxt.Text =
    .Fields("designation")deptcbo.Text
    = .Fields("dept") addrtxt.Text =
    .Fields("addr") basictxt.Text
    .Fields("basic")
  End If
End With

End Sub
```

Output

```
  1* create table emp1(empname varchar2(25),dob varchar2(10),gender varchar2(6),designation varchar2
SQL> /

Table created.

SQL>
```






```
SQL> select * from emp1;

EMPNAME                    DOB        GENDER DESIGNATION
-------------------------- ---------- ------ --------------------------
DEPT                       ADDR                       BASIC
-------------------------- ------------------------- -------
Leo                        2/3/2014   True   Technician
B.C.A                      Kattankulathur            15000


SQL> SELECT * FROM EMP1;

EMPNAME                    DOB        GENDER DESIGNATION
-------------------------- ---------- ------ --------------------------
DEPT                       ADDR                       BASIC
-------------------------- ------------------------- -------
Leo                        2/3/2014   True   Technician
B.C.A                      Kattankulathur            15000

Rani                       4/6/2014   Female TEACHER
MCA                        CHENNAI                   16000


SQL>
```

Ex. No. 11. **Front-end tools – Visual Basic/Developer 2000**
Date:

Database connectivity using Front End Tools (Application Development using Oracle/ Mysql)
Mini Project

a) Inventory Control System.
b) Material Requirement Processing.
c) Hospital Management System.
d) Railway Reservation System.
e) Personal Information System

Aim: To demonstrate embedded SQL or Database connectivity

Procedure:

1. Develop database tables in oracle
2. Design the required screen in Visual Basic with all the required tools and objects(text boxes, labels, combo box, option box)
3. Write the coding for connecting the oracle database table with the visual basic application.
4. Run the application.
5. Verify the database connectivity by adding, deleting and viewing records through Visual Basic application.

Program:

```
Dim cnn1 As
ADODB.ConnectionDim rs As
ADODB.Recordset Dim strcnn
As String

Private Sub
ADD_Click()With rs
    .Fields("sname") = nametxt.Text
    .Fields("dob") = DTPicker1.Value
    .Fields("gender") = maleopt.Value
    .Fields("UG") = ugchk.Value
    .Fields("PG") = pgchk.Value
    .Fields("ugcourse") = ugcourse.Text
    .Fields("pgcourse") = pgcourse.Text
    .Update
End With
   rs.AddNe

