18CSC303J - DATABASE MANAGEMENT SYSTEMS

SEMESTER – VI

2021 – 2022 (EVEN)

Name :

Register No. :

Branch : CSE-CN

Section : P1

DEPARTMENT OF NETWORKING AND COMMUNICATIONS

SCHOOL OF COMPUTING

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Under Section 3 of UGC Act, 1956)

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Internal Examiner I **Internal Examiner II**

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EXERCISE – 1

Aim: Data Definition Language using SQL COMMANDS

Data Definition Language (DDL) statements are used to define the database structure or schema. Some examples:

- CREATE - to create objects in the database
- ALTER - alters the structure of the database
- DROP - delete objects from the database
- TRUNCATE - remove all records from a table, including all spaces allocated for the records are removed
- COMMENT - add comments to the data dictionary

- RENAME - rename an object

The Create Table Command

The create table command defines each column of the table uniquely. Each column has minimum of three attributes.

- Name
- Data type
- Size (column width).

Each table column definition is a single clause in the create table syntax. Each table column definition is separated from the other by a comma. Finally, the SQL statement is terminated with a semicolon.

The Structure of Create Table Command

Table name is Student

Column name	Data type	Size
Reg_no	varchar2	10
Name	char	30
DOB	date	
Address	varchar2	50

The DROP Command
Syntax:

The TRUNCATE Command

Syntax:

The RENAME Command

Syntax:

The ALTER Table Command

By The use of ALTER TABLE Command we can **modify** our exiting table.

Adding New Columns

Syntax:

Dropping a Column from the Table

Syntax:

Modifying Existing Table

Syntax:
ALTER TABLE <table_name> MODIFY (<column_name> <NewDataType>(<NewSize>))

Restriction on the ALTER TABLE
Using the ALTER TABLE clause the following tasks cannot be performed.

- Change the name of the table
- Change the name of the column
- Decrease the size of a column if table data exists

Lab Experiment:

```
SQL> create table emp
  2  (
  3  empno int,
  4  ename varchar(20) not null,
  5  job varchar(10) not null,
  6  deptno varchar(3),
  7  sal int
  8  );

Table created.
```

```
SQL> describe emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(10)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)

SQL> alter table emp
  2  add (experience int);

Table altered.

SQL> describe emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(10)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)
 EXPERIENCE                                         NUMBER(38)

SQL> alter table emp
  2  modify (job varchar(20));

Table altered.

SQL> describe emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(20)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)
 EXPERIENCE                                         NUMBER(38)

SQL> create table dept
  2  (
  3  deptno int,
  4  dname varchar(10),
  5  loc varchar(10)
  6  );
```

Table created.

```
SQL> describe dept;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 DEPTNO                                             NUMBER(38)
 DNAME                                              VARCHAR2(10)
 LOC                                              VARCHAR2(10)

SQL> alter table dept
  2  modify (deptno int primary key);

Table altered.

SQL> describe dept;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 DEPTNO                                   NOT NULL NUMBER(38)
 DNAME                                              VARCHAR2(10)
 LOC                                              VARCHAR2(10)

SQL> create table emp1 as
  2  select ename, empno
  3  from emp
  4  ;

Table created.

SQL> drop table emp1;

Table dropped

SQL> values (1, 'Aditya', 'ML', 101, 100000, 5);
SP2-0734: unknown command beginning "values (1,..." - rest of line ignored.
SQL> insert into emp
  2  values (1, 'Aditya', 'ML', 101, 100000, 5);

1 row created.

SQL> insert into emp
  2  values (10, 'Rahul', 'AI', 111, 10000, 3);

1 row created.

SQL> insert into emp
  2  values (200, 'Aman', 'AI', 111, 50000, 4);
```

1 row created.

```
SQL> insert into emp
  2  values (250, 'Lenar', 'Mechanic', 001, 20000, 6);

1 row created.

SQL> describe emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(20)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)
 EXPERIENCE                                         NUMBER(38)

SQL> select * from emp;

    EMPNO ENAME              JOB                DEP        SAL EXPERIENCE
---------- ------------------- ------------------- --- ---------- ----------
         1 Aditya              ML                  101     100000          5
        10 Rahul               AI                  111      10000          3
       200 Aman                AI                  111      50000          4
       250 Lenar               Mechanic              1      20000          6

SQL> create table emp1 as
  2  select ename, empno
  3  from emp
  4  where empno > 100;

Table created.

SQL> describe emp1;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ENAME                                     NOT NULL VARCHAR2(20)
 EMPNO                                              NUMBER(38)

SQL> select * from emp1;

ENAME                EMPNO
-------------------- ----------
Aman                    200
Lenar                   250

SQL> alter table emp
```

```
  2  drop column experience;

Table altered.

SQL> describe emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(20)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)

SQL> truncate table emp;

Table truncated.

SQL> describe emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(20)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)

SQL> select * from emp;

no rows selected

SQL> drop table dept;

Table dropped.

SQL> describe dept;
ERROR:
ORA-04043: object dept does not exist


SQL> spool off;
```

Result: Data Definition Language using SQL COMMANDS has been studied and implemented

.

EXERCISE – 2

Aim: To study DML (Data Manipulation Language) using SQL COMMANDS

DML statements affect records in a table. These are basic operations we perform on data such as selecting a few records from a table, inserting new records, deleting unnecessary records, and updating/modifying existing records.

DML statements include the following:

SELECT – select records from a table
INSERT – insert new records
UPDATE – update/Modify existing records
DELETE – delete existing records

DML command

Data Manipulation Language (DML) statements are used for managing data in database. DML commands are not auto-committed. It means changes made by DML command are not permanent to database, it can be rolled back.

INSERT COMMAND

Insert command is used to insert data into a table. Following is its general syntax,

INSERT into *table-name* values(data1,data2,..)

UPDATE COMMAND

Update command is used to update a row of a table. Following is its general syntax,

UPDATE *table-name* set column-name = value *where* **condition**;

DELETE COMMAND

Delete command is used to delete data from a table. Delete command can also be used with conditions to delete a particular row. Following is its general syntax,

DELETE from *table-name*;

WHERE clause

Where clause is used to specify condition while retrieving data from table. ***Where*** clause is used mostly with *Select*, *Update* and *Delete* query. If condition specified by ***where*** clause is true then only the result from table is returned.

Syntax for WHERE clause
SELECT column-name1,
column-name2,
column-name3,
column-nameN
from table-name **WHERE [condition]**;

SELECT COMMAND

SELECT Query

Select query is used to retrieve data from a tables. It is the most used SQL query. We can retrieve complete tables, or partial by mentioning conditions using WHERE clause.

Syntax of SELECT Query
SELECT column-name1, column-name2, column-name3, column-nameN from *table-name*;

Like Clause

Like clause is used as condition in SQL query. **Like** clause compares data with an expression using wildcard operators. It is used to find similar data from the table.

- **Percent sign %** : represents zero, one or more than one character.
- **Underscore sign _** : represents only one character.

Order By Clause

Order by clause is used with the **Select** statement for arranging retrieved data in sorted order. The **Order by clause** by default sort data in ascending order. To sort data in descending order **DESC** keyword is used with **Order by** clause.

Syntax of Order By
SELECT column-list|* from table-name **order by** *asc*|*desc*;

Group By Clause

Group by clause is used to group the results of a SELECT query based on one or more columns. It is also used with SQL functions to group the result from one or more tables.

Syntax for using Group by in a statement.

SELECT column_name, function(column_name)

HAVING Clause

Having clause is used with SQL Queries to give more precise conditions for a statement. It is used to mention conditions in Group based SQL functions, just like WHERE clauses.

Syntax for having will be,

Distinct clause

The **distinct** keyword is used with **Select** statement to retrieve unique values from the table. **Distinct** Removes all the duplicate records while retrieving from database.

Syntax for DISTINCT Keyword **AND** and **OR** operators are used with **Where** clause to make more precise conditions for fetching data from database by combining more than one condition together.

OR operator is also used to combine multiple conditions with the Where clause. The only difference between AND and OR is their behavior. When we use AND to combine two or more than two conditions, records satisfying all the conditions will be in the result. But in the case of OR, at least one condition from the conditions specified must be satisfied by any record to be in the result.

Lab Experiment:

```
SQL> create table student
  2  (
  3  RegNo int not null,
  4  Name varchar(20) not null,
  5  Gender varchar(1),
  6  DOB date,
  7  mobileno int constraint ten check (mobileno between 1000000000 and 9999999999),
  8  City varchar(20),
  9  primary key (RegNo)
 10  );

Table created.

SQL> insert into student
  2  values
  3  (312, 'Randheer', 'M', to_date('2000-12-20','yyyy-mm-dd'), 8096735597, 'Rajahmundry');

1 row created.

SQL> insert into student
  2  values
  3  (9531, 'Sarika', 'F', to_date('2015-09-15','yyyy-mm-dd'), 9848035597, 'Rajahmundry');
```

```
1 row created.

SQL> insert into student
  2  values
  3  (8088, 'Satya Vani', 'F', to_date('1986-12-31','yyyy-mm-dd'), 9705710159, 'Rajahmundry');

1 row created.

SQL> insert into student
  2  values
  3  (2609, 'Durga Rao', 'M', to_date('1973-09-26','yyyy-mm-dd'), 9949028509, 'Rajahmundry');

1 row created.

SQL> insert into student
  2  values
  3  (3001, 'Sanju', 'M', to_date('2002-01-30','yyyy-mm-dd'), 9884792252, 'Rajahmundry');

1 row created.

SQL> insert into student
  2  values
  3  (601, 'Varija Sri', 'F', to_date('1999-01-06','yyyy-mm-dd'), 7674978787, 'Rajahmundry');

1 row created.

SQL> describe student
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 REGNO                                     NOT NULL NUMBER(38)
 NAME                                      NOT NULL VARCHAR2(20)
 GENDER                                             VARCHAR2(1)
 DOB                                                DATE
 MOBILENO                                           NUMBER(38)
 CITY                                               VARCHAR2(20)

SQL> select * from student;

    REGNO NAME                 G DOB         MOBILENO CITY
---------- -------------------- - --------- ---------- --------------------
       312 Randheer             M 20-DEC-00 8096735597 Rajahmundry
      9531 Sarika               F 15-SEP-15 9848035597 Rajahmundry
      8088 Satya Vani           F 31-DEC-86 9705710159 Rajahmundry
      2609 Durga Rao            M 26-SEP-73 9949028509 Rajahmundry
      3001 Sanju                M 30-JAN-02 9884792252 Rajahmundry
       601 Varija Sri           F 06-JAN-99 7674978787 Rajahmundry
```

6 rows selected.

SQL> update student set Name = 'Ranveer' where RegNo = 312;

1 row updated.

SQL> select * from student;

REGNO	NAME	G	DOB	MOBILENO	CITY
312	Ranveer	M	20-DEC-00	8096735597	Rajahmundry
9531	Sarika	F	15-SEP-15	9848035597	Rajahmundry
8088	Satya Vani	F	31-DEC-86	9705710159	Rajahmundry
2609	Durga Rao	M	26-SEP-73	9949028509	Rajahmundry
3001	Sanju	M	30-JAN-02	9884792252	Rajahmundry
601	Varija Sri	F	06-JAN-99	7674978787	Rajahmundry

6 rows selected.

SQL> update student set dob = to_date('1983-05-01','yyyy-mm-dd') where Name = 'Ram';

0 rows updated.

SQL> update student set Name = 'Ram' where RegNo = 312;

1 row updated.

SQL> select * from student;

REGNO	NAME	G	DOB	MOBILENO	CITY
312	Ram	M	20-DEC-00	8096735597	Rajahmundry
9531	Sarika	F	15-SEP-15	9848035597	Rajahmundry
8088	Satya Vani	F	31-DEC-86	9705710159	Rajahmundry
2609	Durga Rao	M	26-SEP-73	9949028509	Rajahmundry
3001	Sanju	M	30-JAN-02	9884792252	Rajahmundry
601	Varija Sri	F	06-JAN-99	7674978787	Rajahmundry

6 rows selected.

SQL> update student set dob = to_date('1983-05-01','yyyy-mm-dd') where Name = 'Ram';

1 row updated.

