CS23332 DATABASE MANAGEMENT SYSTEM LABORATORY

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Definition of a Relational Database

A relational database is a collection of relations or two-dimensional tables.

Terminologies Used in a Relational Database

1. A single ROW or table representing all data required for a particular employee. Each row should be identified by a primary key which allows no duplicate rows.

2. A COLUMN or attribute containing the employee number which identifies a unique employee. Here Employee number is designated as a primary key ,must contain a value and must be unique.

3. A column may contain foreign key. Here Dept_ID is a foreign key in employee table and it is a primary key in Department table.

4. A Field can be found at the intersection of a row and column. There can be only one value in it. Also it may have no value. This is called a null value.

EMP ID	FIRST NAME	LAST NAME	EMAIL
100	King	Steven	Sking
101	John	Smith	Jsmith
102	Neena	Bai	Neenba
103	Eex	De Haan	Ldehaan

Relational Database Properties

A relational database :

- Can be accessed and modified by executing structured query language (SQL) statements.
- Contains a collection of tables with no physical pointers.
- Uses a set of operators

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Relational Database Management Systems

RDBMS refers to a relational database plus supporting software for managing users and processing SQL queries, performing backups/restores and associated tasks.
(Relational Database Management System) Software for storing data using SQL (structured query language). A relational database uses SQL to store data in a series of tables that not only record existing relationships between data items, but which also permit the data to be joined in new relationships. SQL (pronounced 'sequel') is based on a system of algebra developed by E F Codd, an IBM scientist who first defined the relational model in 1970. Relational databases are optimized for storing transactional data, and the majority of modern business software applications therefore use an RDBMS as their data store. The leading RDBMS vendors are Oracle, IBM and Microsoft.

The first commercial RDBMS was the Multics Relational Data Store, first sold in 1978.
INGRES, Oracle, Sybase, Inc., Microsoft Access, and Microsoft SQL
Server are well-known database products and companies.Others include PostgreSQL, SQL/DS, a nd RDB.
A relational database management system (RDBMS) is a program that lets you create, update, and administer a relational database. Most commercial RDBMS's use the Structured Query Language (SQL) to access the database, although SQL was invented after the development of the relational model and is not necessary for its use.
The leading RDBMS products are Oracle, IBM's DB2 and Microsoft's SQL Server. Despite repeated challenges by competing technologies, as well as the claim by some experts that no current RDBMS has fully implemented relational principles, the majority of new corporate databases are still being created and managed with an RDBMS.

SQL Statements

1. Data Retrieval(DR)
2. Data Manipulation Language(DML)
3. Data Definition Language(DDL)
4. Data Control Language(DCL)
5. Transaction Control Language(TCL)

TYPE	STATEMENT	DESCRIPTION
DR	SELECT	Retrieves the data from the database
DML	1.INSERT 2.UPDATE 3.DELETE 4.MERGE	Enter new rows, changes existing rows, removes unwanted rows from tables in the database respectively.

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DDL	1.CREATE 2.ALTER 3.DROP 4.RENAME 5.TRUNCATE	Sets up, changes and removes data structures from tables.
TCL	1.COMMIT 2.ROLLBACK 3.SAVEPOINT	Manages the changes made by DML statements. Changes to the data can be grouped together into logical transactions.
DCL	1.GRANT 2.RREVOKE	Gives or removes access rights to both the oracle database and the structures within it.

DATA TYPES

1. **Character Data types:**

- Char – fixed length character string that can varies between 1-2000 bytes
- Varchar / Varchar2 – variable length character string, size ranges from 1-4000 bytes.it saves the disk space(only length of the entered value will be assigned as the size of column)
- Long - variable length character string, maximum size is 2 GB

2. **Number Data types :** Can store +ve,-ve,zero,fixed point, floating point with 38 precission.

- Number – {p=38,s=0}
- Number(p) - fixed point
- Number(p,s) –floating point (p=1 to 38,s= -84 to 127)

3. **Date Time Data type:** used to store date and time in the table.

- DB uses its own format of storing in fixed length of 7 bytes for century, date, month, year, hour, minutes, and seconds.
- Default data type is “dd-mon-yy”
- New Date time data types have been introduced. They are

TIMESTAMP-Date with fractional seconds
INTERVAL YEAR TO MONTH-stored as an interval of years and months

INTERVAL DAY TO SECOND-stored as o interval of days to hour’s minutes and seconds

4. **Raw Data type:** used to store byte oriented data like binary data and byte string.

5. **Other :**

- CLOB – stores character object with single byte character.
- BLOB – stores large binary objects such as graphics, video, sounds.
- BFILE – stores file pointers to the LOB's.

EXERCISE-1
Creating and Managing Tables

OBJECTIVE

After the completion of this exercise, students should be able to do the following:

Create tables
Describing the data types that can be used when specifying column definition
Alter table definitions
Drop, rename, and truncate tables

NAMING RULES

Table names and column names:

- Must begin with a letter
- Must be 1-30 characters long
- Must contain only A-Z, a-z, 0-9, _, $, and #
- Must not duplicate the name of another object owned by the same user ● Must not be an oracle server reserve words ● 2 different tables should not have same name.
- Should specify a unique column name.
- Should specify proper data type along with width
- Can include "not null" condition when needed. By default it is 'null'.

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The CREATE TABLE Statement

Table: Basic unit of storage; composed of rows and columns

Syntax: 1 Create table table_name (column_name1 data_ type (size)
column_name2 data_ type (size)….);

Syntax: 2 Create table table_name (column_name1 data_ type (size) constraints,

column_name2 data_ type constraints …); **Example:**

Create table employlees (employee_id number(6), first_name varchar2(20), ..job_id
varchar2(10), CONSTRAINT emp_emp_id_pk PRIMARY KEY (employlee_id));

Tables Used in this course

Creating a table by using a Sub query

SYNTAX

// CREATE TABLE table_name(column_name type(size)…);

Create table table_name **as** select
column_name1,column_name2,……colmn_namen from table_name where predicate;

AS Subquery

Subquery is the select statement that defines the set of rows to be inserted into the new table.

Example

Create table dept80 as select employee_id, last_name, salary*12 Annsal, hire_date
from employees where dept_id=80;

The ALTER TABLE Statement

The ALTER statement is used to

- Add a new column
- Modify an existing column
- Define a default value to the new column
- Drop a column
- To include or drop integrity constraint.

SYNTAX

ALTER TABLE table_name ADD /MODIFY(Column_name type(size));

ALTER TABLE table_name DROP COLUMN (Column_nname);

ALTER TABLE ADD CONSTRAINT Constraint_name PRIMARY KEY (Colum_Name);

Example:

Alter table dept80 add (jod_id varchar2(9));
Alter table dept80 modify (last_name varchar2(30));
Alter table dept80 drop column job_id;

NOTE: Once the column is dropped it cannot be recovered.

DROPPING A TABLE

- All data and structure in the table is deleted.
- Any pending transactions are committed.
- All indexes are dropped.
- Cannot roll back the drop table statement.

Syntax:

Drop table *tablename;*

Example:

Drop table dept80;

RENAMING A TABLE

To rename a table or view.
Syntax

RENAME old_name to new_name

Example:

Rename dept to detail_dept;

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TRUNCATING A TABLE

Removes all rows from the table.

Releases the storage space used by that table.

Syntax
TRUNCATE TABLE *table_name*; **Example:**

TRUNCATE TABLE copy_emp;

Find the Solution for the following:

Create the following tables with the given structure.

EMPLOYEES TABLE

NAME	NULL?	TYPE
Employee_id	Not null	Number(6)
First_Name		Varchar(20)
Last_Name	Not null	Varchar(25)
Email	Not null	Varchar(25)
Phone_Number		Varchar(20)
Hire_date	Not null	Date
Job_id	Not null	Varchar(10)
Salary		Number(8,2)
Commission_pct		Number(2,2)
Manager_id		Number(6)
Department_id		Number(4)

```
CREATE TABLE EMPLOYEE (
   Employee_id     NUMBER(6)     NOT NULL,
   First_Name      VARCHAR2(20),
   Last_Name       VARCHAR2(25)  NOT NULL,
   Email           VARCHAR2(25)  NOT NULL,
   Phone_Number    VARCHAR2(20),
```

```
    Hire_date       DATE          NOT NULL,
    Job_id          VARCHAR2(10)  NOT NULL,
    Salary          NUMBER(8,2),
    Commission_pct  NUMBER(2,2),
    Manager_id      NUMBER(6),
    Department_id   NUMBER(4)
);
```

DEPARTMENT TABLE

NAME	NULL?	TYPE
Dept_id	Not null	Number(6)
Dept_name	Not null	Varchar(20)
Manager_id		Number(6)
Location_id		Number(4)

```
CREATE TABLE DEPARTMENT (
    Dept_id      NUMBER(6)    NOT NULL,
    Dept_name    VARCHAR2(20) NOT NULL,
    Manager_id   NUMBER(6),
    Location_id  NUMBER(4)
);
```

JOB_GRADE TABLE

NAME	NULL?	TYPE
Grade_level		Varchar(2)
Lowest_sal		Number
Highest_sal		Number

```
CREATE TABLE SAL_GRADE (
    Grade_level   VARCHAR2(2),
    Lowest_sal    NUMBER,
    Highest_sal   NUMBER
);
```

LOCATION TABLE

NAME	NULL?	TYPE
Location_id	Not null	Number(4)
St_addr		Varchar(40)
Postal_code		Varchar(12)

City	Not null	Varchar(30)
State_province		Varchar(25)
Country_id		Char(2)

```
CREATE TABLE LOCATION (
   Location_id      NUMBER(4)     NOT NULL,
   St_addr          VARCHAR2(40),
   Postal_code      VARCHAR2(12),
   City             VARCHAR2(30)  NOT NULL,
   State_province   VARCHAR2(25),
   Country_id       CHAR(2)
);
```

1. Create the DEPT table based on the DEPARTMENT following the table instance chart below. Confirm that the table is created.

Column name	ID	NAME
Key Type		
Nulls/Unique		
FK table		
FK column		
Data Type	Number	Varchar2
Length	7	25

```
CREATE TABLE DEPT (ID NUMBER(7), NAME VARCHAR2(25) );
```

2. Create the EMP table based on the following instance chart. Confirm that the table is created.

Column name	ID	LAST_NAME	FIRST_NAME	DEPT_ID
Key Type				
Nulls/Unique				
FK table				
FK column				
Data Type	Number	Varchar2	Varchar2	Number
Length	7	25	25	7

```
CREATE TABLE EMPLOYEE_SIMPLE (
   ID          NUMBER(7),
   LAST_NAME   VARCHAR2(25),
```

```
   FIRST_NAME  VARCHAR2(25),
   DEPT_ID     NUMBER(7)
);
```

With enhancements

```
CREATE TABLE EMPLOYEE_SIMPLE (
   ID          NUMBER(7)      PRIMARY KEY,
   LAST_NAME   VARCHAR2(25)   NOT NULL,
   FIRST_NAME  VARCHAR2(25),
   DEPT_ID     NUMBER(7),
   CONSTRAINT fk_dept
      FOREIGN KEY (DEPT_ID) REFERENCES DEPT(ID)
);
```

3. Modify the EMP table to allow for longer employee last names. Confirm the modification.(Hint: Increase the size to 50)

```
ALTER TABLE EMP MODIFY LAST_NAME VARCHAR2(50);
```

4. Create the EMPLOYEES2 table based on the structure of EMPLOYEES table. Include Only the Employee_id, First_name, Last_name, Salary and Dept_id coloumns. Name the columns Id, First_name, Last_name, salary and Dept_id respectively.

```
CREATE TABLE EMPLOYEES2 AS
SELECT
   Employee_id AS Id,
   First_name,
   Last_name,
   Salary,
   Dept_id
FROM EMPLOYEES
WHERE 1=0;
```

`WHERE 1=0` ensures **no data is copied**, only the structure.

5. Drop the EMP table.

```
DROP TABLE EMP;
```

6. Rename the EMPLOYEES2 table as EMP.

```
RENAME EMPLOYEES2 TO EMP;
```

7. Add a comment on DEPT and EMP tables. Confirm the modification by describing the table.

```
COMMENT ON TABLE DEPT IS 'This table stores department information';
```

COMMENT ON TABLE EMP IS 'This table stores employee details'; 8.
Drop the First_name column from the EMP table and confirm it.