wEnd Sub



Private Sub
   cancelcmd_Click()
   rs.CancelBatch
   cnn1.CommitTrans
End Sub

Private Sub clrcmd_Click()
```

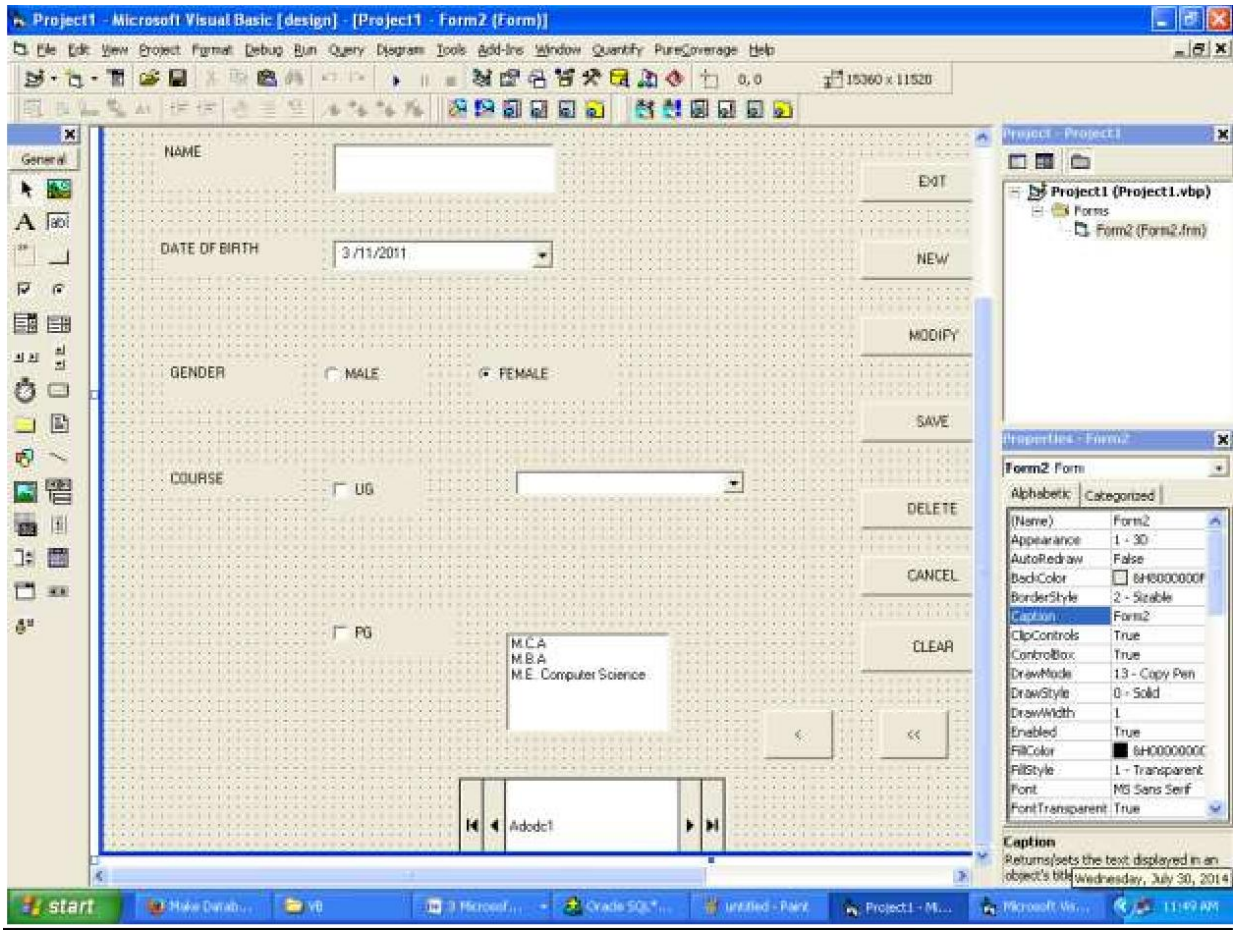
```
   nametxt.Text = " "
   maleopt.Value = True
   femaleopt.Value = True
   ugchk.Value = 0
   pgchk.Value = 0
   ugcourse.Text =
   ""pgcourse.Text =
   ""
End Sub

Private Sub
   delcmd_Click()
   cnn1.BeginTrans
   rs.Delete rs.UpdateBatch
   cnn1.CommitTrans
    MsgBox ("Record
 Deleted")End Sub

Private Sub
  endcmd_Click()End
End Sub

Private Sub
 firstcmd_Click()On Error
 GoTo l1:
     rs.Open "Select * from personal", cnn1, adOpenKeyset,
adLockBatchOptimisticl1:  rs.MoveFirst
     transfer


End Sub

Private Sub Form_Load()
  Form2.WindowState = 2

  Set cnn1 = New
  ADODB.ConnectionSet rs = New
  ADODB.Recordset
  rs.CursorLocation = adUseClient
  strcnn = "User ID =scott; Password=tiger; Data Source = leo; Persist Security Info
=False"'strcnn = "Provider=MSDAORA.1;User ID=scott;Password=tiger;Data
Source=dbserver;Persist Security Info=False"
  strcnn = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=E:\student.mdb;Persist
SecurityInfo=False"
  cnn1.Open strcnn




End Sub

Private Sub
lastcmd_Click()On Error
```

GoTo l5:

```
    rs.Open "Select * from personal", cnn1, adOpenKeyset,
adLockBatchOptimisticl5:  rs.MoveLast
    transfer

End Sub

Private Sub
 modcmd_Click()On Error
 GoTo l3:
    rs.Open "Select * from personal", cnn1, adOpenKeyset, adLockBatchOptimistic
l3: cnn1.BeginTrans