SQL> select * from student;

REGNO	NAME	G	DOB	MOBILENO	CITY

```
---------- -------------------- - --------- ---------- --------------------
       312 Ram                  M 01-MAY-83 8096735597 Rajahmundry
      9531 Sarika               F 15-SEP-15 9848035597 Rajahmundry
      8088 Satya Vani           F 31-DEC-86 9705710159 Rajahmundry
      2609 Durga Rao            M 26-SEP-73 9949028509 Rajahmundry
      3001 Sanju                M 30-JAN-02 9884792252 Rajahmundry
       601 Varija Sri           F 06-JAN-99 7674978787 Rajahmundry

6 rows selected.

SQL> describe emp;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(20)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)

SQL> select * from emp;

no rows selected

SQL> insert into emp
  2  values (1, 'Aditya', 'ML', 101, 100000);

1 row created.

SQL> insert into emp
  2  values (10, 'Rahul', 'AI', 111, 10000);

1 row created.

SQL> insert into emp
  2  values (200, 'Aman', 'AI', 111, 50000);

1 row created.

SQL> insert into emp
  2  values (200, 'Aman', 'AI', 111, 50000);

1 row created.

SQL> insert into emp
  2  values (250, 'Lenar', 'Mechanic', 001, 20000);

1 row created.
```

```
SQL> select * from emp;

    EMPNO ENAME              JOB                 DEP       SAL
---------- -------------------- -------------------- --- ----------
         1 Aditya               ML                  101     100000
        10 Rahul                AI                  111      10000
       200 Aman                  AI                   111      50000
       200 Aman                  AI                   111      50000
       250 Lenar                 Mechanic               1       20000

SQL> insert into emp
  2  values (50, 'Kil', 'Ass. Prof', 201, 2000);

1 row created.

SQL> select * from emp;

    EMPNO ENAME              JOB                 DEP       SAL
---------- -------------------- -------------------- --- ----------
         1 Aditya               ML                  101     100000
        10 Rahul                AI                  111      10000
       200 Aman                  AI                   111      50000
       200 Aman                  AI                   111      50000
       250 Lenar                 Mechanic               1       20000
        50 Kil                   Ass. Prof            201       2000

6 rows selected.

SQL> update emp set sal = 15000 where job = 'Ass. Prof';

1 row updated.

SQL> select * from emp;

    EMPNO ENAME              JOB                 DEP       SAL
---------- -------------------- -------------------- --- ----------
         1 Aditya               ML                  101     100000
        10 Rahul                AI                  111      10000
       200 Aman                  AI                   111      50000
       200 Aman                  AI                   111      50000
       250 Lenar                 Mechanic               1       20000
        50 Kil                   Ass. Prof            201      15000

6 rows selected.

SQL> create table employee as (select * from emp where sal > 12000);
```

Table created.

```
SQL> describe employee;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPNO                                              NUMBER(38)
 ENAME                                     NOT NULL VARCHAR2(20)
 JOB                                       NOT NULL VARCHAR2(20)
 DEPTNO                                             VARCHAR2(3)
 SAL                                                NUMBER(38)
```

```
SQL> select * from employee;

    EMPNO ENAME                JOB                  DEP        SAL
---------- -------------------- -------------------- --- ----------
         1 Aditya               ML                   101     100000
       200 Aman                 AI                   111      50000
       200 Aman                 AI                   111      50000
       250 Lenar                Mechanic               1      20000
        50 Kil                  Ass. Prof            201      15000
```

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

ENAME                JOB
-------------------- --------------------
Aditya               ML
Rahul                AI
Aman                 AI
Aman                 AI
Lenar                Mechanic
Kil                  Ass. Prof

6 rows selected.

SQL> spool off;
```

Result:

DML (Data Manipulation Language) using SQL COMMANDS has been studied and implemented.

EXERCISE-3

AIM: To write SQL queries to execute different DCL and TCL commands.

Explanation: Database created for this exercise is:

Data Control Language (DCL) Commands:

DCL includes commands such as GRANT and REVOKE which mainly deal with the rights, permissions, and other controls of the database system.

List of DCL commands:

- **GRANT:** This command gives users access privileges to the database.
- **REVOKE:** This command withdraws the user's access privileges given by using the GRANT command.

Transaction Control Language (TCL) Commands:

- **COMMIT:** Commits a Transaction.
- **ROLLBACK:** Rollbacks a transaction in case of any error occurs.
- **SAVEPOINT:**Sets a savepoint within a transaction.

Lab Experiment:

```
SQL> create table customers
  2  (customer_id int,
  3  sale_date date,
  4  sale_amount int,
  5  salesperson varchar(25),
  6  store_state varchar(5),
  7  order_id int
```

```
  8  );
```

Table created.

```
SQL> insert into customers values (1001, to_date('2020-05-23', 'yyyy-mm-dd'),
1200, 'Raj K', 'KA', 1001);
```

1 row created.

```
SQL> insert into customers values (1001, to_date('2020-05-22', 'yyyy-mm-dd'),
1200, 'M K', NULL, 1002);
```

1 row created.

```
SQL> insert into customers values (1002, to_date('2020-05-23', 'yyyy-mm-dd'),
1200, 'Malika Rakesh', 'MH', 1003);
```

1 row created.

```
SQL> insert into customers values (1003, to_date('2020-05-22', 'yyyy-mm-dd'),
1500, 'Malika Rakesh', 'MH', 1004);
```

1 row created.

```
SQL> insert into customers values (1004, to_date('2020-05-22', 'yyyy-mm-dd'),
1210, 'M K', NULL, 1003);
```

1 row created.

SQL> insert into customers values (1005, to_date('2019-12-12', 'yyyy-mm-dd'), 4200, 'RK Rakesh', 'MH', 1007);

1 row created.

SQL> insert into customers values (1002, to_date('2020-05-21', 'yyyy-mm-dd'), 1200, 'Molly Samberg', 'DL', 1001);

1 row created.

SQL> describe customers;

Name	Null?	Type
CUSTOMER_ID		NUMBER(38)
SALE_DATE		DATE
SALE_AMOUNT		NUMBER(38)
SALESPERSON		VARCHAR2(25)
STORE_STATE		VARCHAR2(5)
ORDER_ID		NUMBER(38)

SQL> select * from customers;

CUSTOMER_ID SALE_DATE SALE_AMOUNT SALESPERSON
STORE ORDER_ID

---------- --------- ---------- ---------- ----- ----------

1001 23-MAY-20 1200 Raj K KA 1001

1001 22-MAY-20 1200 M K 1002

1002 23-MAY-20 1200 Malika Rakesh MH 1003

1003 22-MAY-20 1500 Malika Rakesh MH 1004

1004 22-MAY-20 1210 M K 1003

1005 12-DEC-19 4200 RK Rakesh MH 1007

1002 21-MAY-20 1200 Molly Samberg DL 1001

7 rows selected.

SQL> insert into customers values (1002, to_date('2020-05-20', 'yyyy-mm-dd'), 1200, 'Molly Samberg', 'DL', 1005);

1 row created.

SQL> commit;

Commit complete.

SQL> select * from customers;

CUSTOMER_ID SALE_DATE SALE_AMOUNT SALESPERSON
STORE ORDER_ID

---------- --------- ---------- ---------- ----- ----------

1001 23-MAY-20 1200 Raj K KA 1001

1001	22-MAY-20	1200	M K		1002
1002	23-MAY-20	1200	Malika Rakesh	MH	1003
1003	22-MAY-20	1500	Malika Rakesh	MH	1004
1004	22-MAY-20	1210	M K		1003
1005	12-DEC-19	4200	RK Rakesh	MH	1007
1002	21-MAY-20	1200	Molly Samberg	DL	1001
1002	20-MAY-20	1200	Molly Samberg	DL	1005

8 rows selected.

SQL> rollback;

Rollback complete.

SQL> select * from customers;

CUSTOMER_ID	SALE_DATE	SALE_AMOUNT	SALESPERSON	STORE	ORDER_ID
1001	23-MAY-20	1200	Raj K	KA	1001
1001	22-MAY-20	1200	M K		1002
1002	23-MAY-20	1200	Malika Rakesh	MH	1003
1003	22-MAY-20	1500	Malika Rakesh	MH	1004
1004	22-MAY-20	1210	M K		1003
1005	12-DEC-19	4200	RK Rakesh	MH	1007

1002 21-MAY-20 1200 Molly Samberg DL 1001

1002 20-MAY-20 1200 Molly Samberg DL 1005

8 rows selected.

SQL> delete from customers where store_state = 'MH' and customer_id = 1002;

1 row deleted.

SQL> select * from customers;

CUSTOMER_ID SALE_DATE SALE_AMOUNT SALESPERSON
STORE ORDER_ID

---------- --------- ---------- ---------- ----- ----------

1001 23-MAY-20 1200 Raj K KA 1001

1001 22-MAY-20 1200 M K 1002

1003 22-MAY-20 1500 Malika Rakesh MH 1004

1004 22-MAY-20 1210 M K 1003

1005 12-DEC-19 4200 RK Rakesh MH 1007

1002 21-MAY-20 1200 Molly Samberg DL 1001

1002 20-MAY-20 1200 Molly Samberg DL 1005

7 rows selected.

SQL> rollback;

Rollback complete.

SQL> select * from customers;

CUSTOMER_ID SALE_DATE SALE_AMOUNT SALESPERSON
STORE ORDER_ID

---------- --------- ---------- ---------- ----- ----------

1001 23-MAY-20 1200 Raj K KA 1001

1001 22-MAY-20 1200 M K 1002

1002 23-MAY-20 1200 Malika Rakesh MH 1003

1003 22-MAY-20 1500 Malika Rakesh MH 1004

1004 22-MAY-20 1210 M K 1003

1005 12-DEC-19 4200 RK Rakesh MH 1007

1002 21-MAY-20 1200 Molly Samberg DL 1001

1002 20-MAY-20 1200 Molly Samberg DL 1005

8 rows selected.

SQL> savepoint sp1;

Savepoint created.

SQL> delete from customers where store_state = 'MH' and customer_id = 1002;

1 row deleted.

SQL> savepoint sp2;

Savepoint created.

SQL> rollback to sp1;

Rollback complete.

SQL> select * from customers;

CUSTOMER_ID	SALE_DATE	SALE_AMOUNT	SALESPERSON	STORE	ORDER_ID
1001	23-MAY-20	1200	Raj K	KA	1001
1001	22-MAY-20	1200	M K		1002
1002	23-MAY-20	1200	Malika Rakesh	MH	1003
1003	22-MAY-20	1500	Malika Rakesh	MH	1004
1004	22-MAY-20	1210	M K		1003
1005	12-DEC-19	4200	RK Rakesh	MH	1007
1002	21-MAY-20	1200	Molly Samberg	DL	1001
1002	20-MAY-20	1200	Molly Samberg	DL	1005

8 rows selected.

SQL> grant select on customers to RA1911026010101;

Grant succeeded.

SQL> grant select on customers to RA1911026010100;

Grant succeeded.

SQL> revoke select on customers from RA1911026010100;

Revoke succeeded.

SQL> spool off;

Result: Thus the DCL and TCL commands are used to modify or manipulate data recordspresent in the customer database tables.

EXERCISE – 4

Aim: Built-In functions in SQL

Functions

Functions accept zero or more arguments and both return one or more results. Both are used to manipulate individual data items.Operators differ from functional in that they follow the format of function_name(arg..). Functions can be classified into **single row functions and group functions**.

Single Row functions

The single row function can be broadly classified as, o Date Function o Numeric Function o Character Function o Conversion Function o Miscellaneous Function

The example that follows mostly uses the symbol table "**dual**". It is a table, which is automatically created by oracle along with the data dictionary

Date Function

- **Add_month**

This function returns a date after adding a specified date with a specified number of months.

Syntax: Add_months(d,n); where d-date n-number of months
Example: *Select add_months(sysdate,2) from dual;*

- **last_day**

It displays the last date of that month.

Syntax: last_day (d); where d-date

Example: *Select last_day ('1-jun-2009') from dual;*

- **Months_between**

It gives the difference in the number of months between d1 & d2.

Syntax: month_between (d1,d2); where d1 & d2 –dates
Example: *Select month_between ('1-jun-2009','1-aug-2009') from dual;*

- **next_day**

It returns a day followed the specified date.

Syntax: next_day (d,day);
Example: *Select next_day (sysdate,'wednesday') from dual*

- **round**

This function returns the date, which is rounded to the unit specified by the format model.
Syntax : round (d,[fmt]);
where d- date, [fmt] – optional. By default date will be rounded to the nearest day
Example: *Select round (to_date('1-jun-2009','dd-mm-yy'),'year') from dual;*
Select round ('1-jun-2009','year') from dual;
Numerical Functions

Command	Query	Output
Abs(n)	Select abs(-15) from dual;	15
Ceil(n)	Select ceil(55.67) from dual;	56
Exp(n)	Select exp(4) from dual;	54.59
Floor(n)	Select floor(100.2) from dual;	100
Power(m,n)	Select power(4,2) from dual;	16
Mod(m,n)	Select mod(10,3) from dual;	1
Round(m,n)	Select round(100.256,2) from dual;	100.26
Trunc(m,n)	Select trunc(100.256,2) from dual;	100.23
Sqrt(m,n)	Select sqrt(16) from dual;	4

Character Functions

Command	Query	Output
initcap(char);	*select initcap("hello") from dual;*	Hello

lower (char); upper (char);	*select lower ('HELLO') from dual;* *select upper ('hello') from dual;*	hello HELLO
ltrim (char,[set]);	*select ltrim ('cseit', 'cse') from dual;*	it
rtrim (char,[set]);	*select rtrim ('cseit', 'it') from dual;*	cse
replace (char,search string, replace string);	*select replace ('jack and jue', 'j', 'bl') from dual;*	black an blue
substr (char,m,n);	*select substr ('information', 3, 4) from dual;*	form

Conversion Function

- **to_char()**

Syntax: to_char(d,[format]);
This function converts date to a value of varchar type in a form specified by date format.
If format is negelected then it converts date to varchar2 in the default date format.
Example: *select to_char (sysdate, 'dd-mm-yy') from dual;*

- **to_date()**

Syntax: to_date(d,[format]);
This function converts character to date data format specified in the form character.
Example: *select to_date('aug 15 2009','mm-dd-yy') from dual;*

Miscellaneous Functions

- **uid** – This function returns the integer value (id) corresponding to the user currently logged in.

Example: *select uid from dual;*

- **user** – This function returns the logins user name. **Example:** *select user from dual;*
- **nvl** – The null value function is mainly used in the case where we want to consider null values as zero.

Syntax; nvl(exp1, exp2)
If exp1 is null, return exp2. If exp1 is not null, return exp1.

Example: *select custid, shipdate, nvl(total,0) from order;*

- **vsize:** It returns the number of bytes in expression.

Example: *select vsize('tech') from dual;*

Group Functions
A group function returns a result based on group of rows.

1. avg
Example: *select avg (total) from student;*

2.max
Example: *select max (percentagel) from student;*

3.min
Example: *select min (marksl) from student;*

4. sum
Example: *select sum(price) from product;*

Count Function
In order to count the number of rows, count function is used.

- **count(*)** – It counts all, inclusive of duplicates and nulls.

Example: *select count(*) from student;*

- **count(col_name)–** It avoids null value. **Example**: *select count(total) from order;*

- **count(distinct col_name)** – It avoids the repeated and null values. **Example:** *select count(distinct ordid) from order;*

Group by clause
This allows us to use simultaneous column name and group functions.

Example: *Select max(percentage), deptname from student group by deptname;*

Having clause
This is used to specify conditions on rows retrieved by using group by clause.
Example: *Select max(percentage), deptname from student group by deptname having count(*)>=50;*

Special Operators:
In / not in – used to select a equi from a specific set of values
Any - used to compare with a specific set of values
Between / not between – used to find between the ranges
Like / not like – used to do the pattern matching

Lab Experiment:

SQL> select add_months(sysdate, 2) from dual;

ADD_MONTH

08-APR-22

SQL> select last_day ('1-jun-2009') from dual;

LAST_DAY(

30-JUN-09

SQL> select months_between ('1-jun-2009', '1-aug-2009') from dual;

MONTHS_BETWEEN('1-JUN-2009','1-AUG-2009')