ALTER TABLE EMP DROP COLUMN First_name;

DESC EMP;

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EXERCISE-2

MANIPULATING DATA

OBJECTIVE

After, the completion of this exercise the students will be able to do the following

- Describe each DML statement
- Insert rows into tables
- Update rows into table
- Delete rows from table
- Control Transactions

A DML statement is executed when you:

- Add new rows to a table ● Modify existing rows
- Removing existing rows

A transaction consists of a collection of DML statements that form a logical unit of work.

To Add a New Row

INSERT Statement

Syntax

INSERT INTO table_name VALUES (column1 values, column2 values, …, columnn values);

Example:

INSERT INTO department (70, 'Public relations', 100,1700);

Inserting rows with null values

Implicit Method: (Omit the column)

INSERT INTO department VALUES (30,'purchasing');

Explicit Method: (Specify NULL keyword)

INSERT INTO department VALUES (100,'finance', NULL, NULL);

Inserting Special Values

Example:

Using SYSDATE

INSERT INTO employees VALUES (113,'louis', 'popp', 'lpopp','5151244567',**SYSDATE**, 'ac_account', 6900, NULL, 205, 100);

Inserting Specific Date Values Example:

INSERT INTO employees VALUES (114,'den', 'raphealy', 'drapheal', '5151274561', **TO_DATE('feb 3,1999','mon, dd ,yyyy'),** 'ac_account', 11000,100,30);

To Insert Multiple Rows

& is the placeholder for the variable value **Example:**

INSERT INTO department VALUES (&dept_id, &dept_name, &location);

Copying Rows from another table

Using Subquery **Example:**

```
INSER INTO sales_reps(id, name, salary, commission_pct)
        SELECt employee_id, Last_name, salary, commission_pct
FROM employees
WHERE jod_id LIKE '%REP');
```

CHANGING DATA IN A TABLE

UPDATE Statement

Syntax1: (to update specific rows**)**

UPDATE table_name SET column=value WHERE condition;

Syntax 2: (To updae all rows)

UPDATE table_name SET column=value;

Updating columns with a subquery

```
UPDATE employees
SET job_id= (SELECT job_id
FROM employees
WHERE employee_id=205)
WHERE employee_id=114;
```

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REMOVING A ROW FROM A TABLE

DELETE STATEMENT

Syntax

DELETE FROM table_name WHERE conditions;

Example:

DELETE FROM department WHERE dept_name='finance'';

Find the Solution for the following:

1. Create MY_EMPLOYEE table with the following structure

NAME	NULL?	TYPE
ID	Not null	Number(4)
Last_name		Varchar(25)
First_name		Varchar(25)
Userid		Varchar(25)
Salary		Number(9,2)

```
CREATE TABLE STAFF ( ID        NUMBER(4)      NOT NULL,
   Last_name  VARCHAR2(25),
   First_name VARCHAR2(25),
   Userid     VARCHAR2(25),
   Salary     NUMBER(9,2)
);
```

2. Add the first and second rows data to MY_EMPLOYEE table from the following sample data.

ID	Last_name	First_name	Userid	salary
1	Patel	Ralph	rpatel	895
2	Dancs	Betty	bdancs	860
3	Biri	Ben	bbiri	1100
4	Newman	Chad	Cnewman	750
5	Ropebur	Audrey	aropebur	1550

```
INSERT INTO MY_EMPLOYEE (ID, Last_name, First_name, Userid, Salary)
VALUES (1, 'Patel', 'Ralph', 'rpatel', 895);

INSERT INTO MY_EMPLOYEE (ID, Last_name, First_name, Userid, Salary)
VALUES (2, 'Dancs', 'Betty', 'bdancs', 860);
```

3. Display the table with values.

```
SELECT * FROM MY_EMPLOYEE;
```

4. Populate the next two rows of data from the sample data. Concatenate the first letter of the first_name with the first seven characters of the last_name to produce Userid.

```
INSERT INTO MY_EMPLOYEE (ID, Last_name, First_name, Userid, Salary)
VALUES (
   3,
   'Biri',
   'Ben',
   SUBSTR('Ben', 1, 1) || SUBSTR('Biri', 1, 7),
   1100
);

INSERT INTO MY_EMPLOYEE (ID, Last_name, First_name, Userid, Salary)
VALUES (
   4,
   'Newman',
   'Chad',
   SUBSTR('Chad', 1, 1) || SUBSTR('Newman', 1, 7),
   750
);
```

5. Make the data additions permanent.

```
COMMIT;
```

6. Change the last name of employee 3 to Drexler.

```
UPDATE MY_EMPLOYEE
SET Last_name = 'Drexler'
WHERE ID = 3;
```

7. Change the salary to 1000 for all the employees with a salary less than 900.

```
UPDATE MY_EMPLOYEE
```

```
SET Salary = 1000
WHERE Salary < 900;
```

8. Delete Betty dancs from MY _EMPLOYEE table.

```
DELETE FROM MY_EMPLOYEE
WHERE First_name = 'Betty' AND Last_name = 'Dancs';
```

9. Empty the fourth row of the emp table.

```
UPDATE MY_EMPLOYEE SET  Last_name = NULL,  First_name = NULL,
Userid = NULL,  Salary = NULL WHERE ID = 4;
```

EXERCISE-3

INCLUDING CONSTRAINTS

OBJECTIVE

After the completion of this exercise the students should be able to do the following

- Describe the constraints
- Create and maintain the constraints

What are Integrity constraints?

- Constraints enforce rules at the table level.
- Constraints prevent the deletion of a table if there are dependencies

The following types of integrity constraints are valid

a) **Domain Integrity**

✓ NOT NULL
✓ CHECK

b) **Entity Integrity**

✓ UNIQUE
✓ PRIMARY KEY

c) **Referential Integrity**

✓ FOREIGN KEY

Constraints can be created in either of two ways

1. At the same time as the table is created
2. After the table has been created.

Defining Constraints

Create table tablename (column_name1 data_ type constraints, column_name2 data_ type constraints …); **Example:**

Create table employlees (employee_id number(6), first_name varchar2(20), ..job_id varchar2 (10), CONSTRAINT emp_emp_id_pk PRIMARY KEY (employlee_id));

Domain Integrity

This constraint sets a range and any violations that takes place will prevent the user from performing the manipulation that caused the breach.It includes:

NOT NULL Constraint

While creating tables, by default the rows can have null value.the enforcement of not null constraint in a table ensure that the table contains values.

Principle of null values:

o Setting null value is appropriate when the actual value is unknown, or when a value would not be meaningful. o A null value is not equivalent to a value of zero. o A null value will always evaluate to null in any expression.

o When a column name is defined as not null, that column becomes a mandatory i.e., the user has to enter data into it.

o Not null Integrity constraint cannot be defined using the alter table command when the table contain rows.

Example

CREATE TABLE employees (employee_id number (6), last_name varchar2(25) NOT NULL, salary number(8,2), commission_pct number(2,2), hire_date date constraint emp_hire_date_nn NOT NULL'….);

CHECK

Check constraint can be defined to allow only a particular range of values.when the manipulation violates this constraint,the record will be rejected.Check condition cannot contain sub queries.

CREATE TABLE employees (employee_id number (6), last_name varchar2 (25) NOT NULL, salary number(8,2), commission_pct number(2,2), hire_date date constraint emp_hire_date_nn NOT NULL'…,CONSTRAINT emp_salary_mi CHECK(salary > 0));

Entity Integrity

Maintains uniqueness in a record. An entity represents a table and each row of a table represents an instance of that entity. To identify each row in a table uniquely we need to use this constraint. There are 2 entity constraints:

a) Unique key constraint

It is used to ensure that information in the column for each record is unique, as with telephone or driver's license numbers. It prevents the duplication of value with rows of a specified column in a set of column. A column defined with the constraint can allow null value.
If unique key constraint is defined in more than one column i.e., combination of column cannot be specified. Maximum combination of columns that a composite unique key can contain is 16.

Example:

CREATE TABLE employees (employee_id number(6), last_name varchar2(25) NOT NULL,email varchar2(25), salary number(8,2), commission_pct number(2,2), hire_date date constraint emp_hire_date_nn NOT NULL' COSTRAINT emp_email_uk UNIQUE(email));

PRIMARY KEY CONSTRAINT

A primary key avoids duplication of rows and does not allow null values. Can be defined on one or more columns in a table and is used to uniquely identify each row in a table. These values should never be changed and should never be null.
A table should have only one primary key. If a primary key constraint is assigned to more than one column or combination of column is said to be composite primary key, which can contain 16 columns

Example:

CREATE TABLE employees (employee_id number(6) , last_name varchar2(25) NOT NULL,email varchar2(25), salary number(8,2), commission_pct number(2,2), hire_date date

constraint emp_hire_date_nn NOT NULL, Constraint emp_id pk PRIMARY KEY (employee_id),CONSTRAINT emp_email_uk UNIQUE(email));

c) Referential Integrity

It enforces relationship between tables. To establish parent-child relationship between 2 tables having a common column definition, we make use of this constraint. To implement this, we should define the column in the parent table as primary key and same column in the child table as foreign key referring to the corresponding parent entry.

Foreign key

A column or combination of column included in the definition of referential integrity, which would refer to a referenced key.

Referenced key

It is a unique or primary key upon which is defined on a column belonging to the parent table.
Keywords:

FOREIGN KEY: Defines the column in the child table at the table level constraint.

REFERENCES: Identifies the table and column in the parent table.

ON DELETE CASCADE: Deletes the dependent rows in the child table when a row in the parent table is deleted.

ON DELETE SET NULL: converts dependent foreign key values to null when the parent value is removed.

CREATE TABLE employees (employee_id number(6) , last_name varchar2(25) NOT NULL,email varchar2(25), salary number(8,2), commission_pct number(2,2), hire_date date constraint emp_hire_date_nn NOT NULL, Constraint emp_id pk PRIMARY KEY (employee_id),CONSTRAINT emp_email_uk UNIQUE(email),CONSTRAINT emp_dept_fk FOREIGN KEY (department_id) references deparments(dept_id));

ADDING A CONSTRAINT

Use the ALTER to

- Add or Drop a constraint, but not modify the structure
- Enable or Disable the constraints

- Add a not null constraint by using the Modify clause

Syntax

ALTER TABLE table name ADD CONSTRAINT Cons_name type(column name);

Example:

ALTER TABLE employees ADD CONSTRAINT emp_manager_fk FOREIGN KEY (manager_id) REFERENCES employees (employee_id);

DROPPING A CONSTRAINT

Example:

ALTER TABLE employees DROP CONSTRAINT emp_manager_fk;

CASCADE IN DROP

- The CASCADE option of the DROP clause causes any dependent constraints also to be dropped.

Syntax

ALTER TABLE departments DROP PRIMARY KEY|UNIQUE (column)| CONSTRAINT constraint _name CASCADE;

DISABLING CONSTRAINTS

- Execute the DISABLE clause of the ALTER TABLE statement to deactivate an integrity constraint
- Apply the CASCADE option to disable dependent integrity constraints.

Example

ALTER TABLE employees DISABLE CONSTRAINT emp_emp_id_pk CASCADE;

ENABLING CONSTRAINTS

- Activate an integrity constraint currently disabled in the table definition by using the ENABLE clause.

Example

ALTER TABLE employees ENABLE CONSTRAINT emp_emp_id_pk CASCADE;

CASCADING CONSTRAINTS

The CASCADE CONSTRAINTS clause is used along with the DROP column clause.
It drops all referential integrity constraints that refer to the primary and unique keys defined on the dropped Columns.

This clause also drops all multicolumn constraints defined on the dropped column.