End Sub

Private Sub
newcmd_Click()On Error
GoTo l6:
   rs.Open "Select * from personal", cnn1, adOpenKeyset, adLockBatchOptimistic

l6:
       cnn1.BeginTran
   srs.AddNew

End Sub

Private Sub
 nextcmd_Click()On Error
 GoTo l2:
    rs.Open "Select * from personal", cnn1, adOpenKeyset,
adLockBatchOptimisticl2:  rs.MoveNext
    transfer
End Sub

Private Sub
pgchk_Click()If
pgchk.Value = 1 Then
pgcourse.Enabled = True
Else
  pgcourse.Enabled = False
End If
End Sub



Private Sub
prevcmd_Click()On Error
GoTo l4:
    rs.Open "Select * from personal", cnn1, adOpenKeyset,
adLockBatchOptimisticl4:  rs.MovePrevious
    transfer

End Sub
```

```
Private Sub
savecmd_Click()With rs
```

```
    .Fields("sname") = nametxt.Text
    .Fields("dob") = DTPicker1.Value
    .Fields("gender") = maleopt.Value
    .Fields("UG") = ugchk.Value
    .Fields("PG") = pgchk.Value
    .Fields("ugcourse") = ugcourse.Text
    .Fields("pgcourse") = pgcourse.Text
    .UpdateBatch
End With
cnn1.CommitTrans
 MsgBox ("Record is saved

successfully")End Sub

Private Sub  ugchk_Click()
  If ugchk.Value = 1 Then
  ugcourse.Enabled = True
  Else
    ugcourse.Enabled = False
  End If

End Sub


Public Sub transfer()
With rs
  If .EOF = False Then
     nametxt.Text = .Fields("sname")
      DTPicker1.Value =
      .Fields("dob")If
      .Fields("gender") <> 0 Then
      maleopt.Value = True
      Else
        femaleopt.Value = True
      End If

      ugchk.Value = .Fields("UG")
     pgchk.Value = .Fields("PG")
     ugcourse.Text =
     .Fields("ugcourse")
     If .Fields("pgcourse") <> "" Then
         pgcourse.Text =
         .Fields("pgcourse")
    End If
End If
End
With