```
SQL> select next_day (sysdate, 'wednesday') from dual;

NEXT_DAY(
---------
09-FEB-22

SQL> select round (to_date('1-jun-2009', 'dd-mm-yyyy'), 'year') from dual;

ROUND(TO_
---------
01-JAN-09

SQL> select to_char (sysdate, 'dd-mm-yy') from dual;

TO_CHAR(
--------
08-02-22

SQL> select uid from dual;

       UID
----------
       111

SQL> select user from dual;

USER
------------------------------------------------------------------------------
RA1911026010101
```

SQL> select * from student;

REGNO	NAME	G	DOB	MOBILENO	CITY
312	Ram	M	01-MAY-83	8096735597	Rajahmundry
9531	Sarika	F	15-SEP-15	9848035597	Rajahmundry
8088	Satya Vani	F	31-DEC-86	9705710159	Rajahmundry
2609	Durga Rao	M	26-SEP-73	9949028509	Rajahmundry
3001	Sanju	M	30-JAN-02	9884792252	Rajahmundry
601	Varija Sri	F	06-JAN-99	7674978787	Rajahmundry

6 rows selected.

SQL> select * from employee;

EMPNO	ENAME	JOB	DEP	SAL
1	Aditya	ML	101	100000
200	Aman	AI	111	50000
200	Aman	AI	111	50000
250	Lenar	Mechanic	1	20000
50	Kil	Ass. Prof	201	15000

SQL> select avg(sal) from employee;

AVG(SAL)
47000

```
SQL> select max(sal) from employee;

  MAX(SAL)
----------
    100000

SQL> select min(sal) from employee;

  MIN(SAL)
----------
     15000

SQL> select sum(sal) from employee;

  SUM(SAL)
----------
    235000

SQL> select count(*) from employee;

  COUNT(*)
----------
         5

SQL> select count(*) from student;

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

6

SQL> select count(regno) from student;

COUNT(REGNO)

6

SQL> select count(empno) from employee;

COUNT(EMPNO)

5

SQL> select count(distinct regno) from student;

COUNT(DISTINCTREGNO)

6

SQL> select count(distinct empno) from employee;

COUNT(DISTINCTEMPNO)

4

SQL> spool off;

SQL> select * from employee;

EMPNO	ENAME	JOB	DEP	SAL
1	Aditya	ML	101	100000
200	Aman	AI	111	50000
200	Aman	AI	111	50000
250	Lenar	Mechanic	1	20000
50	Kil	Ass. Prof	201	15000

SQL> select * from student;

REGNO	NAME	G	DOB	MOBILENO	CITY
312	Ram	M	01-MAY-83	8096735597	Rajahmundry
9531	Sarika	F	15-SEP-15	9848035597	Rajahmundry
8088	Satya Vani	F	31-DEC-86	9705710159	Rajahmundry
2609	Durga Rao	M	26-SEP-73	9949028509	Rajahmundry
3001	Sanju	M	30-JAN-02	9884792252	Rajahmundry
601	Varija Sri	F	06-JAN-99	7674978787	Rajahmundry

6 rows selected.

SQL> select * from student where name like 'S%';

REGNO	NAME	G	DOB	MOBILENO	CITY
9531	Sarika	F	15-SEP-15	9848035597	Rajahmundry
8088	Satya Vani	F	31-DEC-86	9705710159	Rajahmundry
3001	Sanju	M	30-JAN-02	9884792252	Rajahmundry

SQL> select * from student where name not like 'S%';

REGNO	NAME	G	DOB	MOBILENO	CITY
312	Ram	M	01-MAY-83	8096735597	Rajahmundry
2609	Durga Rao	M	26-SEP-73	9949028509	Rajahmundry
601	Varija Sri	F	06-JAN-99	7674978787	Rajahmundry

SQL> select * from employee where empno between 150 and 250;

EMPNO	ENAME	JOB	DEP	SAL
200	Aman	AI	111	50000
200	Aman	AI	111	50000
250	Lenar	Mechanic	1	20000

SQL> select sqrt(sal) from employee;

SQRT(SAL)
316.227766
223.606798
223.606798
141.421356
122.474487

SQL> select count(*) from employee;

COUNT(*)

```
----------
         5

SQL> select sum(sal), avg(sal) from employee;

  SUM(SAL)   AVG(SAL)
---------- ----------
    235000      47000

SQL> select max(sal) as max_salary, min(sal) as min_salary from employee;

MAX_SALARY MIN_SALARY
---------- ----------
    100000      15000

SQL> select sum(sal) from employee;

  SUM(SAL)
----------
    235000

SQL> select add_months (sysdate, 2) from dual;

ADD_MONTH
---------
08-APR-22


SQL> select add_months (sysdate, -2) from dual;
```

ADD_MONTH

08-DEC-21

SQL> select * from customers;

CUSTOMER_ID	SALE_DATE	SALE_AMOUNT	SALESPERSON	STORE	ORDER_ID
1001	23-MAY-20	1200	Raj K	KA	1001
1001	22-MAY-20	1200	M K		1002
1002	23-MAY-20	1200	Malika Rakesh	MH	1003
1003	22-MAY-20	1500	Malika Rakesh	MH	1004
1004	22-MAY-20	1210	M K		1003
1005	12-DEC-19	4200	RK Rakesh	MH	1007
1002	21-MAY-20	1200	Molly Samberg	DL	1001
1002	20-MAY-20	1200	Molly Samberg	DL	1005

8 rows selected.

SQL> select min(sale_amount) from customers group by salesperson;

MIN(SALE_AMOUNT)
1200
1200
4200
1200
1200

SQL> select min(sale_amount), salesperson from customers group by salesperson;

MIN(SALE_AMOUNT) SALESPERSON

--- ---

1200 Molly Samberg

1200 M K

4200 RK Rakesh

1200 Raj K

1200 Malika Rakesh

SQL> spool off;

Result:

The Built-in Functions in SQL have been implemented.

EXERCISE - 5

Aim: To draw an er-diagram for a Hotel Management System.

Members: Aditya Manoj Bhaskaran (RA1911026010101)
Abhisek Biswal (RA1911026010109)

PROCEDURE:

Entities: Teacher, Supervisor (Weak Entity), Evaluator (Weak Entity), Room, Student, Paper

Relationships:

- The teacher is a generaliazation of the supervisor and the evaluator entities and has an 'IS A' relationship with them. The evaluator and supervisor entities are a specialization of the teacher entity.
- The supervisor has the relationship of 'supervises' with the room entity. It has a one-to-many relationship. It is a weak relationship.
- The evaluator has the relationship of 'corrects' with the paper entity. It has a many-to-many relationship. It is a weak relationship.
- The instances of the student entity sit in the room entity. It has a many-to-one relationship.
- The student entity has a relationship of 'gives' with the paper entity. It has a one-to-many relationship.