Example:

Assume table TEST1 with the following structure

CREATE TABLE test1 (pk number PRIMARY KEY, fk number, col1 number,col2 number, CONTRAINT fk_constraint FOREIGN KEY(fk) references test1, CONSTRAINT ck1 CHECK (pk>0 and col1>0), CONSTRAINT ck2 CHECK (col2>0));

An error is returned for the following statements
ALTER TABLE test1 DROP (pk);

ALTER TABLE test1 DROP (col1);

The above statement can be written with CASCADE CONSTRAINT

ALTER TABLE test 1 DROP(pk) CASCADE CONSTRAINTS; **(OR)**
ALTER TABLE test 1 DROP(pk, fk, col1) CASCADE CONSTRAINTS;

VIEWING CONSTRAINTS

Query the USER_CONSTRAINTS table to view all the constraints definition and names.

Example:

SELECT constraint_name, constraint_type, search_condition FROM user_constraints
WHERE table_name='employees';

Viewing the columns associated with constraints

SELECT constraint_name, constraint_type, FROM user_cons_columns

WHERE table_name='employees';

Find the Solution for the following:

1. Add a table-level PRIMARY KEY constraint to the EMP table on the ID column.The constraint should be named at creation. Name the constraint my_emp_id_pk.

ALTER TABLE EMP ADD CONSTRAINT my_emp_id_pk PRIMARY KEY (ID);

To check null and duplicates

SELECT * FROM EMP WHERE ID IS NULL;

SELECT ID, COUNT(*) AS count
FROM EMP
GROUP BY ID
HAVING COUNT(*) > 1;

2. Create a PRIMAY KEY constraint to the DEPT table using the ID colum. The constraint should be named at creation. Name the constraint my_dept_id_pk.

ALTER TABLE DEPT ADD CONSTRAINT my_dept_id_pk PRIMARY KEY (ID);

3. Add a column DEPT_ID to the EMP table. Add a foreign key reference on the EMP table that ensures that the employee is not assigned to nonexistent deparment. Name the constraint my_emp_dept_id_fk.

ALTER TABLE EMP ADD DEPT_ID NUMBER;

ALTER TABLE EMP
ADD CONSTRAINT my_emp_dept_id_fk
FOREIGN KEY (DEPT_ID)
REFERENCES DEPT(ID);

4. Modify the EMP table. Add a COMMISSION column of NUMBER data type, precision 2, scale 2. Add a constraint to the commission column that ensures that a commission value is greater than zero.

```
ALTER TABLE EMP ADD COMMISSION NUMBER(2, 2);


ALTER TABLE EMP
ADD CONSTRAINT emp_commission_check
CHECK (COMMISSION > 0);
```

EXERCISE-4

Writing Basic SQL SELECT Statements

OBJECTIVES

After the completion of this exercise, the students will be able to do the following:

- List the capabilities of SQL SELECT Statement
- Execute a basic SELECT statement

Capabilities of SQL SELECT statement

A SELECT statement retrieves information from the database. Using a select statement, we can perform

- ✓ Projection: To choose the columns in a table
- ✓ Selection: To choose the rows in a table
- ✓ Joining: To bring together the data that is stored in different tables

Basic SELECT Statement

Syntax

SELECT *|DISTINCT Column_ name| alias
` FROM table_name;

NOTE:

DISTINCT—Suppress the duplicates.
Alias—gives selected columns different headings.

Example: 1

SELECT * FROM departments;

Example: 2

SELECT location_id, department_id FROM departments;

Writing SQL Statements

- SQL statements are not case sensitive
- SQL statements can be on one or more lines.
- Keywords cannot be abbreviated or split across lines
- Clauses are usually placed on separate lines
- Indents are sued to enhance readability

Using Arithmetic Expressions

Basic Arithmetic operators like *, /, +, -can be used

Example:1

SELECT last_name, salary, salary+300 FROM employees;

Example:2

SELECT last_name, salary, 12*salary+100 FROM employees;

The statement is not same as
SELECT last_name, salary, 12*(salary+100) FROM employees;

Example:3

SELECT last_name, job_id, salary, commission_pct FROM employees;

Example:4

SELECT last_name, job_id, salary, 12*salary*commission_pct FROM employees;

Using Column Alias

- To rename a column heading with or without AS keyword.

Example:1

SELECT last_name AS Name

FROM employees;
Example: 2
SELECT last_name “Name” salary*12 “Annual Salary “
FROM employees;
Concatenation Operator

- Concatenates columns or character strings to other columns
- Represented by two vertical bars (||)
- Creates a resultant column that is a character expression **Example:**

SELECT last_name||job_id AS “EMPLOYEES JOB” FROM employees;

Using Literal Character String

- A literal is a character, a number, or a date included in the SELECT list.
- Date and character literal values must be enclosed within single quotation marks.

Example:

SELECT last_name||’is a’||job_id AS “EMPLOYEES JOB” FROM employees;
Eliminating Duplicate Rows

- Using DISTINCT keyword.

Example:
SELECT DISTINCT deparment_id FROM employees;
Displaying Table Structure

- Using DESC keyword.

Syntax
DESC table_name; **Example:**
DESC employees;
Find the Solution for the following:
True OR False

1. The following statement executes successfully.

Identify the Errors

SELECT employee_id, last_name sal*12
ANNUAL SALARY
FROM employees;
Queries

```
SELECT employee_id, last_name,
      salary * 12 AS annual_salary
FROM employees;
```

2. Show the structure of departments the table. Select all the data from it.

```
DESC departments;
SELECT * FROM departments;
```

3. Create a query to display the last name, job code, hire date, and employee number for each employee, with employee number appearing first.

```
SELECT employee_id, last_name, job_id, hire_date FROM employees;
```

4. Provide an alias STARTDATE for the hire date.

```
SELECT employee_id, last_name, job_id, hire_date AS STARTDATE
FROM employees;
```

5. Create a query to display unique job codes from the employee table.

```
SELECT DISTINCT job_id FROM employees;
```

6. Display the last name concatenated with the job ID , separated by a comma and space, and name the column EMPLOYEE and TITLE.

```
SELECT last_name || ', ' || job_id AS "EMPLOYEE AND TITLE"
FROM employees;
```

7. Create a query to display all the data from the employees table. Separate each column by a comma. Name the column THE_OUTPUT.

```
SELECT
  employee_id || ', ' ||
first_name || ', ' ||    last_name
|| ', ' ||
```

```
  email || ', ' ||
phone_number || ', ' ||
hire_date || ', ' ||    job_id
|| ', ' ||
  salary || ', ' ||
commission_pct || ', ' ||
  manager_id || ', ' ||
  department_id AS "THE_OUTPUT"
FROM employees;
```

EXERCISE-5

Restricting and Sorting data

After the completion of this exercise, the students will be able to do the following:

- Limit the rows retrieved by the queries
- Sort the rows retrieved by the queries
-

Limiting the Rows selected

- Using WHERE clause

- Alias cannot used in WHERE clause

Syntax

SELECT----------
FROM---------- WHERE
condition; **Example:**

SELECT employee_id,last_name, job_id, deparment_id FROM employees WHERE department_id=90;

Character strings and Dates

Character strings and date values are enclosed in single quotation marks.

Character values are case sensitive and date values are format sensitive.

Example:
SELECT employee_id,last_name, job_id, deparment_id FROM employees
WHERE last_name='WHALEN";
Comparison Conditions

All relational operators can be used. (=, >, >=, <, <= ,<>,!=)

Example:

SELECT last_name, salary
FROM employees
WHERE salary<=3000;

Other comparison conditions

Operator	Meaning
BETWEEN …AND…	Between two values
IN	Match any of a list of values
LIKE	Match a character pattern
IS NULL	Is a null values

Example:1

SELECT last_name, salary

```
FROM employees
WHERE salary BETWEEN 2500 AND 3500;
```

Example:2

```
SELECT employee_id, last_name, salary , manager_id
FROM employees
WHERE manager_id IN (101, 100,201);
```

Example:3

- Use the LIKE condition to perform wildcard searches of valid string values.
- Two symbols can be used to construct the search string
  - % denotes zero or more characters
  - _ denotes one character

```
SELECT first_name, salary
FROM employees
WHERE first_name LIKE '%s';
```

Example:4

```
SELECT last_name, salary
FROM employees
WHERE last_name LIKE '_o%';
```

Example:5

ESCAPE option-To have an exact match for the actual % and_ characters
To search for the string that contain 'SA_'

```
SELECT employee_id, first_name, salary,job_id
FROM employees
WHERE job_id LIKE '%sa\_%'ESCAPE'\';
```

Test for NULL

- Using IS NULL operator **Example:**

```
SELECT employee_id, last_name, salary , manager_id
FROM employees
WHERE manager_id  IS NULL;
```

Logical Conditions

All logical operators can be used.(AND,OR,NOT)

Example:1

```
SELECT employee_id, last_name, salary , job_id
FROM employees
WHERE salary>=10000
AND job_id LIKE '%MAN%';
```

Example:2

```
SELECT employee_id, last_name, salary , job_id
FROM employees
WHERE salary>=10000
OR job_id LIKE '%MAN%';
```

Example:3

```
SELECT employee_id, last_name, salary , job_id
FROM employees
WHERE  job_id NOT IN ('it_prog', st_clerk', sa_rep');
```

Rules of Precedence

Order Evaluated	Operator
1	Arithmetic
2	Concatenation
3	Comparison
4	IS [NOT] NULL, LIKE, [NOT] IN
5	[NOT] BETWEEN
6	Logical NOT
7	Logical AND
8	Logical OR

Example:1

```
SELECT employee_id, last_name, salary , job_id
FROM employees
WHERE  job_id =’sa_rep’
OR job_id=’ad_pres’
AND salary>15000;
```

Example:2

```
SELECT employee_id, last_name, salary , job_id
FROM employees
WHERE  (job_id =’sa_rep’
OR job_id=’ad_pres’)
AND salary>15000;
```

Sorting the rows

Using ORDER BY Clause

ASC-Ascending Order,Default

DESC-Descending order

Example:1

```
SELECT  last_name, salary , job_id,department_id,hire_date
FROM employees
ORDER BY hire_date;
```

Example:2

```
SELECT  last_name, salary , job_id,department_id,hire_date
FROM employees
ORDER BY hire_date DESC;
```

Example:3

Sorting by column alias

```
SELECT  last_name, salary*12 annsal , job_id,department_id,hire_date
FROM employees
ORDER BY annsal;
```

Example:4

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Sorting by Multiple columns

SELECT last_name, salary , job_id,department_id,hire_date
FROM employees ORDER BY department_id, salary DESC;

Find the Solution for the following:

1. **Create a query to display the last name and salary of employees earning more than 12000.**

```
SELECT last_name, salary
FROM employees
WHERE salary > 12000;
```

2. **Create a query to display the employee last name and department number for employee number 176.**

```
SELECT last_name, department_id
FROM employees
 WHERE employee_id = 176;
```

3. **Create a query to display the last name and salary of employees whose salary is not in the range of 5000 and 12000. (hints: not between)**

```
SELECT last_name, salary
FROM employees
WHERE salary NOT BETWEEN 5000 AND 12000;
```

4. **Display the employee last name, job ID, and start date of employees hired between February 20,1998 and May 1,1998.order the query in ascending order by start date.(hints: between)**

```
SELECT last_name, job_id, hire_date
FROM employees
WHERE hire_date BETWEEN TO_DATE('20-FEB-1998', 'DD-MON-YYYY')
                    AND TO_DATE('01-MAY-1998', 'DD-MON-YYYY')
ORDER BY hire_date ASC;
```

5. **Display the last name and department number of all employees in departments 20 and 50 in alphabetical order by name.(hints: in, orderby)**

```
SELECT lastname, department_id
FROM employees
WHERE department_id IN (20, 50)
ORDER BY lastname asc;
```

6. **Display the last name and salary of all employees who earn between 5000 and 12000 and are in departments 20 and 50 in alphabetical order by name. Label the columns**

EMPLOYEE, MONTHLY SALARY respectively.(hints: between, in)

```
SELECT last_name AS "EMPLOYEE", salary AS "MONTHLY SALARY"
FROM employees
WHERE salary BETWEEN 5000 AND 12000
AND department_id IN (20, 50) ORDER BY last_name ASC;
```

7. Display the last name and hire date of every employee who was hired in 1994.(hints: like)

```
SELECT last_name, hire_date
FROM employees
WHERE hire_date LIKE '1994%';     or

SELECT last_name, hire_date
FROM employees
WHERE TO_CHAR(hire_date, 'YYYY') LIKE '1994';
```

8. Display the last name and job title of all employees who do not have a manager.(hints: is null)

```
SELECT last_name, job_title
FROM employees
WHERE manager_id IS NULL;
```

9. Display the last name, salary, and commission for all employees who earn commissions. Sort data in descending order of salary and commissions.(hints: is not nul,orderby)

```
SELECT last_name, salary, commission_pct
FROM employees
WHERE commission_pct IS NOT NULL
ORDER BY salary DESC, commission_pct DESC;
```

10. Display the last name of all employees where the third letter of the name is *a*.(hints:like)

```
SELECT last_name
FROM employees
WHERE last_name LIKE '__a%';
```

11. Display the last name of all employees who have an a and an *e* in their last name.(hints: like)

```
SELECT last_name
FROM employees
WHERE last_name LIKE '%a%'
 AND last_name LIKE '%e%';
```

12. Display the last name and job and salary for all employees whose job is sales representative or stock clerk and whose salary is not equal to 2500 ,3500 or 7000.(hints:in,not in)

```
SELECT last_name, job_id, salary
FROM employees
WHERE job_id IN ('SA_REP', 'ST_CLERK')
  AND salary NOT IN (2500, 3500, 7000);
```

13. Display the last name, salary, and commission for all employees whose commission amount is 20%.(hints:use predicate logic)

```
SELECT last_name, salary, commission_pct
FROM employees
WHERE commission_pct = 0.20;
```

EXERCISE-6

Single Row Functions

Objective

After the completion of this exercise, the students will be able to do the following:

- Describe various types of functions available in SQL.
- Use character, number and date functions in SELECT statement.
- Describe the use of conversion functions.