End Sub
```



Viva questions:

1. What is a front-end tool, and how does it interact with the database?
2. What is the main purpose of using a tool like Visual Basic or Developer 2000 in application development?
3. How does Visual Basic differ from other programming languages like C or C++ in terms of GUI-based application development?
4. What is Visual Basic, and what kind of applications can you build with it?
5. What is the Integrated Development Environment (IDE) in Visual Basic, and what are its key components?

Result:

Thus the above program is executed successfully

Ex No:12 Normalization

Aim:

To normalize a given unnormalized relation into higher normal forms (1NF, 2NF, 3NF, and BCNF) and remove data redundancies while maintaining data integrity

Algorithm:

1. **First Normal Form (1NF):**
   - **Goal:** Eliminate repeating groups by ensuring that each column contains atomic (indivisible) values.
   - **Steps:**
     - Identify repeating groups and separate them into individual rows.
     - Make sure each cell contains only a single value.
2. **Second Normal Form (2NF):**
   - **Goal:** Eliminate partial dependencies, i.e., all non-prime attributes must depend on the **entire** primary key.
   - **Steps:**
     - Ensure the relation is in 1NF.
     - Identify attributes that depend only on part of the composite primary key and remove them into new relations.
     - Make sure all non-prime attributes depend on the **entire** primary key.
3. **Third Normal Form (3NF):**
   - **Goal:** Eliminate transitive dependencies, i.e., non-prime attributes should not depend on other non-prime attributes.
   - **Steps:**
     - Ensure the relation is in 2NF.
     - Identify transitive dependencies and remove them by creating new relations with only direct dependencies.
4. **Boyce-Codd Normal Form (BCNF):**
   - **Goal:** Ensure every determinant is a candidate key.
   - **Steps:**
     - Ensure the relation is in 3NF.
     - Identify any cases where a non-candidate key determines another attribute and resolve them by splitting the relation further.

Procedure:

Step 1: Given Unnormalized Table

Let's consider an example of a **Student-Course** table:

Student_ID	Student_Name	Course1	Instructor1	Course2	Instructor2
S101	Alice	Math	Dr. Smith	Science	Dr. Brown
S102	Bob	English	Dr. Adams	Math	Dr. Smith
S103	Charlie	Science	Dr. Brown	English	Dr. Adams

This table contains **non-atomic** data in columns Course1, Instructor1, Course2, and Instructor2.

Step 2: First Normal Form (1NF)
We will remove repeating groups and ensure each column contains atomic values.
Converted to 1NF:

Student_ID	Student_Name	Course	Instructor
S101	Alice	Math	Dr. Smith
S101	Alice	Science	Dr. Brown
S102	Bob	English	Dr. Adams
S102	Bob	Math	Dr. Smith
S103	Charlie	Science	Dr. Brown
S103	Charlie	English	Dr. Adams

Step 3: Second Normal Form (2NF)
We eliminate partial dependencies. **Student_Name** depends only on **Student_ID** and not on **Course**. This results in two relations:

1. **Student Table:**

Student_ID	Student_Name
S101	Alice
S102	Bob
S103	Charlie

2. **Course-Student Table:**

Student_ID	Course	Instructor
S101	Math	Dr. Smith
S101	Science	Dr. Brown
S102	English	Dr. Adams
S102	Math	Dr. Smith
S103	Science	Dr. Brown
S103	English	Dr. Adams

Step 4: Third Normal Form (3NF)
We eliminate transitive dependencies. In the **Course-Student Table**, **Instructor** is dependent on **Course**, not on the entire primary key. Therefore, we decompose further:

1. **Student Table** (unchanged):

Student_ID	Student_Name
S101	Alice
S102	Bob
S103	Charlie

2. **Course-Student Table**:

Student_ID	Course
S101	Math
S101	Science
S102	English
S102	Math
S103	Science
S103	English

3. **Instructor Table**:

Course	Instructor
Math	Dr. Smith
Science	Dr. Brown
English	Dr. Adams

Step 5: Boyce-Codd Normal Form (BCNF)
Since in **Instructor Table**, **Course** is not a candidate key (it is not unique), we break down the table further to ensure that each determinant is a candidate key.

1. **Student Table**:

Student_ID	Student_Name
S101	Alice
S102	Bob
S103	Charlie

2. **Course-Student Table**:

Student_ID	Course
S101	Math
S101	Science
S102	English
S102	Math
S103	Science
S103	English

3. **Course Table**:

Course	Instructor
Math	Dr. Smith
Science	Dr. Brown
English	Dr. Adams

Output:

1. **Normalized Table in 1NF:**

Student_ID	Student_Name	Course	Instructor
S101	Alice	Math	Dr. Smith
S101	Alice	Science	Dr. Brown
S102	Bob	English	Dr. Adams
S102	Bob	Math	Dr. Smith
S103	Charlie	Science	Dr. Brown
S103	Charlie	English	Dr. Adams

2. **Normalized Table in 2NF:**

Student Table:

Student_ID	Student_Name
S101	Alice
S102	Bob
S103	Charlie

Course-Student Table:

Student_ID	Course	Instructor
S101	Math	Dr. Smith
S101	Science	Dr. Brown

Student_ID	Course	Instructor
S102	English	Dr. Adams
S102	Math	Dr. Smith
S103	Science	Dr. Brown
S103	English	Dr. Adams

3. **Normalized Table in 3NF:**

Instructor Table:

Course	Instructor
Math	Dr. Smith
Science	Dr. Brown
English	Dr. Adams

4. **Normalized Table in BCNF:**
    - All the relations are now in BCNF, ensuring that every determinant is a candidate key.

Result:

By following the steps of normalization, the original unnormalized table is successfully decomposed into **1NF**, **2NF**, **3NF**, and **BCNF** relations. This process eliminates redundancy, improves consistency, and ensures that the database design is optimized for querying and data integrity.