Attributes:

Teacher:

- Name
- Gender
- Teacher_ID (Primary Key)

Supervisor:

- Room_No (Foreign Key)

Evaluator:

- Course_ID (Foreign Key)

Room:

- Room_No (Primary Key)
- RegNo (Foreign Key)
- Teacher_ID (Foreign Key)

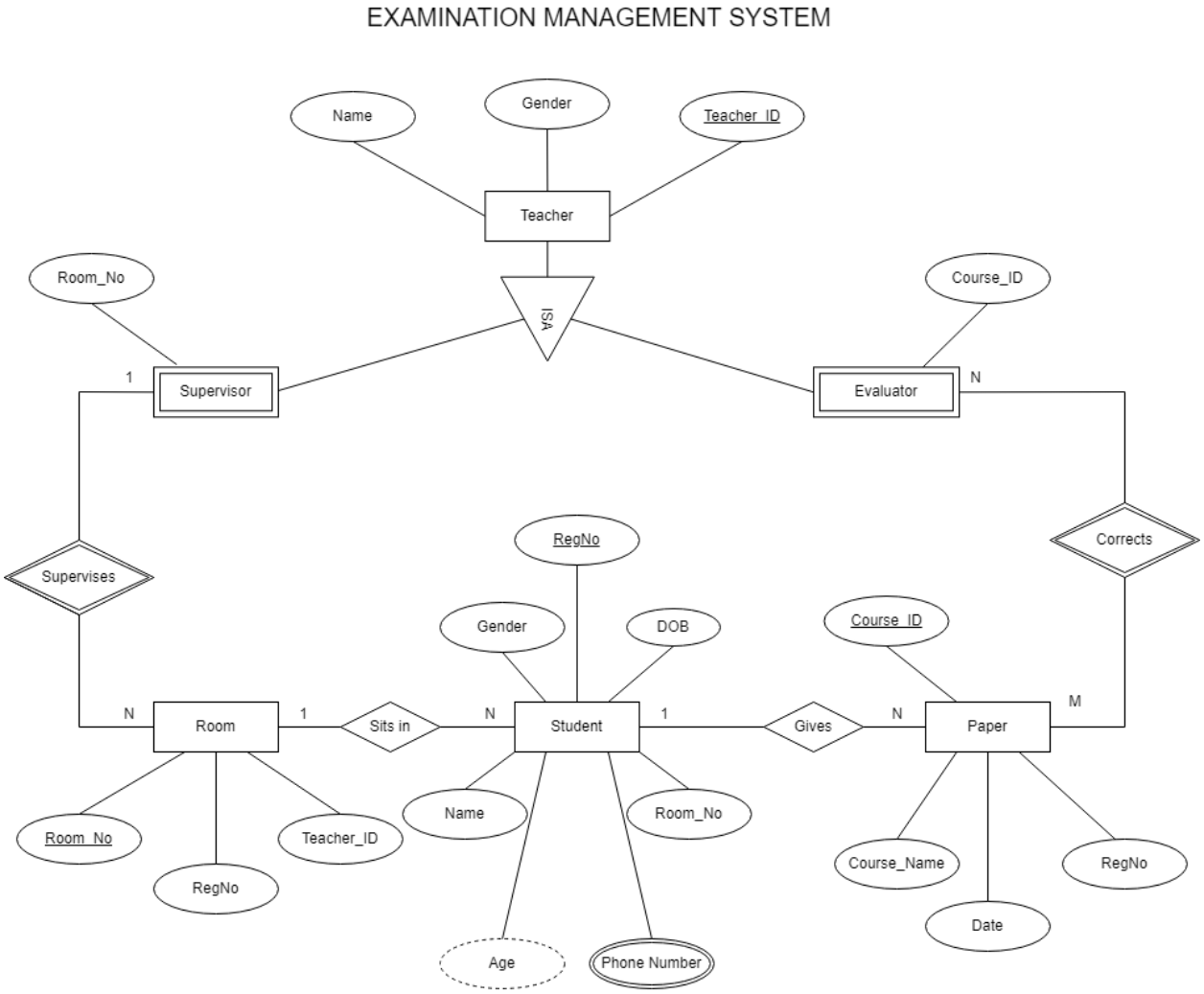
Paper:

- Course_ID (Primary Key)
- Course_Name
- Date
- RegNo (Foreign Key)

Student:

- RegNo (Primary Key)
- Gender
- DOB
- Name
- Room_No (Foreign Key)
- Age (Derived Attribute)
- Phone Number (Multi-valued Attribute)

EER Diagram:



RESULT – The Extended ER Diagram for Bookstore Management System has been studied.

EXERCISE – 6

AIM - To study JOIN QUERIES in SQL.

EXPLANATION - SQL Join is used to fetch data from two or more tables, which is joined to appear as single set of data. SQL Join is used for combining column from two or more tables by using values common to both tables. **Join** Keyword is used in SQL queries for joining two or more tables. Minimum required condition for joining table, is **(n-1)** where **n**, is number of tables. A table can also join to itself known as, **Self Join**.

Types of Join

The following are the types of JOIN that we can use in SQL.

- Inner
- Outer
- Left
- Right

Cross JOIN or Cartesian Product

This type of JOIN returns the cartesian product of rows from the tables in Join. It will return a table which consists of records which combines each row from the first table with each row of the second table.

Cross JOIN Syntax is,
SELECT column-name-list from table-name1

INNER Join or EQUI Join

This is a simple JOIN in which the result is based on matched data as per the equality condition specified in the query.

Inner Join Syntax is,
SELECT column-name-list from table-name1

Natural JOIN

Natural Join is a type of Inner join which is based on column having same name and same datatype present in both the tables to be joined.

Natural Join Syntax is,
SELECT * from table-name1

NATURAL JOIN

Natural join query will be,

SELECT * from class NATURAL JOIN class_info;

Outer JOIN

Outer Join is based on both matched and unmatched data. Outer Joins subdivide further into,

- Left Outer Join
- Right Outer Join
- Full Outer Join

Left Outer Join

The left outer join returns a result table with the **matched data** of two tables then remaining rows of the **left** table and null for the **right** table's column.

Left Outer Join syntax is,
SELECT column-name-list from table-name1

LEFT OUTER JOIN

Left outer Join Syntax for **Oracle** is,
select column-name-list from table-name1, table-name2 on table-name1.column-name = table-name2.column-name(+);

Left Outer Join query will be,
SELECT * FROM class LEFT OUTER JOIN class_info ON (class.id=class_info.id);

Right Outer Join

The right outer join returns a result table with the **matched data** of two tables then remaining rows of the **right table** and null for the **left** table's columns.

Right Outer Join Syntax is, select column-name-list from table-name1

RIGHT OUTER JOIN

Right Outer Join query will be,
SELECT * FROM class RIGHT OUTER JOIN class_info on (class.id=class_info.id);
The result table will look like,

Full Outer Join

The full outer join returns a result table with the **matched data** of two table then remaining rows of both **left** table and then the **right** table. Full Outer Join Syntax is, select column-name-list from table-name1

FULL OUTER JOIN

Full Outer Join query will be like,
SELECT * FROM class FULL OUTER JOIN class_info on (class.id=class_info.id);

Lab Experiment:

```
SQL> create table orders
  2  (
  3  order_id int primary key,
  4  order_number int,
  5  p_id varchar(20) not null
  6  );

Table created.

SQL> create table person
  2  (
  3  p_id varchar(20) primary key,
  4  firstname varchar(15),
  5  lastname varchar(15),
  6  city varchar(10)
  7  );

Table created.

SQL> desc orders;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 ORDER_ID                                  NOT NULL NUMBER(38)
 ORDER_NUMBER                                       NUMBER(38)
 P_ID                                      NOT NULL VARCHAR2(20)

SQL> desc person;
 Name                                      Null?    Type
```

```
 ---------------------------------------- -------- ----------------------------
P_ID                                      NOT NULL VARCHAR2(20)
FIRSTNAME                                          VARCHAR2(15)
LASTNAME                                           VARCHAR2(15)
CITY                                               VARCHAR2(10)

SQL> insert into orders values(101, 1, 'A1');

1 row created.

SQL> insert into orders values(102, 2, 'A2');

1 row created.

SQL> insert into orders values(105, 3, 'B2');

1 row created.

SQL> insert into orders values(115, 5, 'C2');

1 row created.

SQL> insert into orders values(120, 6, 'D1');

1 row created.

SQL> select * from orders;
```

```
  ORDER_ID ORDER_NUMBER P_ID
---------- ------------ --------------------
       101            1 A1
       102            2 A2
       105            3 B2
       115            5 C2
       120            6 D1

SQL> insert into person values('A1', 'Aditya', 'Bhaskaran', 'Kol');

1 row created.

SQL> insert into person values('A2', 'Alex', 'Kohr', 'Del');

1 row created.

SQL> insert into person values('B1', 'Chandan', 'Kamal', 'Jai');

1 row created.

SQL> insert into person values('C1', 'Venkata', 'Raman', 'Chen');

1 row created.

SQL> insert into person values('D1', 'John', 'Kramer', 'NY');

1 row created.
```

```
SQL> insert into person values('D2', 'Okabe', 'Rintarou', 'Shib');

1 row created.

SQL> select * from person;

P_ID               FIRSTNAME       LASTNAME        CITY
-------------------- --------------- --------------- ----------
A1                 Aditya          Bhaskaran       Kol
A2                 Alex            Kohr            Del
B1                 Chandan         Kamal           Jai
C1                 Venkata         Raman           Chen
D1                 John            Kramer          NY
D2                 Okabe           Rintarou        Shib

6 rows selected.

SQL> select * from orders cross join person;

  ORDER_ID ORDER_NUMBER P_ID                P_ID
---------- ------------ -------------------- --------------------
FIRSTNAME       LASTNAME        CITY
--------------- --------------- ----------
       101            1 A1                 A1
Aditya          Bhaskaran       Kol

       101            1 A1                 A2
Alex            Kohr            Del
```

101 1 A1 B1

Chandan Kamal Jai

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

101 1 A1 C1

Venkata Raman Chen

101 1 A1 D1

John Kramer NY

101 1 A1 D2

Okabe Rintarou Shib

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

102 2 A2 A1

Aditya Bhaskaran Kol

102 2 A2 A2

Alex Kohr Del

102 2 A2 B1

Chandan Kamal Jai

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

102 2 A2 C1

Venkata Raman Chen

102 2 A2 D1

John Kramer NY

102 2 A2 D2

Okabe Rintarou Shib

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

105 3 B2 A1

Aditya Bhaskaran Kol

105 3 B2 A2

Alex Kohr Del

105 3 B2 B1

Chandan Kamal Jai

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

105 3 B2 C1

Venkata Raman Chen

105 3 B2 D1

John Kramer NY

105 3 B2 D2

Okabe Rintarou Shib

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

115 5 C2 A1

Aditya Bhaskaran Kol

115 5 C2 A2

Alex Kohr Del

115 5 C2 B1

Chandan Kamal Jai

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

115 5 C2 C1

Venkata Raman Chen

115 5 C2 D1

John Kramer NY

115 5 C2 D2

Okabe Rintarou Shib

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

120 6 D1 A1

Aditya Bhaskaran Kol

120 6 D1 A2

Alex Kohr Del

120 6 D1 B1

Chandan Kamal Jai

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

120 6 D1 C1

Venkata Raman Chen

120 6 D1 D1

John Kramer NY

120 6 D1 D2

Okabe Rintarou Shib

30 rows selected.

SQL> select * from orders inner join person using(p_id);

P_ID ORDER_ID ORDER_NUMBER FIRSTNAME LASTNAME

---------- ---------- ---------- ---------- ----------

CITY

A1 101 1 Aditya Bhaskaran

Kol

A2 102 2 Alex Kohr

Del

D1 120 6 John Kramer

NY

SQL> select * from orders inner join person using(p_id);

P_ID ORDER_ID ORDER_NUMBER FIRSTNAME LASTNAME

---------- ---------- ---------- ---------- ----------

CITY

A1 101 1 Aditya Bhaskaran

Kol

A2 102 2 Alex Kohr

Del

D1 120 6 John Kramer

NY

SQL> select * from orders natural join person;

P_ID ORDER_ID ORDER_NUMBER FIRSTNAME LASTNAME

CITY

A1 101 1 Aditya Bhaskaran

Kol

A2 102 2 Alex Kohr

Del

D1 120 6 John Kramer

NY

SQL> select * from orders left outer join person on (orders.p_id = person.p_id);

ORDER_ID ORDER_NUMBER P_ID P_ID

FIRSTNAME LASTNAME CITY

---

101 1 A1 A1

Aditya Bhaskaran Kol

102 2 A2 A2

Alex Kohr Del

120 6 D1 D1

John Kramer NY

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

115 5 C2

105 3 B2

SQL> select * from orders right outer join person on (orders.p_id = person.p_id);

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

101 1 A1 A1

Aditya Bhaskaran Kol

102 2 A2 A2

Alex Kohr Del

120 6 D1 D1

John Kramer NY

```
  ORDER_ID ORDER_NUMBER P_ID               P_ID
---------- ------------ -------------------- --------------------
FIRSTNAME       LASTNAME        CITY
--------------- --------------- ----------
                                 B1
Chandan         Kamal           Jai


                                 C1
Venkata         Raman           Chen


                                 D2
Okabe           Rintarou        Shib



6 rows selected.

SQL> select * from orders full outer join person on (orders.p_id = person.p_id);

  ORDER_ID ORDER_NUMBER P_ID               P_ID
---------- ------------ -------------------- --------------------
FIRSTNAME       LASTNAME        CITY
--------------- --------------- ----------
       101           1 A1                 A1
Aditya          Bhaskaran       Kol

       102           2 A2                 A2
Alex            Kohr            Del
```

B1

Chandan Kamal Jai

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

C1

Venkata Raman Chen

120 6 D1 D1

John Kramer NY

D2

Okabe Rintarou Shib

ORDER_ID ORDER_NUMBER P_ID P_ID

---------- ---------- ---------- ----------

FIRSTNAME LASTNAME CITY

---------- ---------- ----------

115 5 C2

105 3 B2

8 rows selected.