Single row functions:

Manipulate data items.
Accept arguments and return one value.
Act on each row returned. Return
one result per row.
May modify the data type.
Can be nested.
Accept arguments which can be a column or an expression

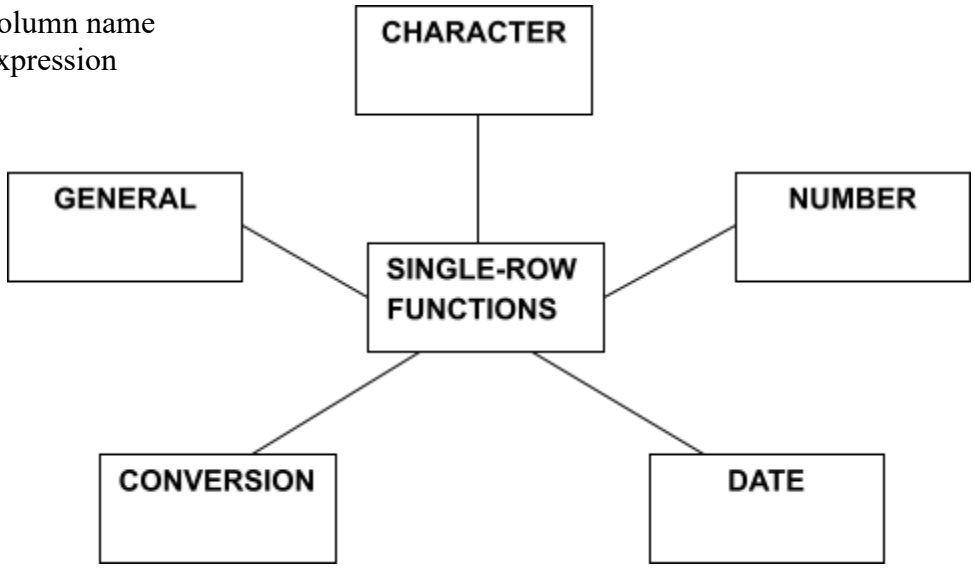
Syntax

Function_name(arg1,…argn)

An argument can be one of the following

✓ User-supplied constant

Variable value
Column name
Expression



✓ ✓
✓

- Character Functions: Accept character input and can return both character and number values.
- Number functions: Accept numeric input and return numeric values.
- Date Functions: Operate on values of the DATE data type.
- Conversion Functions: Convert a value from one type to another.

Character Functions

Character Functions

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Case-manipulation functions

1. Lower
2. Upper
3. Initcap
4. Instr
5. Lpad/Rpad
6. Trim
7. Repalce

Character-manipulation functions

1. Concat
2. Substr
3. Length

Function	**Purpose**
lower(column/expr)	Converts alpha character values to lowercase
upper(column/expr)	Converts alpha character values to uppercase
initcap(column/expr)	Converts alpha character values the to uppercase for the first letter of each word, all other letters in lowercase
concat(column1/expr1, column2/expr2)	Concatenates the first character to the second character
substr(column/expr,m,n)	Returns specified characters from character value starting at character position m, n characters long
length(column/expr)	Returns the number of characters in the expression
instr(column/expr,'string',m,n)	Returns the numeric position of a named string
lpad(column/expr, n,'string')	Pads the character value right-justified to a total width of n character positions
rpad(column/expr,'string',m,n)	Pads the character value left-justified to a total width of n character positions
trim(leading/trailing/both, trim_character FROM trim_source)	Enables you to trim heading or string. trailing or both from a character
replace(text, search_string, replacement_string)	

Example: lower('SQL Course') sql

course upper('SQL Course') SQL

COURSE initcap('SQL Course') Sql

Course

SELECT 'The job id for'|| upper(last_name||'is'||lower(job_id) AS "EMPLOYEE DETAILS"
FROM employees;

SELECT employee_id, last_name, department_id
FROM employees
WHERE LOWER(last_name)='higgins';

Function	**Result**
CONCAT('hello', 'world')	helloworld
Substr('helloworld',1,5)	Hello
Length('helloworld')	10
Instr('helloworld','w')	6
Lpad(salary,10,'*')	*****24000
Rpad(salary,10,'*')	24000*****
Trim('h' FROM 'helloworld')	elloworld

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 and blue
substr (char,m,n);	*select substr ('information', 3, 4) from dual;*	form

Example:

SELECT employee_id, CONCAT (first_name,last_name) NAME , job_id,LENGTH(last_name), INSTR(last_name,'a') "contains'a'?"

FROM employees WHERE SUBSTR(job_id,4)='ERP';

NUMBER FUNCTIONS

Function	Purpose
round(column/expr, n)	Rounds the value to specified decimal
trunc(column/expr,n)	Truncates value to specified decimal
mod(m,n)	Returns remainder of division

Example

Function	Result
round(45.926,2)	45.93
trunc(45.926,2)	45.92
mod(1600,300)	100

SELECT ROUND(45.923,2), ROUND(45.923,0), ROUND(45.923,-1) FROM dual;

NOTE: Dual is a dummy table you can use to view results from functions and calculations.

SELECT TRUNC(45.923,2), TRUNC(45.923), TRUNC(45.923,-2) FROM dual;

SELECT last_name,salary,MOD(salary,5000) FROM employees WHERE job_id='sa_rep';

Working with Dates

The Oracle database stores dates in an internal numeric format: century, year, month, day, hours, minutes, and seconds.

• The default date display format is DD-MON-RR.

– Enables you to store 21st-century dates in the 20th century by specifying only the last two digits of the year

– Enables you to store 20th-century dates in the 21st century in the same way

Example

SELECT last_name, hire_date FROM employees WHERE hire_date < '01-FEB-88;

Working with Dates

SYSDATE is a function that returns:

• Date

• Time

Example

Display the current date using the DUAL table.

SELECT SYSDATE FROM DUAL;

Arithmetic with Dates

• Add or subtract a number to or from a date for a resultant date value.
• Subtract two dates to find the number of days between those dates.
• Add hours to a date by dividing the number of hours by 24.

Arithmetic with Dates

Because the database stores dates as numbers, you can perform calculations using arithmetic Operators such as addition and subtraction. You can add and subtract number constants as well as dates.
You can perform the following operations:

Operation	Result	Description
date + number	Date	Adds a number of days to a date
date – number	Date	Subtracts a number of days from a date
date – date	Number of days	Subtracts one date from another
date + number/24	Date	Adds a number of hours to a date

Example

```
SELECT last_name, (SYSDATE-hire_date)/7 AS WEEKS
FROM   employees
WHERE  department_id = 90;
```

Date Functions

Date Functions

Date functions operate on Oracle dates. All date functions return a value of DATE data type except MONTHS_BETWEEN, which returns a numeric value.

• MONTHS_BETWEEN(date1, date2):::: Finds the number of months between date1 and date2. The result can be positive or negative. If date1 is later than date2, the result is positive; if date1 is earlier than date2, the result is negative. The noninteger part of the result represents a portion of the month.

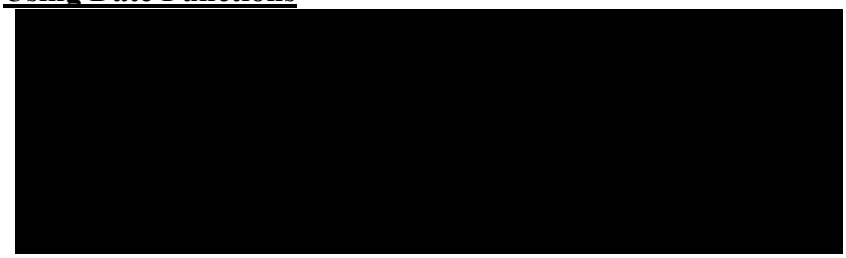
- ADD_MONTHS(date, n)::: Adds n number of calendar months to date. The value of n must be an integer and can be negative.

- NEXT_DAY(date, 'char')::: Finds the date of the next specified day of the week ('char') following date. The value of char may be a number representing a day or a character string.

- LAST_DAY(date)::: Finds the date of the last day of the month that contains date
- ROUND(date[,'fmt'])::: Returns date rounded to the unit that is specified by the format model fmt. If the format model fmt is omitted, date is rounded to the nearest day.

- TRUNC(date[, 'fmt'])::: Returns date with the time portion of the day truncated to the unit that is specified by the format model fmt. If the format model fmt is omitted, date is truncated to the nearest day.

Using Date Functions



Example

Display the employee number, hire date, number of months employed, sixmonth review date, first Friday after hire date, and last day of the hire month for all employees who have been employed for fewer than 70 months.

```
SELECT employee_id, hire_date,MONTHS_BETWEEN (SYSDATE, hire_date)
TENURE,ADD_MONTHS (hire_date, 6) REVIEW,NEXT_DAY (hire_date, 'FRIDAY'),
LAST_DAY(hire_date)
FROM   employees
WHERE  MONTHS_BETWEEN (SYSDATE, hire_date) < 70;
```

Conversion Functions

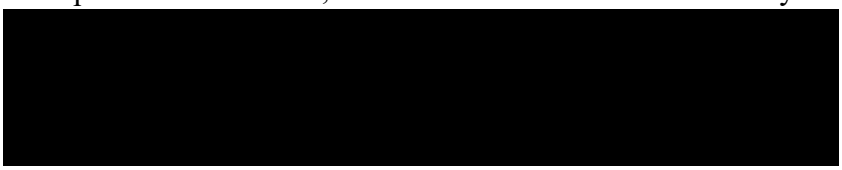
This covers the following topics:
- Writing a query that displays the current date
- Creating queries that require the use of numeric, character, and date functions
- Performing calculations of years and months of service for an employee

Implicit Data Type Conversion

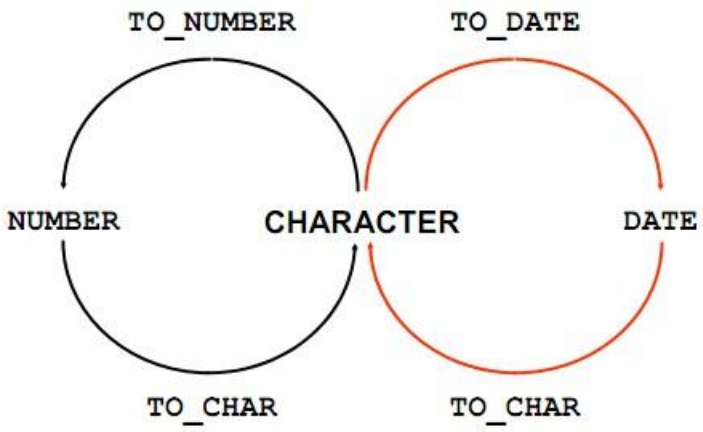
For assignments, the Oracle server can automatically convert the following:

For example, the expression hire_date > '01-JAN-90' results in the implicit conversion from the string '01-JAN-90' to a date.