SQL> spool off;

Result: JOIN QUERIES in SQL have been successfully implemented.

EXERCISE- 7

Aim: To study SQL SUBQUERIES

Subquery or **Inner query** or **Nested query** is a query in a query. SQL subquery is usually added in the WHERE Clause of the SQL statement. Most of the time, a subquery is used when you know how to search for a value using a SELECT statement, but do not know the exact value in the database.

Subqueries are an alternate way of returning data from multiple tables.

Subqueries can be used with the following SQL statements along with the comparision operators like =, <, >, >=, <= etc.

- SELECT
- INSERT
- UPDATE
- DELETE

2) Let's consider the student_details table which we have used earlier. If you know the name of the students who are studying science subject, you can get their id's by using this query below,

```
SELECT id, first_name
FROM student_details
WHERE first_name IN ('Rahul', 'Stephen');
```

but, if you do not know their names, then to get their id's you need to write the query in this manner,

```
SELECT id, first_name
FROM student_details
WHERE first_name IN (SELECT first_name
FROM student_details
WHERE subject= 'Science');
```

Subquery Output:

id	first_name
100	Rahul
102	Stephen

In the above sql statement, first the inner query is processed first and then the outer query is processed.

SQL Subquery; INSERT Statement

- Subquery can be used with INSERT statement to add rows of data from one or more tables to another table. Lets try to group all the students who study Maths in a table 'maths_group'.

```
INSERT INTO maths_group(id, name)
SELECT id, first_name || ' ' || last_name
FROM student_details WHERE subject= 'Maths'
```

SQL Subquery; SELECT Statement

- A subquery can be used in the SELECT statement as follows. Lets use the product and order_items table defined in the sql_joins section.

```
select p.product_name, p.supplier_name, (select order_id from order_items where
product_id = 101) as order_id from product p where p.product_id =
101
```

product_name	supplier_name	order_id
Television	Onida	5103

Correlated Subquery

A query is called correlated subquery when both the inner query and the outer query are interdependent. For every row processed by the inner query, the outer query is processed as well. The inner query depends on the outer query before it can be processed.

```
SELECT p.product_name FROM product p
```

WHERE p.product_id = (SELECT o.product_id FROM order_items o
WHERE o.product_id = p.product_id);

Subquery Notes

Nested Subquery

- You can nest as many queries you want but it is recommended not to nest more than 16 subqueries in oracle

Non-Correlated Subquery

- If a subquery is not dependent on the outer query it is called a non-correlated subquery**Subquery Errors**

- Minimize subquery errors: Use drag and drop, copy and paste to avoid running subqueries with spelling and database typos. Watch your multiple field SELECT comma use, extra or to few getting SQL error message "Incorrect syntax".

SQL Subquery Comments

Adding SQL Subquery comments are good habit (/* your command comment */) which can save you time, clarify your previous work .. results in less SQL headaches

Nested Queries and Performance Issues in SQL

Nested Queries are queries that contain another complete SELECT statement nested within it, that is, in the WHERE clause. The nested SELECT statement is called an "inner query" or an "inner SELECT." The main query is called "outer SELECT" or "outer query." Many nested queries are equivalent to a simple query using JOIN operation. The use of nested query in this case is to avoid explicit coding of JOIN which is a very expensive database operation and to improve query performance. However, in many cases, the use of nested queries is necessary and cannot be replaced by a JOIN operation.

I. Nested queries that can be expressed using JOIN operations:

Example 1: (Library DB Query A) How many copies of the book titled the lost tribe are owned by the library branch whose name is "Sharptown"?

Single Block Query Using Join:

```
SELECT  No_Of_Copies
      FROM    BOOK_COPIES, BOOK, LIBRARY_BRANCH
```

```
WHERE  BOOK_COPIES.BranchId = LIBRARY_BRANCH.BranchId AND
       BOOK_COPIES.BookId = BOOK.BookId        AND
       BOOK.Title = "The Lost Tribe"  AND
       LIBRARY_BRANCH.BranchName = "Sharpstown";
```

Using Nested Queries:

```
SELECT No_Of_Copies
FROM     BOOK_COPIES
 WHERE      BranchID  IN
              (SELECT  BranchID  from LIBRARY_BRANCH   WHERE
                     LIBRARY_BRANCH.BranchName = "Sharpstown")

 AND          BookID IN
                (SELECT  BookID from  BOOK  WHERE
                BOOK.Title = "The Lost Tribe" ) ;
```

Performance considerations: The nested queries in this example involves simpler and faster operations. Each subquery will be executed once and then a simple select operation will be performed. On the other hands, the operations using join require Cartesian products of three tables and have to evaluate 2 join conditions and 2 selection conditions. Nested queries in this example also save internal temporary memory space for holding Cartesian join results.

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Rule of thumb:

- ***Correlated queries*** *where the inner query references some attribute of a relation declared in the outer query and use the" =" or IN operators.*
- *Conversely, if the attributes in the projection operation of a single block query that joins several tables are from only one table, this query can always be translated into a nested query.*

==========
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Example 2: see Query 12 and Query 12A

Retrieve the name of each employee who has a dependent with the same first name and same sex as the employee.

Single Block query using JOIN operation

```
select A.fname, A.lname from
employee A, dependent B
where A.ssn = B.essn and
        A.sex = B.sex and A.fname = B.dependent_name;
```

Correlated Query: select A.fname, A.lname from employee A where A.ssn **IN** (SELECT essn

FROM dependent
WHERE **essn = A.ssn** and dependent_name = A.fname and sex = A.sex);

Computer Procedures:

Conceptually, think of this query as stepping through the EMPLOYEE table one row at a time, and then executing the inner query each time. The first row has A.fname = "John" and A.sex = "M" so that the inner query becomes **SELECT Essn FROM dependent where essn = 12345678, dependent_name = "John" and sex = "M"**; The first run of the subquery returns nothing so it continues to proceed to the next tuple and executes the inner query again with the values of A.SSN, A.fname and A.sex for the second row, and so on for all rows of EMPLOYEE.

The term *correlated subquery* is used because its value depends on a variable (or variables) that receives its value from an outer query (e.g., A.SSN, A.fname, A.sex in this example; they are called **correlation variables**.). A correlated subquery thus cannot be evaluated once and for all. It must be evaluated repeatedly -- once for each value of the variable received from the outer query. This is different from non-correlated subqueries explained below.

Non-correlated Subquery:

A non-correlated subquery needs to be evaluated only once. For example:

Query EMP-NQ2: find an employee that has the highest salary of the company.

SELECT fname, lname, bdate

FROM EMPLOYEE

WHERE salary = **(SELECT max (salary) FROM Employee)**;

Here the inner query returns a value: 55000. The inner query will be executed first and only *once* and then the entire query becomes

SELECT fname, lname, bdate

FROM EMPLOYEE WHERE **salary = 55000**;

II. Nested Queries that cannot be directly translated into Join Operations

Rule of thumb:

- Unknown selection criteria: WHERE clause examines unknown value.

For example shown above (Query EMP-NQ2): find everybody in a department which has an employee that has the highest salary of the company.

Another example in section 7.2.5. finds employees who has salary higher than the highest salary in Department 5.

SELECT ssn, salary, dno from Employee where salary > (SELECT max (salary) from employee where dno = 5);

- Relational **set** operations such as Division or other comparison that involves EXISTS, NOT EXISTS, > , etc. (This may involve using paradox SET operation operators, such as NO, ONLY, EXACTLY and EVERY.)

- Outer Join that involves Null value operations. This is the equivalent of using NOT EXISTS. (See *SQL solution for queries on Library DB*: query C and C').

III. General Discussion on SQL query formulation:

There are many ways to specify the same query in SQL. This flexibility in specifying queries has advantage and disadvantages.

- Advantage: You can choose a way to express the query that you prefer. **It is general preferable to write a query with as little nesting and implied ordering as possible.**
- Disadvantages:
    - the user may be confused

- users may have the burden to figure out which way is more efficient due to different DBMS query optimization strategies. (Performance issues.)

Sample Correlated and Non-correlated Subqueries

Write SQL statements for the following queries on the Company Database and determine whether it's a correlated or non-correlated query. (Please translate your SQL single-block join, if applicable, to subqueries.)

Tip: the term *correlated subquery* is used because its value depends on a variable (or variables) that receives its value from an outer query (e.g., A.SSN, A.fname, A.sex in the example shown in the previous handout; they are called **correlation variables**.). A correlated subquery thus cannot be evaluated once and for all. It must be evaluated repeatedly -- once for each value of the variable received from the outer query. A non-correlated subquery needs to be evaluated only once.

Lab Experiment

```
SQL> select * from employee;

    EMPNO ENAME                JOB                  DEP        SAL
---------- -------------------- -------------------- --- ----------
         1 Aditya               ML                   101     100000
       200 Aman                 AI                   111      50000
       200 Aman                 AI                   111      50000
       250 Lenar                Mechanic               1      20000
        50 Kil                  Ass. Prof            201      15000

SQL> insert into employee values(30, 'Broth', 'Teacher', 80, 65000);

1 row created.

SQL> insert into employee values(430, 'Kristy', 'Teacher', 80, 45000);

1 row created.
```

SQL> insert into employee values(540, 'Brenda', 'Teacher', 80, 40000);

1 row created.

SQL> select * from employee;

EMPNO	ENAME	JOB	DEP	SAL
1	Aditya	ML	101	100000
200	Aman	AI	111	50000
200	Aman	AI	111	50000
250	Lenar	Mechanic	1	20000
50	Kil	Ass. Prof	201	15000
30	Broth	Teacher	80	65000
430	Kristy	Teacher	80	45000
540	Brenda	Teacher	80	40000

8 rows selected.

SQL> select sal from employee;

SAL
100000
50000
50000

20000

15000

65000

45000

40000

8 rows selected.

SQL> desc employee;

Name	Null?	Type
EMPNO		NUMBER(38)
ENAME	NOT NULL	VARCHAR2(20)
JOB	NOT NULL	VARCHAR2(20)
DEPTNO		VARCHAR2(3)
SAL		NUMBER(38)

SQL> select sal from employee where deptno = 80;

SAL

65000

45000

40000

SQL> select avg(sal) from employee where deptno = 80;

```
  AVG(SAL)
----------
     50000
```

```
SQL> select * from employee where sal > (select avg(sal) from employee where deptno = 60);

no rows selected

SQL> select * from employee where sal > 50000;

    EMPNO ENAME              JOB                 DEP       SAL
---------- -------------------- -------------------- --- ----------
         1 Aditya               ML                  101     100000
        30 Broth                Teacher              80      65000

SQL> select * from employee where sal > (select avg(sal) from employee where deptno = 60);

no rows selected

SQL> select * from employee where sal > (select avg(sal) from employee where deptno = 80);

    EMPNO ENAME              JOB                 DEP       SAL
---------- -------------------- -------------------- --- ----------
         1 Aditya               ML                  101     100000
        30 Broth                Teacher              80      65000

SQL> insert into emp values(214, 'Ghu', 'Teacher', 80, 46000);
```

1 row created.

SQL> insert into emp values(345, 'Bu', 'ML', 101, 94000);

1 row created.

SQL> select empno, ename from employee where deptno in (select deptno from employee where employee.ename like '%u');

no rows selected

SQL> select empno, ename from employee where deptno in (select deptno from employee where ename like '%u');

no rows selected

SQL> select deptno from employee where ename like '%u';

no rows selected

SQL> select * from employee;

EMPNO	ENAME	JOB	DEP	SAL
1	Aditya	ML	101	100000
200	Aman	AI	111	50000
200	Aman	AI	111	50000
250	Lenar	Mechanic	1	20000
50	Kil	Ass. Prof	201	15000

```
 30 Broth            Teacher          80       65000
430 Kristy           Teacher          80       45000
540 Brenda           Teacher          80       40000
```

8 rows selected.

```
SQL> insert into employee values(214, 'Ghu', 'Teacher', 80, 46000);
```

1 row created.

```
SQL> insert into employee values(345, 'Bu', 'ML', 101, 94000);
```

1 row created.

```
SQL> select empno, ename from employee where deptno in (select deptno from employee
where ename like '%u');

    EMPNO ENAME
---------- --------------------
 30 Broth
430 Kristy
540 Brenda
214 Ghu
  1 Aditya
345 Bu
```

6 rows selected.

```
SQL> insert into employee values(248, 'Ham', 'Transport', 170, 67000);

1 row created.

SQL> select ename, deptno, empno from employee where deptno = 170;

ENAME                DEP      EMPNO
-------------------- --- ----------
Ham                  170        248

SQL> create table product
  2  ( catno int,
  3  name varchar(10),
  4  cost int,
  5  id int
  6  );

Table created.

SQL> insert into product values(100, 'Brush', 100, 64);

1 row created.

SQL> insert into product values(100, 'Paint', 300, 103);

1 row created.

SQL> insert into product values(100, 'Bucket', 500, 123);
```

1 row created.

SQL> insert into product values(60, 'Mouse', 900, 143);

1 row created.

SQL> insert into product values(60, 'File', 50, 243);

1 row created.

SQL> insert into product values(60, 'Folder', 100, 203);

1 row created.

SQL> insert into product values(80, 'Orange', 50, 23);

1 row created.

SQL> insert into product values(80, 'Apple', 100, 33);

1 row created.

SQL> select * from product;

CATNO	NAME	COST	ID
100	Brush	100	64

```
       100 Paint            300       103
       100 Bucket           500       123
        60 Mouse            900       143
        60 File              50       243
        60 Folder           100       203
        80 Orange            50        23
        80 Apple            100        33

8 rows selected.

SQL> select * from product where catno in (select catno from product where id = 64);

    CATNO NAME            COST        ID
---------- ---------- ---------- ----------
       100 Brush           100        64
       100 Paint           300       103
       100 Bucket          500       123


SQL> select * from product where cost > (select avg(cost) from product where catno = 60);

    CATNO NAME            COST        ID
---------- ---------- ---------- ----------
       100 Bucket          500       123
        60 Mouse           900       143

SQL> select * from product where cost in (select cost from product where catno = 80);
```

CATNO	NAME	COST	ID
60	File	50	243
80	Orange	50	23
100	Brush	100	64
60	Folder	100	203
80	Apple	100	33

SQL> select * from product where cost > (select max(cost) from product where catno = 80);

CATNO	NAME	COST	ID
100	Paint	300	103
100	Bucket	500	123
60	Mouse	900	143

SQL> spool off;

Result - SQL Subqueries have been studied and implemented.

EXERCISE – 8

Aim: To study SET OPERATIONS and VIEWS in SQL

The Set operator combines the result of 2 queries into a single result.The following are the operators:

· **Union**

· **Union all**

· **Intersect**

· **Minus**

Rule:

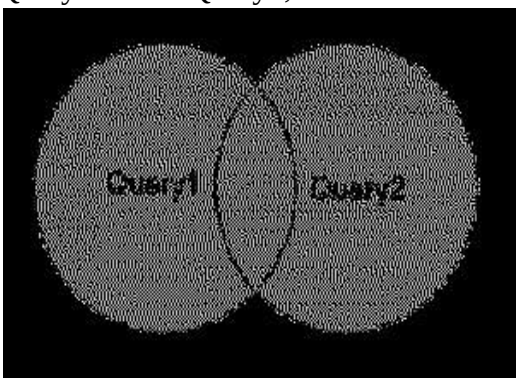
The queries which are related by the set operators should have a same number of column and column definition.

Union:

Returns all distinct rows selected by both the queries

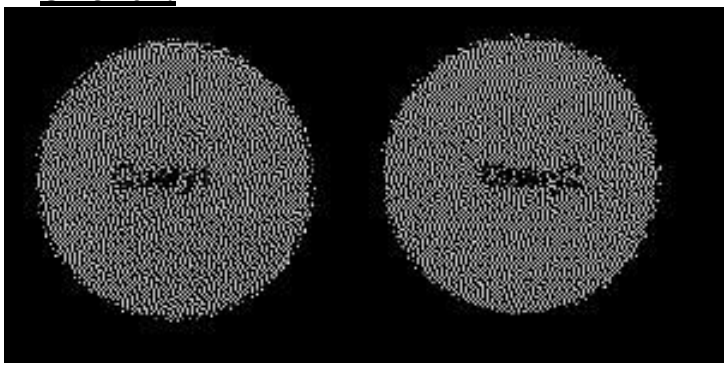
Syntax:

Query1 Union Query2;



Exp: SELECT * FROM table1 UNION SELECT * FROM table2;

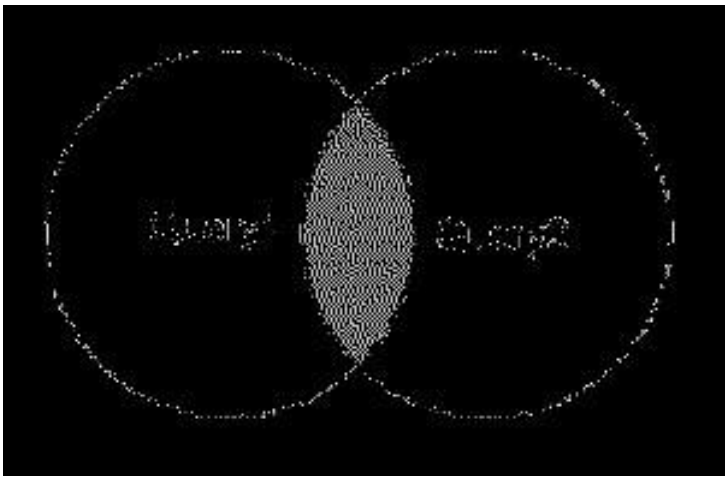
Union all:



Returns all rows selected by either query including the duplicates.
Syntax:
Query1 Union all Query2;

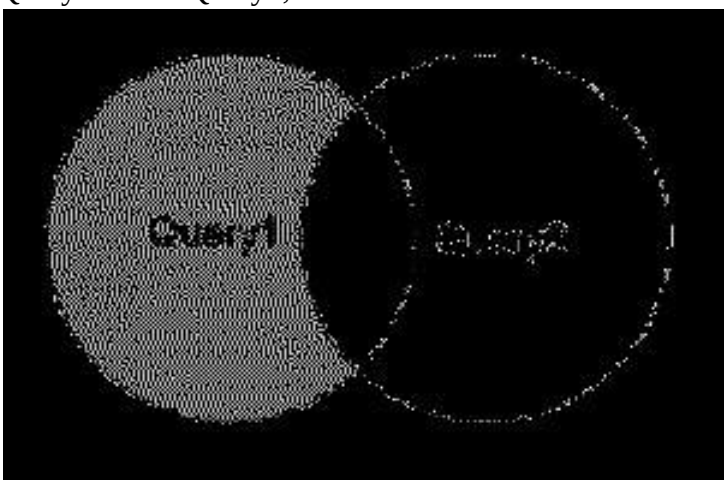
Exp: SELECT * FROM table1 UNION ALL SELECT * FROM table2;

Intersect
Returns rows selected that are common to both queries.
Syntax:
Query1 Intersect Query2;



Exp: SELECT * FROM table1 INTERSECT SELECT * FROM table2;

Minus
Returns all distinct rows selected by the first query and are not by the second
Syntax:
Query1 minus Query2;



Exp: SELECT * FROM table1 MINUS SELECT * FROM table2;

VIEWS

A view is the tailored presentation of data contained in one or more table and can also be said as restricted view to the data's in the tables. A view is a "virtual table" or a "stored query" which takes the output of a query and treats it as a table. The table upon which a view is created is called as base table.

Advantages of a view:

- Additional level of table security.
- Hides data complexity.
- Simplifies the usage by combining multiple tables into a single table.
- Provides data‟s in different perspective.

Types of view:

Horizontal -> enforced by where cause
Vertical -> enforced by selecting the required columns

SQL Commands for Creating and dropping view:

Syntax:

Create [or replace] view <view name> [column alias names] as <query> [with <options> conditions];
Drop view <view name>;

Lab Experiment:

```
SQL> desc employee;
 Name                                      Null?    Type
 ----------------------------------------- -------- ----------------------------
 EMPID                                     NOT NULL NUMBER(38)
 EMPNAME                                            VARCHAR2(20)
 LOCATION                                           VARCHAR2(10)
 DEPT                                               VARCHAR2(10)
 SALARY                                             NUMBER(38)

SQL> insert into employee values(101, 'Aditya', 'Kol', 'AI', 1000000);

1 row created.

SQL> insert into employee values(102, 'Adi', 'Kol', 'AI', 500000);

1 row created.

SQL> insert into employee values(103, 'Kalim', 'Guj', 'Mech', 40000);

1 row created.

SQL> insert into employee values(104, 'Burj', 'Bihar', 'Civil', 1000);

1 row created.

SQL> insert into employee values(105, 'Lin', 'Kerela', 'Business', 100000);

1 row created.

SQL> insert into employee values(1000, 'Ayanokouji', 'Japan', 'HR', 10000000);

1 row created.

SQL> select * from employee;

    EMPID EMPNAME              LOCATION   DEPT          SALARY
--------- -------------------- ---------- ---------- ----------
      101 Aditya               Kol        AI            1000000
      102 Adi                  Kol        AI             500000
      103 Kalim                Guj        Mech            40000
      104 Burj                 Bihar      Civil            1000
      105 Lin                  Kerela     Business       100000
     1000 Ayanokouji           Japan      HR           10000000

6 rows selected.
```

SQL> select empid, empname from employee where salary > 300000 union select empid, empname from employee where salary < 100000;

```
    EMPID EMPNAME
---------- --------------------
       101 Aditya
       102 Adi
       103 Kalim
       104 Burj
      1000 Ayanokouji
```

SQL> select empid, empname from employee where dept = 'AI' union select empid, empname from employee where salary > 100000;

```
    EMPID EMPNAME
---------- --------------------
       101 Aditya
       102 Adi
      1000 Ayanokouji
```

SQL> select empid, empname from employee where dept = 'AI' union all select empid, empname from employee where salary > 100000;

```
    EMPID EMPNAME
---------- --------------------
       101 Aditya
       102 Adi
       101 Aditya
       102 Adi
      1000 Ayanokouji
```

SQL> select empid, empname from employee where dept = 'AI' union all select empid, empname from employee where salary > 100000 order by empname;

```
    EMPID EMPNAME
---------- --------------------
       102 Adi
       102 Adi
       101 Aditya
       101 Aditya
      1000 Ayanokouji
```

SQL> select empid, empname from employee where dept = 'AI' intersect select empid, empname from employee where salary > 100000 order by empname;

```
    EMPID EMPNAME
---------- --------------------
       102 Adi
       101 Aditya
```

```
SQL> spool off;

SQL> create table student(
  2  sid int primary key,
  3  fname varchar(20),
  4  lname varchar(20),
  5  address varchar(20),
  6  zip int,
  7  phone int
  8  );

Table created.

SQL> create table dept(
  2  deptid int primary key,
  3  deptname varchar(20)
  4  );

Table created.


SQL> insert into student values(2, 'Ghaha', 'Bhhahah', 'Somalia', 23020, 1010101034);

1 row created.

SQL> insert into student values(3, 'Oveveveve', 'Ofuefuefuefue', 'Afrika', 23420, 2010101034);

1 row created.

SQL> insert into dept values(100, 'AI');

1 row created.

SQL> insert into dept values(101, 'ML');

1 row created.

SQL> insert into dept values(102, 'Mech');

1 row created.

SQL> insert into dept values(103, 'Anime');

1 row created.

SQL> select * from student;

       SID FNAME                LNAME                ADDRESS
---------- -------------------- -------------------- --------------------
```

```
       ZIP      PHONE
---------- ----------
         1 A                Bh                 Ghana
     10000 1010101010

         2 Ghaha            Bhhahah            Somalia
     23020 1010101034

         3 Oveveveve        Ofuefuefuefue      Afrika
     23420 2010101034


SQL> select * from dept;

    DEPTID DEPTNAME
---------- --------------------
       100 AI
       101 ML
       102 Mech
       103 Anime

SQL> create view stud as select student.sid, student.fname, student.lname, dept.deptid from student, dept;

View created.

SQL> select * from stud;

       SID FNAME              LNAME                DEPTID
---------- -------------------- -------------------- ----------
         1 A                Bh                 100
         1 A                Bh                 101
         1 A                Bh                 102
         1 A                Bh                 103
         2 Ghaha            Bhhahah                100
         2 Ghaha            Bhhahah                101
         2 Ghaha            Bhhahah                102
         2 Ghaha            Bhhahah                103
         3 Oveveveve        Ofuefuefuefue          100
         3 Oveveveve        Ofuefuefuefue          101
         3 Oveveveve        Ofuefuefuefue          102

       SID FNAME              LNAME                DEPTID
---------- -------------------- -------------------- ----------
         3 Oveveveve        Ofuefuefuefue          103

12 rows selected.
```

Result - SET and View Operations have been studied and successfully implemented.