For expression evaluation, the Oracle Server can automatically convert the following:



Explicit Data Type Conversion



SQL provides three functions to convert a value from one data type to another:

Example:

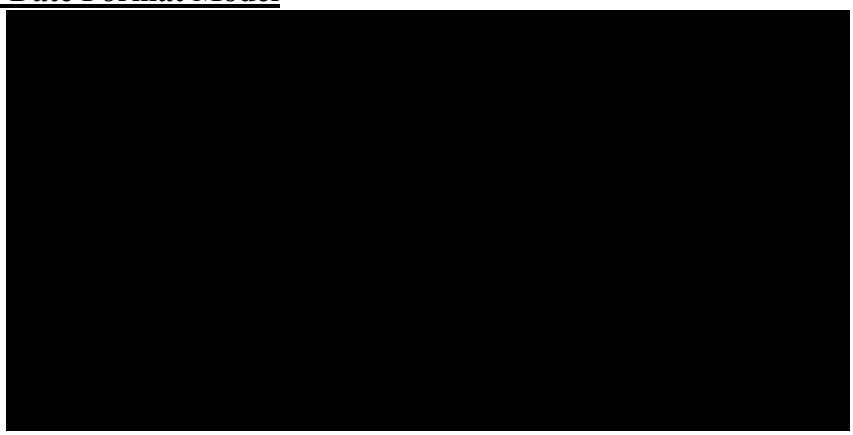
Using the TO_CHAR Function with Dates

TO_CHAR(date, 'format_model') **The format model:**

- Must be enclosed by single quotation marks
- Is case-sensitive
- Can include any valid date format element
- Has an fm element to remove padded blanks or suppress leading zeros
- Is separated from the date value by a comma

```
SELECT employee_id, TO_CHAR(hire_date, 'MM/YY') Month_Hired
FROM   employees  WHERE  last_name = 'Higgins';
```

Elements of the Date Format Model



Sample Format Elements of Valid Date

Element	Description
SCC or CC	Century; server prefixes B.C. date with -
Years in dates YYYY or SYYYY	Year; server prefixes B.C. date with -
YYY or YY or Y	Last three, two, or one digits of year
Y,YYY	Year with comma in this position
IYYY, IYY, IY, I	Four-, three-, two-, or one-digit year based on the ISO standard
SYEAR or YEAR	Year spelled out; server prefixes B.C. date with -
BC or AD	Indicates B.C. or A.D. year
B.C. or A.D.	Indicates B.C. or A.D. year using periods
Q	Quarter of year
MM	Month: two-digit value
MONTH	Name of month padded with blanks to length of nine characters
MON	Name of month, three-letter abbreviation
RM	Roman numeral month
WW or W	Week of year or month
DDD or DD or D	Day of year, month, or week
DAY	Name of day padded with blanks to a length of nine characters
DY	Name of day; three-letter abbreviation
J	Julian day; the number of days since December 31, 4713 B.C.

Date Format Elements: Time Formats

Use the formats that are listed in the following tables to display time information and literals and to change numerals to spelled numbers.

Element	Description
AM or PM	Meridian indicator
A.M. or P.M.	Meridian indicator with periods
HH or HH12 or HH24	Hour of day, or hour (1–12), or hour (0–23)
MI	Minute (0–59)
SS	Second (0–59)
SSSSS	Seconds past midnight (0–86399)

Other Formats

Element	Description
/ . ,	Punctuation is reproduced in the result.
"of the"	Quoted string is reproduced in the result.

Specifying Suffixes to Influence Number Display

Element	Description
TH	Ordinal number (for example, DDTH for 4TH)
SP	Spelled-out number (for example, DDSP for FOUR)
SPTH or THSP	Spelled-out ordinal numbers (for example, DDSPTH for FOURTH)

Example

```
SELECT last_name,
TO_CHAR(hire_date, 'fmDD Month YYYY') AS HIREDATE
FROM   employees;
```

Modify example to display the dates in a format that appears as "Seventeenth of June 1987 12:00:00 AM."

```
SELECT last_name,
TO_CHAR (hire_date, 'fmDdspth "of" Month YYYY fmHH:MI:SS AM') HIREDATE FROM
employees;
```

Using the TO_CHAR Function with Numbers

TO_CHAR(number, 'format_model')

These are some of the format elements that you can use with the TO_CHAR function to display a number value as a character:

Number Format Elements

If you are converting a number to the character data type, you can use the following format elements:

Element	Description	Example	Result
9	Numeric position (number of 9s determine display width)	999999	1234
0	Display leading zeros	099999	001234
$	Floating dollar sign	$999999	$1234
L	Floating local currency symbol	L999999	FF1234
D	Returns in the specified position the decimal character. The default is a period (.).	99D99	99.99
.	Decimal point in position specified	999999.99	1234.00
G	Returns the group separator in the specified position. You can specify multiple group separators in a number format model.	9,999	9G999
,	Comma in position specified	999,999	1,234
MI	Minus signs to right (negative values)	999999MI	1234-
PR	Parenthesize negative numbers	999999PR	<1234>
EEEE	Scientific notation (format must specify four Es)	99.999EEEE	1.234E+03
U	Returns in the specified position the "Euro" (or other) dual currency	U9999	€1234
V	Multiply by 10 *n* times (*n* = number of 9s after V)	9999V99	123400
S	Returns the negative or positive value	S9999	-1234 or +1234
B	Display zero values as blank, not 0	B9999.99	1234.00

```
SELECT TO_CHAR(salary, '$99,999.00') SALARY
FROM   employees
WHERE  last_name = 'Ernst';
```

Using the TO_NUMBER and TO_DATE Functions

• Convert a character string to a number format using the TO_NUMBER function:

TO_NUMBER(char[, 'format_model']

• Convert a character string to a date format using the TO_DATE function:
TO_DATE(char[, 'format_model']

• These functions have an fx modifier. This modifier specifies the exact matching for the character argument and date format model of a TO_DATE function.

The fx modifier specifies exact matching for the character argument and date format model of a TO_DATE function:

• Punctuation and quoted text in the character argument must exactly match (except for case) the corresponding parts of the format model.

• The character argument cannot have extra blanks. Without fx, Oracle ignores extra blanks.

• Numeric data in the character argument must have the same number of digits as the corresponding element in the format model. Without fx, numbers in the character argument can omit leading zeros.

```
SELECT last_name, hire_date
FROM   employees
WHERE  hire_date = TO_DATE('May 24, 1999', 'fxMonth DD, YYYY');
```

Find the Solution for the following:

1. Write a query to display the current date. Label the column Date.

```
SELECT SYSDATE AS "Date" FROM dual;
```

2. The HR department needs a report to display the employee number, last name, salary, and increased by 15.5% (expressed as a whole number) for each employee. Label the column New Salary.

```
SELECT employee_id,
    last_name,
    salary,
    ROUND(salary * 1.155) AS "New Salary"
FROM employees;
```

3. Modify your query lab_03_02.sql to add a column that subtracts the old salary from the new salary. Label the column Increase.

```
SELECT employee_id, last_name, salary,
```

```
    ROUND(salary * 1.155) AS "New Salary",
    ROUND(salary * 1.155) - salary AS Increase FROM employees;
```

4. Write a query that displays the last name (with the first letter uppercase and all other letters lowercase) and the length of the last name for all employees whose name starts with the letters J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.

```
SELECT
   INITCAP(last_name) AS "Last Name",
   LENGTH(last_name) AS "Name Length"
FROM employees
WHERE UPPER(SUBSTR(last_name, 1, 1)) IN ('J', 'A', 'M')
ORDER BY last_name;
```

5. Rewrite the query so that the user is prompted to enter a letter that starts the last name. For example, if the user enters H when prompted for a letter, then the output should show all employees whose last name starts with the letter H.

```
SELECT last_name,
     LENGTH(last_name) AS "Name Length"
FROM employees
WHERE UPPER(SUBSTR(last_name, 1, 1)) = UPPER('&start_letter')
ORDER BY last_name;
```

6. The HR department wants to find the length of employment for each employee. For each employee, display the last name and calculate the number of months between today and the date on which the employee was hired. Label the column MONTHS_WORKED. Order your results by the number of months employed. Round the number of months up to the closest whole number.

Note: Your results will differ.

```
SELECT last_name,
     CEIL(MONTHS_BETWEEN(SYSDATE, hire_date)) AS MONTHS_WORKED
FROM employees
ORDER BY MONTHS_WORKED;
```

7. Create a report that produces the following for each employee:

<employee last name> earns <salary> monthly but wants <3 times salary>. Label the column Dream Salaries.

```
SELECT last_name || ' earns ' || TO_CHAR(salary) || ' monthly but wants ' ||
TO_CHAR(salary * 3) AS "Dream Salaries" FROM employees;
```

8. Create a query to display the last name and salary for all employees. Format the salary to be 15 characters long, left-padded with the $ symbol. Label the column SALARY.

```
SELECT last_name,
    LPAD('$' || TO_CHAR(salary), 15, '$') AS SALARY
FROM employees;
```

9. Display each employee's last name, hire date, and salary review date, which is the first Monday after six months of service. Label the column REVIEW. Format the dates to appear in the format similar to "Monday, the Thirty-First of July, 2000."

```
SELECT last_name,
    TO_CHAR(hire_date, 'fmDay, "the" fmDDth "of" Month, YYYY') AS hire_date,
    TO_CHAR(
      NEXT_DAY(ADD_MONTHS(hire_date, 6) - 1, 'MONDAY'),
      'fmDay, "the" fmDDth "of" Month, YYYY'
    ) AS REVIEW FROM
employees;
```

10. Display the last name, hire date, and day of the week on which the employee started. Label the column DAY. Order the results by the day of the week, starting with Monday.

```
SELECT last_name, hire_date,
    TO_CHAR(hire_date, 'fmDay') AS DAY
FROM employees ORDER BY
 CASE TO_CHAR(hire_date, 'DY', 'NLS_DATE_LANGUAGE=ENGLISH')
  WHEN 'MON' THEN 1
  WHEN 'TUE' THEN 2
  WHEN 'WED' THEN 3
  WHEN 'THU' THEN 4
  WHEN 'FRI' THEN 5
  WHEN 'SAT' THEN 6
  WHEN 'SUN' THEN 7
 END;
```

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EXERCISE-7

Displaying data from multiple tables

Objective

After the completion of this exercise, the students will be able to do the following:

- Write SELECT statements to access data from more than one table using equality and nonequality joins
- View data that generally does not meet a join condition by using outer joins
- Join a table to itself by using a self join

Sometimes you need to use data from more than one table.

Cartesian Products

- A Cartesian product is formed when:
  - A join condition is omitted
  - A join condition is invalid
  - All rows in the first table are joined to all rows in the second table
- To avoid a Cartesian product, always include a valid join condition in a WHERE clause. A Cartesian product tends to generate a large number of rows, and the result is rarely useful. You should always include a valid join condition in a WHERE clause, unless you have a specific need to combine all rows from all tables.

Cartesian products are useful for some tests when you need to generate a large number of rows to simulate a reasonable amount of data.

Example:

To displays employee last name and department name from the EMPLOYEES and DEPARTMENTS tables.

```
SELECT last_name, department_name dept_name
FROM   employees, departments;
```

Types of Joins

- **Equijoin**
- **Non-equijoin**
- **Outer join**

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- **Self join**
- **Cross joins**
- **Natural joins**
- **Using clause**
- **Full or two sided outer joins**
- **Arbitrary join conditions for outer joins**

Joining Tables Using Oracle Syntax

```
SELECT table1.column, table2.column
FROM table1, table2
WHERE table1.column1 = table2.column2;
```

Write the join condition in the WHERE clause.
- Prefix the column name with the table name when the same column name appears in more than one table.

Guidelines

- When writing a SELECT statement that joins tables, precede the column name with the table name for clarity and to enhance database access.
- If the same column name appears in more than one table, the column name must be prefixed with the table name.
- To join n tables together, you need a minimum of n-1 join conditions. For example, to join four tables, a minimum of three joins is required. This rule may not apply if your table has a concatenated primary key, in which case more than one column is required to uniquely identify each row

What is an Equijoin?

To determine an employee's department name, you compare the value in the DEPARTMENT_ID column in the EMPLOYEES table with the DEPARTMENT_ID values in the DEPARTMENTS table.

The relationship between the EMPLOYEES and DEPARTMENTS tables is an equijoin—that is, values in the DEPARTMENT_ID column on both tables must be equal. Frequently, this type of join involves primary and foreign key complements.

Note: Equijoins are also called simple joins or inner joins

```
SELECTemployees.employee_id,employees.last_name,employees.department_id,
departments.department_id,departments.location_id
FROM   employees, departments
WHERE  employees.department_id = departments.department_id;
```

Additional Search Conditions
Using the AND Operator Example:

To display employee Matos'department number and department name, you need an additional condition in the WHERE clause.

```
SELECT last_name, employees.department_id, department_name
FROM   employees, departments
WHERE  employees.department_id = departments.department_id AND    last_name = 'Matos';
```

Qualifying Ambiguous
Column Names

- Use table prefixes to qualify column names that are in multiple tables.
- Improve performance by using table prefixes.
- Distinguish columns that have identical names but reside in different tables by using column aliases.

Using Table Aliases

- Simplify queries by using table aliases.
- Improve performance by using table prefixes **Example:**

```
SELECT e.employee_id, e.last_name, e.department_id, d.department_id,
d.location_id
FROM   employees e , departments d
WHERE  e.department_id = d.department_id;
```

Joining More than Two Tables

To join n tables together, you need a minimum of n-1 join conditions. For example, to join three tables, a minimum of two joins is required.

Example:

To display the last name, the department name, and the city for each employee, you have to join the EMPLOYEES, DEPARTMENTS, and LOCATIONS tables.

```
SELECT e.last_name, d.department_name, l.city
FROM   employees e, departments d, locations l
WHERE  e.department_id = d.department_id
AND    d.location_id = l.location_id;
```

Non-Equijoins

A non-equijoin is a join condition containing something other than an equality operator.The relationship between the EMPLOYEES table and the JOB_GRADES table has an example of a

non-equijoin. A relationship between the two tables is that the SALARY column in the EMPLOYEES table must be between the values in the LOWEST_SALARY and HIGHEST_SALARY columns of the JOB_GRADES table. The relationship is obtained using an operator other than equals (=).

Example:

```
SELECT e.last_name, e.salary, j.grade_level
FROM   employees e, job_grades j
WHERE  e.salary
BETWEEN j.lowest_sal AND j.highest_sal;
```

Outer Joins

Syntax

• You use an outer join to also see rows that do not meet the join condition.
• The Outer join operator is the plus sign (+).

```
SELECT table1.column, table2.column
FROM table1, table2
WHERE table1.column(+) = table2.column;
SELECT table1.column, table2.column
FROM table1, table2
WHERE table1.column = table2.column(+);
```

The missing rows can be returned if an outer join operator is used in the join condition. The operator is a plus sign enclosed in parentheses (+), and it is placed on the "side" of the join that is deficient in information. This operator has the effect of creating one or more null rows, to which one or more rows from the nondeficient table can be joined.

Example:

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e, departments d
WHERE  e.department_id(+) = d.department_id ;
```

Outer Join Restrictions

- The outer join operator can appear on only one side of the expression—the side that has information missing. It returns those rows from one table that have no direct match in the other table.
- A condition involving an outer join cannot use the IN operator or be linked to another condition by the OR operator

Self Join

Sometimes you need to join a table to itself.

Example:
To find the name of each employee's manager, you need to join the EMPLOYEES table to itself, or perform a self join.

```
SELECT worker.last_name || ' works for '
|| manager.last_name
FROM   employees worker, employees manager
WHERE  worker.manager_id = manager.employee_id ;
```

Use a join to query data from more than one table.

```
SELECT table1.column, table2.column
FROM table1
[CROSS JOIN table2] |
[NATURAL JOIN table2] |
[JOIN table2 USING (column_name)] |
[JOIN table2
ON(table1.column_name = table2.column_name)] |
[LEFT|RIGHT|FULL OUTER JOIN table2
ON (table1.column_name = table2.column_name)];
```

In the syntax: table1.column Denotes the table and column from which
data is retrieved
CROSS JOIN Returns a Cartesian product from the two tables
NATURAL JOIN Joins two tables based on the same column name
JOIN table USING column_name Performs an equijoin based on the column name
JOIN table ON table1.column_name Performs an equijoin based on the condition in the ON clause
= table2.column_name

LEFT/RIGHT/FULL OUTER

Creating Cross Joins
• The CROSS JOIN clause produces the crossproduct of two tables.
• This is the same as a Cartesian product between the two tables.

Example:

```
SELECT last_name, department_name
FROM   employees
CROSS JOIN departments ;
```

```
SELECT last_name, department_name
FROM   employees, departments;
```

Creating Natural Joins

- The NATURAL JOIN clause is based on all columns in the two tables that have the same name.
- It selects rows from the two tables that have equal values in all matched columns.
- If the columns having the same names have different data types, an error is returned. **Example:**

```
SELECT department_id, department_name, location_id,
city
FROM   departments
NATURAL JOIN locations ;
```

LOCATIONS table is joined to the DEPARTMENT table by the LOCATION_ID column, which is the only column of the same name in both tables. If other common columns were present, the join would have used them all.

Example:

```
SELECT  department_id, department_name,
location_id, city
FROM    departments
NATURAL JOIN locations
WHERE   department_id IN (20, 50);
```

Creating Joins with the USING Clause

- If several columns have the same names but the data types do not match, the NATURAL JOIN clause can be modified with the USING clause to specify the columns that should be used for an equijoin.
- Use the USING clause to match only one column when more than one column matches.
- Do not use a table name or alias in the referenced columns.
- The NATURAL JOIN and USING clauses are mutually exclusive.

Example:

```
SELECT l.city, d.department_name
FROM   locations l JOIN departments d USING (location_id)
WHERE  location_id = 1400; EXAMPLE:


SELECT e.employee_id, e.last_name, d.location_id
FROM   employees e JOIN departments d
USING (department_id) ;
```

Creating Joins with the ON Clause

- The join condition for the natural join is basically an equijoin of all columns with the same name.
- To specify arbitrary conditions or specify columns to join, the ON clause is used.
- The join condition is separated from other searchconditions.
- The ON clause makes code easy to understand.

Example:

```
SELECT e.employee_id, e.last_name, e.department_id,  d.department_id,
d.location_id
FROM   employees e JOIN departments d ON
(e.department_id = d.department_id);
```

EXAMPLE:

```
SELECT e.last_name emp, m.last_name mgr
FROM   employees e JOIN employees m
ON     (e.manager_id = m.employee_id);
```

INNER Versus OUTER Joins

- A join between two tables that returns the results of the inner join as well as unmatched rows left (or right) tables is a left (or right) outer join.

- A join between two tables that returns the results of an inner join as well as the results of a left and right join is a full outer join.

LEFT OUTER JOIN Example:

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e
LEFT OUTER JOIN departments d
ON   (e.department_id = d.department_id) ;
```

Example of LEFT OUTER JOIN

This query retrieves all rows in the EMPLOYEES table, which is the left table even if there is no match in the DEPARTMENTS table.

This query was completed in earlier releases as follows:

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e, departments d
```

```
WHERE  d.department_id (+) = e.department_id;
```

RIGHT OUTER JOIN Example:

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e
RIGHT OUTER JOIN departments d
ON    (e.department_id = d.department_id) ;
```

This query retrieves all rows in the DEPARTMENTS table, which is the right table even if there is no match in the EMPLOYEES table.

This query was completed in earlier releases as follows:

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e, departments d
WHERE  d.department_id = e.department_id  (+);
```

FULL OUTER JOIN Example:

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e
FULL OUTER JOIN departments d
ON   (e.department_id = d.department_id) ;
```

This query retrieves all rows in the EMPLOYEES table, even if there is no match in the DEPARTMENTS table. It alslso retrieves all rows in the DEPARTMENTS table, even if there is no match in the EMPLOYEES table.

Find the Solution for the following:

1. Write a query to display the last name, department number, and department name for all employees.

```
SELECT
   e.last_name,
   e.department_id,
   d.department_name FROM
```

```
   employees e JOIN
   departments d ON e.department_id = d.department_id;
```

2. Create a unique listing of all jobs that are in department 80. Include the location of the department in the output.

```
SELECT DISTINCT
   E.job_id,    l.location_name FROM     employees e
JOIN
   departments d ON e.department_id = d.department_id JOIN
   locations l ON d.location_id = l.location_id WHERE   e.department_id = 80;
```

3. Write a query to display the employee last name, department name, location ID, and city of all employees who earn a commission

```
SELECT
   e.last_name,
   d.department_name,
   l.location_id,
   l.city
FROM
   employees e JOIN
   departments d ON e.department_id = d.department_id JOIN
   locations l ON d.location_id = l.location_id
WHERE
   e.commission_pct IS NOT NULL;
```

4. Display the employee last name and department name for all employees who have an a(lowercase) in their last names. P

```
SELECT
   e.last_name,
   d.department_name FROM
   employees e JOIN
   departments d ON e.department_id = d.department_id
WHERE
   e.last_name LIKE '%a%';
```

5. Write a query to display the last name, job, department number, and department name for all employees who work in Toronto.

```
SELECT
   e.last_name,    j.job_title,    d.department_id,    d.department_name
FROM    employees e JOIN
   jobs j ON e.job_id = j.job_id
JOIN
   departments d ON e.department_id = d.department_id JOIN
   locations l ON d.location_id = l.location_id
WHERE
   l.city = 'Toronto';
```

6. Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, Respectively

```
SELECT
   e.last_name AS Employee,
   e.employee_id AS "Emp#",
   m.last_name AS Manager,
   m.employee_id AS "Mgr#" FROM
   employees e
LEFT JOIN
   employees m ON e.manager_id = m.employee_id;
```

7. Modify lab4_6.sql to display all employees including King, who has no manager. Order the results by the employee number.

```
SELECT
   e.last_name AS Employee,
   e.employee_id AS "Emp#",
   m.last_name AS Manager,
   m.employee_id AS "Mgr#" FROM
   employees e
LEFT JOIN
   employees m ON e.manager_id = m.employee_id
ORDER BY
   e.employee_id;
```

8. Create a query that displays employee last names, department numbers, and all the employees who work in the same department as a given employee. Give each column an appropriate label

```
SELECT
   e1.last_name AS "Employee",
   e1.department_id AS "Department Number",
   e2.last_name AS "Colleague"
FROM
   employees e1 JOIN
   employees e2 ON e1.department_id = e2.department_id ORDER
BY
   e1.last_name, e2.last_name;
```

9. Show the structure of the JOB_GRADES table. Create a query that displays the name, job, department name, salary, and grade for all employees

```
DESC JOB_GRADES;

SELECT
   e.last_name AS "Name",
   j.job_title AS "Job",
   d.department_name AS "Department Name",
   e.salary AS "Salary",
   g.grade AS "Grade"
FROM
   employees e JOIN
   jobs j ON e.job_id = j.job_id JOIN
   departments d ON e.department_id = d.department_id JOIN
   job_grades g ON e.salary BETWEEN g.low_salary AND g.high_salary;
```

10. Create a query to display the name and hire date of any employee hired after employee Davies.

```
SELECT
   last_name AS Name,     hire_date AS "Hire Date" FROM      employees
WHERE
   hire_date > (
      SELECT hire_date
      FROM employees
      WHERE last_name = 'Davies'

      FETCH FIRST 1 ROW ONLY   –it may require if multipl values for davies
   );
```

11. Display the names and hire dates for all employees who were hired before their managers, along with their manager's names and hire dates. Label the columns Employee, Emp Hired, Manager, and Mgr Hired, respectively.

```
SELECT
   e.last_name AS Employee,    e.hire_date AS "Emp Hired",
   m.last_name AS Manager,     m.hire_date AS "Mgr Hired"
FROM    employees e JOIN
   employees m ON e.manager_id = m.employee_id
WHERE
   e.hire_date < m.hire_date;
```

EXERCISE-8

Aggregating Data Using Group Functions

Objectives

After the completion of this exercise, the students be will be able to do the following:

- Identify the available group functions
- Describe the use of group functions
- Group data by using the GROUP BY clause
- Include or exclude grouped rows by using the HAVING clause

What Are Group Functions?