Exercise 9

Aim : To perform PL/SQL Programs

In addition to SQL commands, PL/SQL can also process data using flow of statements. The flow of control statements are classified into the following categories.

- Conditional control -Branching
- Iterative control – looping
- Sequential control

BRANCHING in PL/SQL:

Sequences of statements can be executed on satisfying certain condition . If statements are being used and different forms of if are:

- Simple IF
- If-Else
- Nested IF

SIMPLE IF:

Syntax
IF condition THEN statement1; statement2;

END IF;

IF-THEN-ELSE STATEMENT:

Syntax:

IF condition THEN statement1;

```
ELSE statement2;

END IF;
```

ELSIF STATEMENTS:

Syntax:

```
IF condition1 THEN statement1;
ELSIF condition2 THEN statement2;
ELSIF condition3 THEN statement3;
ELSE statement;

END IF;
```

NESTED IF :

Syntax:

```
IF condition THEN statement1;

ELSE
  IF condition THEN statement2;

  ELSE statement3;

  END IF;
END IF;
ELSE statement3;

END IF;
```

SELECTION IN PL/SQL(Sequential Controls) SIMPLE CASE

Syntax:

```
CASE SELECTOR
WHEN Expr1 THEN statement1;
WHEN Expr2 THEN statement2;
          :
ELSE Statement n;
```

END CASE;
SEARCHED
CASE:
CASE
WHEN searchcondition1
THEN statement1; WHEN
searchcondition2 THEN statement2;
:
ELSE statement n;
END CASE;

ITERATIONS IN PL/SQL

Sequence of statements can be executed any number of times using loop construct. It is broadly classified into:

- Simple Loop
- For Loop
- While Loop

SIMPLE LOOP
Syntax:

LOOP statement1;

EXIT [WHEN
Condition]; END
LOOP;

WHILE LOOP

Syntax

WHILE condition LOOP statement1; statement2;

END LOOP;

FOR LOOP

Syntax:

```
FOR counter IN [REVERSE] LowerBound..UpperBound
LOOP
statement1;
statement2;
END
LOOP;
```

```
SQL> declare
  2  rev number := &rev;
  3  comm number;
  4  begin
  5  if rev > 200000
  6  then
  7  comm := 0.1;
  8  else
  9  comm := 0.05;
 10  end if;
 11  dbms_output.put_line('Value of commission: ' || comm);
 12  end;
 13  /
Enter value for rev: 250000
old   2: rev number := &rev;
new   2: rev number := 250000;
Value of commission: .1

PL/SQL procedure successfully completed.
```

```
SQL> declare
  2  monthly_value number := &monthly_value;
  3  income_level varchar(20);
  4  begin
  5  if monthly_value <= 4000
  6  then
  7  income_level := 'Low Income';
  8  elsif monthly_value <= 5000
  9  then
 10  income_level := 'Avg Income';
 11  else
 12  income_level := 'High Income';
 13  end if;
 14  dbms_output.put_line('Income level: ' || income_level);
 15  end;
 16  /
Enter value for monthly_value: 5600
old   2: monthly_value number := &monthly_value;
new   2: monthly_value number := 5600;
Income level: High Income

PL/SQL procedure successfully completed.
```

```
SQL> select table_name from user_tables;

TABLE_NAME
--------------------------------------------------------------------------------
EMPLOYEE
STUDENT
DEPT

SQL> create table customer
  2  (
  3  customer_id int primary key,
  4  name varchar(20)
  5  );

Table created.

SQL> insert into customer values (1, 'Aditya');

1 row created.

SQL> insert into customer values (2, 'Aman');

1 row created.

SQL> insert into customer values (3, 'Linu');

1 row created.

SQL> insert into customer values (4, 'Rahul');

1 row created.

SQL> select * from customer;

CUSTOMER_ID NAME
----------- --------------------
          1 Aditya
          2 Aman
          3 Linu
          4 Rahul

SQL> declare
  2  names customer.name % type;
  3  id customer.customer_id % type;
  4  begin
  5  id := &id;
  6  select name into names from customer where customer_id = id;
  7  dbms_output.put_line('Name of ' || id || ' is = ' || names);
  8  end;
  9  /
Enter value for id: 1
```

```
old   5: id := &id;
new   5: id := 1;
Name of 1 is = Aditya

PL/SQL procedure successfully completed.

SQL> spool off;
```

Result :

The Basic of PL/SQL programs has been successfully implemented

Exercise-10

Aim : To perform Procedures program in PL/SQL

Subprogram is a program unit that performs a particular task. These subprograms are combined to form larger programs. This is basically called the 'Modular design'. A subprogram can be invoked by another subprogram or program which is called a calling program.

A subprogram can be created –

- At the schema level
- Inside a package
- Inside a PL/SQL block

At the schema level, subprogram is a standalone subprogram. It is created with the CREATE PROCEDURE or the CREATE FUNCTION statement. It is stored in the database and can be deleted with the DROP PROCEDURE or DROP FUNCTION statement.

A subprogram created inside a package is a packaged subprogram. It is stored in the database and can be deleted only when the package is deleted with the DROP PACKAGE statement. We will discuss packages in the chapter 'PL/SQL - Packages'.

PL/SQL subprograms are named PL/SQL blocks that can be invoked with a set of parameters. PL/SQL provides two kinds of subprograms –

- Functions – These subprograms return a single value; mainly used to compute and return a value.
- Procedures – These subprograms do not return a value directly; mainly used to perform an action.

Parts of a PL/SQL Subprogram

Each PL/SQL subprogram has a name, and may also have a parameter list. Like anonymous PL/SQL blocks, the named blocks will also have the following three parts –

Creating a Procedure

A procedure is created with the CREATE OR REPLACE PROCEDURE statement. The simplified syntax for the CREATE OR REPLACE PROCEDURE statement is as follows –

```
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 the modification of an existing procedure. • The optional parameter list contains name, mode and types of the parameters. IN represents the value that will be passed from outside and OUT represents the parameter that 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.

Deleting a Standalone Procedure

A standalone procedure is deleted with the DROP PROCEDURE statement. Syntax for deleting a procedure is –

```
DROP PROCEDURE procedure-name;
```

You can drop the greetings procedure by using the following statement
– DROP PROCEDURE greetings;

Parameter Modes in PL/SQL Subprograms
The following table lists out the parameter modes in PL/SQL
subprograms – S.No Parameter Mode & Description

1	IN An IN parameter lets you pass a value to the subprogram. It is a read-only parameter. Inside the subprogram, an IN parameter acts like a constant. It cannot be assigned a value. You can pass a constant, literal, initialized variable, or expression as an IN parameter. You can also initialize it to a default value; however, in that case, it is omitted from the subprogram call. It is the default mode of parameter passing. Parameters are passed by reference.
2	OUT
	An OUT parameter returns a value to the calling program. Inside the subprogram, an OUT parameter acts like a variable. You can change its value and reference the value after assigning it. The actual parameter must be variable and it is passed by value.
3	IN OUT An IN OUT parameter passes an initial value to a subprogram and returns a updated value to the caller. It can be assigned a value and the value can be read. The actual parameter corresponding to an IN OUT formal parameter must be a variable, not a constant or an expression. Formal parameter must be assigned avalue. Actual parameter is passed by value.

Methods for Passing Parameters
Actual parameters can be passed in three ways –

- Positional notation
- Named notation
- Mixed notation

Positional Notation
In positional notation, you can call the procedure as –

findMin(a, b, c, d);

In positional notation, the first actual parameter is substituted for the first formal parameter; the second actual parameter is substituted for the second formal parameter, and so on. So,
a is substituted for x, b is substituted for y, c is substituted for z and d is
substituted for m. Named Notation
In named notation, the actual parameter is associated with the formal parameter
using the arrow symbol (=>). The procedure call will be like the following –

findMin(x => a, y => b, z => c, m => d);

Mixed Notation
In mixed notation, you can mix both notations in procedure call; however, the positional notation should precede the named notation. The following call is legal – findMin(a, b, c, m => d);

However, this is not legal: findMin(x
=> a, b, c, d);

Q.1 Write a PL/SQL block to get the salary of the employee who has empno=7369 and update his salary as specified below

• if his/her salary < 2500, then increase salary by 25% • otherwise if salary lies between 2500 and 5000, then increase salary by 20% • otherwise increase salary by adding commission amount to the salary.

```
SQL > Create table emp
(Depid
number(3),
empno
number(4),
salary number(5),
depname
varchar(6));

SQL > insert into emp values(71,7369,2600,'Civil');
1 Row(s) inserted
SQL > insert into emp values(73,7379,2800,'HRD');
1 Row(s) inserted
SQL > insert into emp values(71,7379,2200,'HRD');
1 Row(s) inserted
SQL > select * from emp;

   DEPID EMPNO SALARY DEPNAME 71 7369
                      2600 Civil
         73  7379
2800   HRD   71
7379   2200     3
```

HRD rows
selected.

```
SQL > create or replace procedure updatesalary (salary in number,
Depid in number) as
 begin
 if salary < 2500 then
• update emp set salary = salary+ 0.25*salary where Depid = 7369;
• elsif salary >= 2500 and salary < 5000 then
• update emp set salary = salary+ 0.2*salary where Depid = 7369;
• else8 update emp set salary = salary + 0.1*salary where Depid = 7369;
•  end if;
•  end;
•  /
```

Procedure created.

```
SQL > execute updatesalary(2600, 7369)
```

Q.2 Write a PL/SQL Block to modify the department name of the department 71 if it is not 'HRD'.

```
SQL > create or replace procedure updatedepartment (depname in varchar,
Depid in number) as
 begin
 update emp set depname = 'HRD' where Depid = 71 and depname not in
('HRD');
 end;
 /
```

Procedure Created

```
SQL > execute updatesalary('Civil', 71)
```

Result :

Programs related to Procedure in PL/SQL has been successfully implemented.

Exercise-11

Aim: To perform functions in PL/SQL.

A function is the 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 as follows –

```
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 the modification of an existing function. • The optional parameter list contains name, mode and types of the parameters. IN represents the value that will be passed from outside and OUT represents the parameter that will be used to return a value outside of the procedure.
- The function must contain a return statement.
- The RETURN clause specifies the 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. Calling a Function

While creating a function, you give a definition of what the function has to do. To use a function, you will have to call that function to perform the defined task. When a program calls a function, the program control is transferred to the called function.

SQL> set serveroutput on

Q.1 Write a PL/SQL Function to find factorial of a given number.

SQL> CREATE OR REPLACE FUNCTION FACT(N NUMBER) 2 RETURN NUMBER IS

- I NUMBER(10);
- F NUMBER:=1;
- BEGIN
- FOR I IN 1..N LOOP
- F:=F*I;
- END LOOP;
- RETURN F;
- END;
- /

Function created.

SQL> SELECT FAC(5) FROM DUAL;

```
 FACT(5)
-------
   120
```

Q.2 Write a PL/SQL Function that computes and returns the maximum of two values. SQL> DECLARE

- a number;
- b number;
- c number;
- FUNCTION findMax(x IN number, y IN number)
- RETURN number
- IS
- z number;
- BEGIN
- IF x > y THEN
- z:= x;
- ELSE
- Z:= y;
- END IF;
- RETURN z;
- END;
- BEGIN
- a:= 23;

- b:= 45;
- c := findMax(a, b);
- dbms_output.put_line(' Maximum of (23,45): ' || c);
- END;

/

Maximum of (23,45): 45

PL/SQL procedure successfully completed.

SQL> SPOOL OFF

Result:

Programs related to Function in PL/SQL have been successfully implemented.

Exercise-12

AIM:

To implement the concept of CURSORS in PL/SQL

A cursor is a pointer to this context area. PL/SQL controls the context area through a cursor. A cursor holds the rows (one or more) returned by a SQL statement. The set of rows the cursor holds is referred to as the active set.

You can name a cursor so that it could be referred to in a program to fetch and process the rows returned by the SQL statement, one at a time. There are two types of cursors –

- **Implicit cursors**
- **Explicit cursors**

Implicit Cursors:

Implicit cursors are automatically created by Oracle whenever an SQL statement is executed, when there is no explicit cursor for the statement. Programmers cannot control the implicit cursors and the information in it.

Whenever a DML statement (INSERT, UPDATE and DELETE) is issued, an implicit cursor is associated with this statement. For INSERT operations, the cursor holds the data that needs to be inserted. For UPDATE and DELETE operations, the cursor identifies the rows that would be affected.

In PL/SQL, you can refer to the most recent implicit cursor as the SQL cursor, which always has attributes such as %FOUND, %ISOPEN, %NOTFOUND, and %ROWCOUNT. The SQL cursor has additional attributes, %BULK_ROWCOUNT and %BULK_EXCEPTIONS, designed for use with the FORALL statement. The following
table provides the description of the most used attributes –

S.No Attribute & Description

1	%FOUND Returns TRUE if an INSERT, UPDATE, or DELETE statement affected one or more rows or a SELECT INTO statement returned one or more rows. Otherwise, it returns FALSE.
2	%NOTFOUND The logical opposite of %FOUND. It returns TRUE if an INSERT, UPDATE, or DELETE statement affected no rows, or a SELECT INTO statement returned no
	rows. Otherwise, it returns FALSE.
3	%ISOPEN Always returns FALSE for implicit cursors, because Oracle closes the SQL cursor automatically after executing its associated SQL statement.
4	%ROWCOUNT Returns the number of rows affected by an INSERT, UPDATE, or DELETE statement, or returned by a SELECT INTO statement.

Explicit Cursors:

Explicit cursors are programmer-defined cursors for gaining more control over the context area. An explicit cursor should be defined in the declaration section of the PL/SQL Block. It is created on a SELECT Statement which returns more than one row.

The syntax for creating an explicit cursor is –

```
CURSOR cursor_name IS select_statement;
```

Working with an explicit cursor includes the following steps –

- Declaring the cursor for initializing the memory
- Opening the cursor for allocating the memory
- Fetching the cursor for retrieving the data
- Closing the cursor to release the allocated memory

Declaring the Cursor

Declaring the cursor defines the cursor with a name and the associated SELECT statement. For example –

```
CURSOR c_customers IS
SELECT id, name, address FROM customers;
```

Opening the Cursor

Opening the cursor allocates the memory for the cursor and makes it ready for fetching the rows returned by the SQL statement into it. For example, we will open the above defined cursor as follows –

```
OPEN c_customers;
```

Fetching the Cursor

Fetching the cursor involves accessing one row at a time. For example, we

will fetch rows from the above-opened cursor as follows – FETCH

c_customers INTO c_id, c_name, c_addr;

Closing the Cursor

Closing the cursor means releasing the allocated memory. For example, we will close the above opened cursor as follows –

CLOSE c_customers;

SQL> set serveroutput on

Q.1 Write a PL/SQL Block, to update salaries of all the employees who work in deptno 20 by 15%. If none of the employee's salary are updated display a message 'None of the salaries were updated'. Otherwise display the total number ofemployee who got salary updated.

SQL> create table emp(

- dept_id number(10),
- salary number(10));

Table Created

SQL> desc emp

Column Null? Type

DEPT_ID - NUMBER(10,0) SALARY

- NUMBER(10,0)

SQL > Insert into emp values(10,1000); 1 row(s) inserted.

SQL >Insert into emp values(20,1000); 1 row(s) inserted.

SQL >Insert into emp values(20,2000); 1 row(s)
inserted.
SQL >Insert into emp values(30,1500); 1 row(s)
inserted.

SQL > select * from emp;

DEPT_ID SALARY10
1000
20 1000
20 2000
30 1500

4 rows selected.
Declare num number(5); Begin
update emp set salary = salary +
salary*0.15 where dept_id=20; if SQL%NOTFOUND then
dbms_output.put_line('none of the salaries were updated'); elsifSQL%FOUND
then
num := SQL%ROWCOUNT;
dbms_output.put_line('salaries for '|| num || ' employees areupdated');
end if;
End;
/

PL/SQL procedure successfully completed. salaries for 2 employees
are updated

SQL > select * from emp ;

DEPT_ID SALARY
10 1000
20 1150
20 2300
30 1500
4 rows selected.

Result:

Programs related to concept of cursors in PL/SQL has been successfully implemented.

Exercise-13

Aim:

To perform the implementation of the concept TRIGGERS IN PL/SQL

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 can 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 existing trigger with the trigger_name.

  {BEFORE | AFTER | INSTEAD OF} – This specifies when the trigger willbe executed. The INSTEAD OF clause is used for creating trigger on a DML operation. • [OF col_name] – This specifies the column name thatwill 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 values for various DML statements, such as INSERT, UPDATE, and DELETE.
- [FOR EACH ROW] – This specifies a row-level trigger, i.e., the trigger will be executed for each row being affected. Otherwise the trigger will execute just once when the 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.

The following points need to be considered here –

- OLD and NEW references are not available for table-level triggers, rather you can use them for record-level triggers.
- If you want to query the table in the same trigger, then you should use the AFTER keyword, because triggers can query the table or change it again only after the initial changes are applied and the table is back in a consistent state.
- The above trigger has been written in such a way that it will fire before any DELETE or INSERT or UPDATE operation on the table, but you can write your trigger on a single or multiple operations, for example BEFORE DELETE, which will fire whenever a record will be deleted using the DELETE operation on the table.
- view. • {INSERT [OR] | UPDATE [OR] | DELETE} – This specifies the

Triggering a Trigger

Let us perform some DML operations on the CUSTOMERS table. Here is one INSERT statement, which will create a new record in the table –

```
INSERT INTO CUSTOMERS (ID,NAME,AGE,ADDRESS,SALARY)
VALUES (7, 'Kriti', 22, 'HP', 7500.00 );
```

When a record is created in the CUSTOMERS table, the above trigger, display_salary_changes will be fired. will display the following result –

Because this is a new record, old salary is not available and the above result comes as null. Let us now perform one more DML operation on the CUSTOMERS table. The UPDATE statement will update an existing record in the table –

```
UPDATE customers
SET salary = salary + 500
WHERE id = 2;
```

When a record is updated in the CUSTOMERS table, the above trigger, display_salary_changes will be fired and it will display the following result –

```
Old salary: 1500 New
salary: 2000
```

create

1. Create a Trigger to check the entered age is valid or not.

```
create or replace trigger DateofBirth
after insert on Account
begin
if(NEW.age<18)
then dbms_output.put_line('Age should be more than 18');
END;
/
```

2. Create a row-level trigger for the customers table that would fire for INSERT or UPDATE or DELETE operations performed on that table.

```
CREATE OR REPLACE TRIGGER display_salary_changes
BEFORE DELETE OR INSERT OR UPDATE ON customers
FOR 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;
/
```

Result:

Programs related to Trigger in PL/SQL have been successfully implemented.

Exercise-14

Aim:

To implement the concept of exception handling in PL/SQL.

In PL/SQL a warning or error condition is called an exception. Exceptions can be internally defined (by the runtime system) or user-defined. Examples of internally defined exceptions include division by zero and out of memory.

Predefined Exceptions

CURSOR_ALREADY_OPEN is raised if you try to OPEN an already open cursor. DUP_VAL_ON_INDEX is raised if you try to store duplicate values in a database column that is constrained by a unique index.

INVALID_CURSOR is raised if you try an illegal cursor operation. For example, if you try to CLOSE an unopened cursor.

INVALID_NUMBER is raised in a SQL statement if the conversion of a character string to a number fails.

LOGIN_DENIED is raised if you try logging on to ORACLE with an invalid username/password.

NO_DATA_FOUND is raised if a SELECT INTO statement returns no rows or if you reference an uninitialized row in a PL/SQL table.

NOT_LOGGED_ON is raised if your PL/SQL program issues a database call without being logged on to ORACLE. PROGRAM_ERROR is raised if PL/SQL has an internal problem.

STORAGE_ERROR is raised if PL/SQL runs out of memory or if memory is corrupted. TIMEOUT_ON_RESOURCE is raised if a timeout occurs while ORACLE is waiting for a resource.

TOO_MANY_ROWS is raised if a SELECT INTO statement returns more than one row. VALUE_ERROR is raised if an arithmetic, conversion, truncation, or constraint error occurs.

ZERO_DIVIDE is raised if you try to divide a number by zero. Handling Raised Exception

Syntax :
EXCEPTION

WHEN ... THEN

• handle the error differently

WHEN ... OR ... THEN

• handle the error differently

WHEN OTHERS THEN

• handle the error differently

END;

User Defined Exception:

Unlike predefined exceptions, user-defined exceptions must be declared and must be raised explicitly by RAISE statements. Exceptions can be declared only in the declarative part of a PL/SQL block, subprogram, or package. You declare an exception by introducing its name, followed by the keyword EXCEPTION.

Exception Declaration Ex.

DECLARE

past_due EXCEPTION; acct_num

NUMBER(5);

BEGIN

Exceptions and variable declarations are similar. But remember, an exception is an error condition, not an object. Unlike variables, exceptions cannot appear in assignment statements or SQL statements.

Syntax.

Exception-name Exception;

Using Raise statement

User-defined exceptions must be raised explicitly by RAISE statements. Syntax

RAISE exception-name;

Raise_Application_Error

This is a procedure to issue user-defined error messages from a stored

subprogram or database trigger.

Syntax : raise_application_error(error_number, error_message);

where error_number is a negative integer in the range -20000..-20999 and error_message is a character string up to 512 bytes in length.

Ex. IF salary is NULL THEN

raise_application_error(-20101, 'Salary is missing');

SQL> SET SERVEROUTPUT ON

Q.1 Write a PL/SQL program that accepts a customer id as an input and returns the customer name using exception handling.

SQL> create table customer(c_id number(10), c_name varchar2(10)); Table created.

SQL> insert into customer values(1, ‘Aditya’); 1 row(s) inserted.

SQL> insert into customer values(2, ‘Bhim’); 1 row(s) inserted.

SQL> insert into customer values(3, ‘Varun’); 1 row(s) inserted.

SQL> insert into customer values(4, ‘Alan’); 1 row(s) inserted.

SQL> DECLARE

- l_name customer.c_name%TYPE;
- l_customer_id customer.c_id%TYPE := 4;
- BEGIN
- SELECT c_name INTO l_name
- FROM customer

- WHERE c_id = l_customer_id;
- dbms_output.put_line('Customer name is ' || l_name);
- EXCEPTION
- WHEN NO_DATA_FOUND THEN
- dbms_output.put_line('Customer ' || l_customer_id || '
doesnot exist');
- 12 END;

13 /

Customer name is Alan

SQL> DECLARE

- l_name customer.c_name%TYPE;
- l_customer_id customer.c_id%TYPE := 10;
- BEGIN
- SELECT c_name INTO l_name
- FROM customer
- WHERE c_id = l_customer_id;8 dbms_output.put_line('Customer name
  is ' || l_name); 9 EXCEPTION
- WHEN NO_DATA_FOUND THEN
- dbms_output.put_line('Customer ' ||l_customer_id || ' does not exist');
  12 END;

13 /

Customer 10 does not exist

SQL>SPOOL OFF

Result:

The implementation of the concept exception handling in PL/SQL has been successfully implemented.