Group functions operate on sets of rows to give one result per group

Types of Group Functions

- AVG
- COUNT
- MAX
- MIN
- STDDEV
- SUM
- VARIANCE

Each of the functions accepts an argument. The following table identifies the options that you can use in the syntax:

Function	Description
AVG([DISTINCT|ALL] n)	Average value of n, ignoring null values
COUNT({*| [DISTINCT|ALL] expr})	Number of rows, where expr evaluates to something other than null (count all selected rows using *, including duplicates and rows with nulls)
MAX([DISTINCT|ALL] expr)	Maximum value of expr, ignoring null values
MIN([DISTINCT|ALL] expr)	Minimum value of expr, ignoring null values
STDDEV([DISTINCT|ALL] x)	Standard deviation of n, ignoring null values
SUM([DISTINCT|ALL] n)	Sum values of n, ignoring null values
VARIANCE([DISTINCT|ALL] x)	Variance of n, ignoring null values

Group Functions: Syntax

SELECT [*column*,] *group_function(column), ...* FROM
table
[WHERE *condition*]
[GROUP BY *column*]
[ORDER BY *column*];

Guidelines for Using Group Functions

- DISTINCT makes the function consider only nonduplicate values; ALL makes it consider every value, including duplicates. The default is ALL and therefore does not need to be specified.

- The data types for the functions with an expr argument may be CHAR, VARCHAR2, NUMBER, or DATE.

- All group functions ignore null values.

Using the AVG and SUM Functions

You can use AVG and SUM for numeric data.

```
SELECT AVG(salary), MAX(salary),
MIN(salary), SUM(salary)
FROM employees
WHERE job_id LIKE '%REP%';
```

Using the MIN and MAX Functions

You can use MIN and MAX for numeric, character, and date data types.

```
SELECT MIN(hire_date), MAX(hire_date)
FROM employees;
```

You can use the MAX and MIN functions for numeric, character, and date data types. example displays the most junior and most senior employees.

The following example displays the employee last name that is first and the employee last name that is last in an alphabetized list of all employees:

```
SELECT MIN(last_name), MAX(last_name)
FROM employees;
```

Note: The AVG, SUM, VARIANCE, and STDDEV functions can be used only with numeric data types. MAX and MIN cannot be used with LOB or LONG data types.

Using the COUNT Function

COUNT(*) returns the number of rows in a table:

```
SELECT COUNT(*)
FROM employees
WHERE department_id = 50;
```

COUNT(*expr*) returns the number of rows with nonnull values for the *expr*:

```
SELECT COUNT(commission_pct)
FROM employees
WHERE department_id = 80;
```

Using the DISTINCT Keyword

- COUNT(DISTINCT expr) returns the number of distinct non-null values of the *expr*.

- To display the number of distinct department values in the EMPLOYEES table:

```
SELECT COUNT(DISTINCT department_id) FROM employees;
```

Use the DISTINCT keyword to suppress the counting of any duplicate values in a column.

Group Functions and Null Values

Group functions ignore null values in the column:

```
SELECT AVG(commission_pct)
FROM employees;
```

The NVL function forces group functions to include null values:

```
SELECT AVG(NVL(commission_pct, 0))
FROM employees;
```

Creating Groups of Data

To divide the table of information into smaller groups. This can be done by using the GROUP BY clause.

GROUP BY Clause Syntax

```
SELECT column, group_function(column)
FROM table
[WHERE condition]
[GROUP BY group_by_expression]
[ORDER BY column];
```

In the syntax: *group_by_expression* specifies columns whose values determine the basis for grouping rows

Guidelines

- If you include a group function in a SELECT clause, you cannot select individual results as well, *unless* the individual column appears in the GROUP BY clause. You receive an error message if you fail to include the column list in the GROUP BY clause.
- Using a WHERE clause, you can exclude rows before dividing them into groups.
- You must include the *columns* in the GROUP BY clause.
- You cannot use a column alias in the GROUP BY clause.

Using the GROUP BY Clause

All columns in the SELECT list that are not in group functions must be in the GROUP BY clause.

```
SELECT department_id, AVG(salary)
```

FROM employees
GROUP BY department_id ;

The GROUP BY column does not have to be in the SELECT list.

SELECT AVG(salary) FROM employees GROUP BY department_id ;

You can use the group function in the ORDER BY clause:

SELECT department_id, AVG(salary) FROM employees GROUP BY department_id ORDER BY AVG(salary);

Grouping by More Than One Column

SELECT department_id dept_id, job_id, SUM(salary) FROM employees
GROUP BY department_id, job_id ;

Illegal Queries Using Group Functions

Any column or expression in the SELECT list that is not an aggregate function must be in the GROUP

BY clause:

SELECT department_id, COUNT(last_name) FROM employees;

You can correct the error by adding the GROUP BY clause:

SELECT department_id, count(last_name) FROM employees GROUP BY department_id;

You cannot use the WHERE clause to restrict groups.

• You use the HAVING clause to restrict groups.

• You cannot use group functions in the WHERE clause.

SELECT department_id, AVG(salary) FROM employees WHERE AVG(salary) > 8000
GROUP BY department_id;
You can correct the error in the example by using the HAVING clause to restrict groups:

SELECT department_id, AVG(salary) FROM employees

HAVING AVG(salary) > 8000 GROUP BY department_id;

Restricting Group Results

With the HAVING Clause .When you use the HAVING clause, the Oracle server restricts groups as follows:
1. Rows are grouped.
2. The group function is applied.
3. Groups matching the HAVING clause are displayed.

Using the HAVING Clause

SELECT department_id, MAX(salary) FROM employees
GROUP BY department_idHAVING MAX(salary)>10000 ;

The following example displays the department numbers and average salaries for those departments with a maximum salary that is greater than $10,000:

SELECT department_id, AVG(salary) FROM employees GROUP BY department_id HAVING max(salary)>10000;

Example displays the job ID and total monthly salary for each job that has a total payroll exceeding $13,000. The example excludes sales representatives and sorts the list by the total monthly salary.

SELECT job_id, SUM(salary) PAYROLL FROM employees WHERE job_id NOT LIKE '%REP%'
GROUP BY job_id HAVING SUM(salary) > 13000 ORDER BY SUM(salary);

Nesting Group Functions

Display the maximum average salary:
Group functions can be nested to a depth of two. The slide example displays the maximum average salary.

SELECT MAX(AVG(salary)) FROM employees GROUP BY department_id;

Summary
In this exercise, students should have learned how to:
- Use the group functions COUNT, MAX, MIN, and AVG
- Write queries that use the GROUP BY clause
- Write queries that use the HAVING clause

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SELECT *column*, *group_function*
FROM *table*
[WHERE *condition*]
[GROUP BY *group_by_expression*]
[HAVING *group_condition*]
[ORDER BY *column*];

Find the Solution for the following:

Determine the validity of the following three statements. Circle either True or False.

1. Group functions work across many rows to produce one result per group.
True/False

2. Group functions include nulls in calculations.
True/**False**

3. The WHERE clause restricts rows prior to inclusion in a group calculation.
True/False

The HR department needs the following reports:

4. Find the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number

```
SELECT
  ROUND(MAX(salary)) AS Maximum,
  ROUND(MIN(salary)) AS Minimum,
  ROUND(SUM(salary)) AS Sum,
  ROUND(AVG(salary)) AS Average
FROM employees;
```

5. Modify the above query to display the minimum, maximum, sum, and average salary for each job type.

```
SELECT
  job_type,
  ROUND(MIN(salary)) AS Minimum,
  ROUND(MAX(salary)) AS Maximum,
  ROUND(SUM(salary)) AS Sum,
  ROUND(AVG(salary)) AS Average
FROM employees
GROUP BY job_type;
```

6.Write a query to display the number of people with the same job. Generalize the query so that the user in the HR department is prompted for a job title.

```
SELECT job_type, COUNT(*) AS Number_of_People
FROM employees WHERE job_type = ?
GROUP BY job_type;
```

7. Determine the number of managers without listing them. Label the column Number of Managers. *Hint: Use the MANAGER_ID column to determine the number of managers.*

```
SELECT COUNT(DISTINCT MANAGER_ID) AS "Number of Managers"
FROM employees
WHERE MANAGER_ID IS NOT NULL;
```

8. Find the difference between the highest and lowest salaries. Label the column DIFFERENCE.

```
SELECT
  ROUND(MAX(salary) - MIN(salary)) AS DIFFERENCE
FROM employees;
```

9. Create a report to display the manager number and the salary of the lowest-paid employee for that manager. Exclude anyone whose manager is not known. Exclude any groups where the minimum salary is $6,000 or less. Sort the output in descending order of salary.

```
SELECT
  MANAGER_ID AS Manager_Number,
  MIN(salary) AS Lowest_Salary
FROM employees
WHERE MANAGER_ID IS NOT NULL
GROUP BY MANAGER_ID
HAVING MIN(salary) > 6000
ORDER BY Lowest_Salary DESC;
```

10. Create a query to display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998. Create appropriate column headings.

```
SELECT
  COUNT(*) AS Total_Employees,
  COUNT(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1995 THEN 1 END) AS Hired_1995,
  COUNT(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1996 THEN 1 END) AS Hired_1996,
  COUNT(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1997 THEN 1 END) AS Hired_1997,
  COUNT(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1998 THEN 1 END) AS Hired_1998 FROM
employees;
```

11. Create a matrix query to display the job, the salary for that job based on department number, and the total salary for that job, for departments 20, 50, 80, and 90, giving each column an appropriate heading.

```
SELECT
  job,
  SUM(CASE WHEN department_id = 20 THEN salary ELSE 0 END) AS Salary_Dept_20,
  SUM(CASE WHEN department_id = 50 THEN salary ELSE 0 END) AS Salary_Dept_50,
  SUM(CASE WHEN department_id = 80 THEN salary ELSE 0 END) AS Salary_Dept_80,
  SUM(CASE WHEN department_id = 90 THEN salary ELSE 0 END) AS Salary_Dept_90,
SUM(salary) AS Total_Salary
FROM employees
WHERE department_id IN (20, 50, 80, 90)
GROUP BY job
ORDER BY job;
```

12.Write a query to display each department's name, location, number of employees, and the average salary for all the employees in that department. Label the column name-Location, Number of people, and salary respectively. Round the average salary to two decimal places.

```
SELECT
  d.department_name || '-' || d.location AS "name-Location",
  COUNT(e.employee_id) AS "Number of people",
  ROUND(AVG(e.salary), 2) AS salary
FROM departments d
LEFT JOIN employees e ON d.department_id = e.department_id
GROUP BY d.department_name, d.location
ORDER BY d.department_name;
```

EXERCISE-9

Sub queries

Objectives

After completing this lesson, you should be able to do the following:

- Define subqueries

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- Describe the types of problems that subqueries can solve
- List the types of subqueries
- Write single-row and multiple-row subqueries

Using a Subquery to Solve a Problem Who has a salary greater than Abel's?

Main query:
Which employees have salaries greater than Abel's salary?

Subquery:
What is Abel's salary?

Subquery Syntax

SELECT *select_list* FROM *table* WHERE *expr operator* (SELECT *select_list* FROM *table*);

- The subquery (inner query) executes once before the main query (outer query).

- The result of the subquery is used by the main query.

A subquery is a SELECT statement that is embedded in a clause of another SELECT statement. You can build powerful statements out of simple ones by using subqueries. They can be very useful when you need to select rows from a table with a condition that depends on the data in the table itself.

You can place the subquery in a number of SQL clauses, including the following:

- WHERE clause
- HAVING clause
- FROM clause

In the syntax:
operator includes a comparison condition such as >, =, or IN

Note: Comparison conditions fall into two classes: single-row operators (>, =, >=, <, <>, <=) and multiple-row operators (IN, ANY, ALL). statement. The subquery generally executes first, and its output is used to complete the query condition for the main (or outer) query

Using a Subquery

SELECT last_name FROM employees WHERE salary > (SELECT salary FROM employees WHERE last_name = 'Abel');

The inner query determines the salary of employee Abel. The outer query takes the result of the inner query and uses this result to display all the employees who earn more than this amount.

Guidelines for Using Subqueries

- Enclose subqueries in parentheses.
- Place subqueries on the right side of the comparison condition.
- The ORDER BY clause in the subquery is not needed unless you are performing Top-N analysis.
- Use single-row operators with single-row

subqueries, and use multiple-row operators with multiple-row subqueries.

Types of Subqueries

- Single-row subqueries: Queries that return only one row from the inner SELECT statement.
- Multiple-row subqueries: Queries that return more than one row from the inner SELECT statement.

Single-Row Subqueries

- Return only one row
- Use single-row comparison operators

Example

Display the employees whose job ID is the same as that of employee 141:

```
SELECT last_name, job_id FROM employees WHERE job_id = (SELECT job_id FROM
employees
WHERE employee_id = 141);
```

Displays employees whose job ID is the same as that of employee 141 and whose salary is greater than that of employee 143.

```
SELECT last_name, job_id, salary FROM employeesWHERE job_id =(SELECT job_id FROM
employees WHERE employee_id = 141) AND salary > (SELECT salary FROM employees
WHERE employee_id = 143);
```

Using Group Functions in a Subquery

Displays the employee last name, job ID, and salary of all employees whose salary is equal to the minimum salary. The MIN group function returns a single value (2500) to the outer query.

```
SELECT last_name, job_id, salary FROM employees WHERE salary = (SELECT MIN(salary)
FROM employees);
```

The HAVING Clause with Subqueries

- The Oracle server executes subqueries first.

- The Oracle server returns results into the HAVING clause of the main query.

Displays all the departments that have a minimum salary greater than that of department 50.

```
SELECT department_id, MIN(salary)
FROM employees
GROUP BY department_id
HAVING MIN(salary) >
(SELECT MIN(salary)
FROM employees
WHERE department_id = 50);
```

Example

Find the job with the lowest average salary.

```
SELECT job_id, AVG(salary)
FROM employees
GROUP BY job_id
HAVING AVG(salary) = (SELECT MIN(AVG(salary))
FROM employees
GROUP BY job_id);
```

What Is Wrong in this Statements?

```
SELECT employee_id, last_name
FROM employees
WHERE salary =(SELECT MIN(salary) FROM employees GROUP BY department_id);
```

Will This Statement Return Rows?

```
SELECT last_name, job_id
FROM employees
WHERE job_id =(SELECT job_id FROM employees WHERE last_name = 'Haas');
```

Multiple-Row Subqueries

- Return more than one row
- Use multiple-row comparison operators

Example

Find the employees who earn the same salary as the minimum salary for each department.

```
SELECT last_name, salary, department_id FROM employees WHERE salary IN (SELECT
MIN(salary)
FROM employees GROUP BY department_id);
```

Using the ANY Operator in Multiple-Row Subqueries

SELECT employee_id, last_name, job_id, salary FROM employees WHERE salary < ANY (SELECT salary FROM employees WHERE job_id = 'IT_PROG') AND job_id <> 'IT_PROG';

Displays employees who are not IT programmers and whose salary is less than that of any IT programmer. The maximum salary that a programmer earns is $9,000.

< ANY means less than the maximum. >ANY means more than the minimum. =ANY is equivalent to IN.

Using the ALL Operator in Multiple-Row Subqueries

SELECT employee_id, last_name, job_id, salary
FROM employees
WHERE salary < ALL (SELECT salary FROM employees WHERE job_id = 'IT_PROG') AND job_id <> 'IT_PROG';
Displays employees whose salary is less than the salary of all employees with a job ID of IT_PROG and whose job is not IT_PROG.

ALL means more than the maximum, and <ALL means less than the minimum.

The NOT operator can be used with IN, ANY, and ALL operators.

Null Values in a Subquery

SELECT emp.last_name FROM employees emp
WHERE emp.employee_id NOT IN (SELECT mgr.manager_id FROM employees mgr);

Notice that the null value as part of the results set of a subquery is not a problem if you use the IN operator. The IN operator is equivalent to =ANY. For example, to display the employees who have subordinates, use the following SQL statement:

SELECT emp.last_name
FROM employees emp
WHERE emp.employee_id IN (SELECT mgr.manager_id FROM employees mgr);

Display all employees who do not have any subordinates:

SELECT last_name FROM employees
WHERE employee_id NOT IN (SELECT manager_id FROM employees WHERE manager_id IS NOT NULL);

Find the Solution for the following:

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1. The HR department needs a query that prompts the user for an employee last name. The query then displays the last name and hire date of any employee in the same department as the employee whose name they supply (excluding that employee). For example, if the user enters Zlotkey, find all employees who work with Zlotkey (excluding Zlotkey).

```
SELECT last_name, hire_date
FROM employees
WHERE department_id = (
   SELECT department_id
FROM employees     WHERE
last_name = ?
)
AND last_name <> ?
ORDER BY last_name;
```

2. Create a report that displays the employee number, last name, and salary of all employees who earn more than the average salary. Sort the results in order of ascending salary.

```
SELECT employee_id, last_name, salary
FROM employees
WHERE salary > (SELECT AVG(salary) FROM employees)
ORDER BY salary ASC;
```

3. Write a query that displays the employee number and last name of all employees who work in a department with any employee whose last name contains a *u*.

```
SELECT employee_id, last_name
FROM employees
WHERE department_id IN (
   SELECT DISTINCT department_id
   FROM employees
   WHERE last_name LIKE '%u%'
)
ORDER BY employee_id;
```

4. The HR department needs a report that displays the last name, department number, and job ID of all employees whose department location ID is 1700.

```
SELECT e.last_name, e.department_id, e.job_id
FROM employees e
JOIN departments d ON e.department_id = d.department_id
WHERE d.location_id = 1700
ORDER BY e.last_name;
```

5. Create a report for HR that displays the last name and salary of every employee who reports to King.

```
SELECT e.last_name, e.salary
FROM employees e
JOIN employees m ON e.manager_id = m.employee_id
WHERE m.last_name = 'King'
ORDER BY e.last_name;
```

6. Create a report for HR that displays the department number, last name, and job ID for every employee in the Executive department.

```
SELECT e.department_id, e.last_name, e.job_id
FROM employees e
JOIN departments d ON e.department_id = d.department_id
WHERE d.department_name = 'Executive'
ORDER BY e.last_name;
```

7. Modify the query 3 to display the employee number, last name, and salary of all employees who earn more than the average salary and who work in a department with any employee whose last name contains a *u*.

```
SELECT employee_id, last_name, salary
FROM employees
WHERE salary > (SELECT AVG(salary) FROM employees)
  AND department_id IN (
    SELECT DISTINCT department_id
    FROM employees
    WHERE last_name LIKE '%u%'
  )
ORDER BY salary ASC;
```

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EXERCISE-10

USING THE SET OPERATORS

Objectives

After the completion this exercise, the students should be able to do the following:

- Describe set operators
- Use a set operator to combine multiple queries into a single query
- Control the order of rows returned

The set operators combine the results of two or more component queries into one result.

Queries containing set operators are called *compound queries*.

Operator	Returns
UNION	All distinct rows selected by either query
UNION ALL	All rows selected by either query, including all duplicates
INTERSECT	All distinct rows selected by both queries
MINUS	All distinct rows that are selected by the first SELECT statement and not selected in the second SELECT statement

The tables used in this lesson are:

- EMPLOYEES: Provides details regarding all current employees

- JOB_HISTORY: Records the details of the start date and end date of the former job, and the job identification number and department when an employee switches jobs

UNION Operator

Guidelines

- The number of columns and the data types of the columns being selected must be identical in all the SELECT statements used in the query. The names of the columns need not be identical.

- UNION operates over all of the columns being selected.

• NULL values are not ignored during duplicate checking.

• The IN operator has a higher precedence than the UNION operator.

• By default, the output is sorted in ascending order of the first column of the SELECT clause.

Example:

Display the current and previous job details of all employees. Display each employee only once.

SELECT employee_id, job_id FROM employees UNION SELECT employee_id, job_id FROM job_history;

Example:

```
SELECT employee_id, job_id, department_id
FROM employees
UNION
SELECT employee_id, job_id, department_id
FROM job_history;
```

UNION ALL Operator

Guidelines

The guidelines for UNION and UNION ALL are the same, with the following two exceptions that pertain to UNION ALL:
• Unlike UNION, duplicate rows are not eliminated and the output is not sorted by default.
• The DISTINCT keyword cannot be used.

Example:

Display the current and previous departments of all employees.

```
SELECT employee_id, job_id, department_id
FROM employees
UNION ALL
SELECT employee_id, job_id, department_id
FROM job_history
ORDER BY employee_id;
```

INTERSECT Operator

Guidelines

- The number of columns and the data types of the columns being selected by the SELECT statements in the queries must be identical in all the SELECT statements used in the query. The names of the columns need not be identical.
- Reversing the order of the intersected tables does not alter the result.
- INTERSECT does not ignore NULL values.

Example:

Display the employee IDs and job IDs of those employees who currently have a job title that is the same as their job title when they were initially hired (that is, they changed jobs but have now gone back to doing their original job).

```
SELECT employee_id, job_id FROM employees
INTERSECT
SELECT employee_id, job_id
FROM job_history;
```

Example

```
SELECT employee_id, job_id, department_id
FROM employees
INTERSECT
SELECT employee_id, job_id, department_id
FROM job_history;
```

MINUS Operator

Guidelines

- The number of columns and the data types of the columns being selected by the SELECT statements in the queries must be identical in all the SELECT statements used in the query. The names of the columns need not be identical.
- All of the columns in the WHERE clause must be in the SELECT clause for the MINUS operator to work.

Example:

Display the employee IDs of those employees who have not changed their jobs even once.

```
SELECT employee_id,job_id
FROM employees
MINUS
SELECT employee_id,job_id
FROM job_history;
```

Find the Solution for the following:

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1. The HR department needs a list of department IDs for departments that do not contain the job ID ST_CLERK. Use set operators to create this report.

2. The HR department needs a list of countries that have no departments located in them. Display the country ID and the name of the countries. Use set operators to create this report.

3. Produce a list of jobs for departments 10, 50, and 20, in that order. Display job ID and department ID using set operators.

4. Create a report that lists the employee IDs and job IDs of those employees who currently have a job title that is the same as their job title when they were initially hired by the company (that is, they changed jobs but have now gone back to doing their original job).

5. The HR department needs a report with the following specifications:

- Last name and department ID of all the employees from the EMPLOYEES table, regardless of whether or not they belong to a department.

- Department ID and department name of all the departments from the DEPARTMENTS table, regardless of whether or not they have employees working in them Write a compound query to accomplish this.

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EXERCISE-11

CREATING VIEWS

After the completion of this exercise, students will be able to do the following:

- Describe a view
- Create, alter the definition of, and drop a view
- Retrieve data through a view
- Insert, update, and delete data through a view
- Create and use an inline view

View

A view is a logical table based on a table or another view. A view contains no data but is like a window through which data from tables can be viewed or changed.The tables on which a view is based are called base tables.

Advantages of Views

- To restrict data access
- To make complex queries easy
- To provide data independence
- To present different views of the same data

Classification of views

1. Simple view
2. Complex view

Feature	Simple	Complex
No. of tables	One	One or more

Contains functions	No	Yes
Contains groups of data	No	Yes
DML operations thr' view	Yes	Not always

Creating a view

Syntax
CREATE OR REPLACE FORCE/NOFORCE VIEW view_name AS Subquery WITH CHECK OPTION CONSTRAINT constraint WITH READ ONLY CONSTRAINT constraint;

FORCE - Creates the view regardless of whether or not the base tables exist.

NOFORCE - Creates the view only if the ase table exist.

WITH CHECK OPTION CONSTRAINT-specifies that only rows accessible to the view can be inserted or updated.

WITH READ ONLY CONSTRAINT-ensures that no DML operations can be performed on the view.

Example: 1 (W**ithout using Column aliases)**
Create a view EMPVU80 that contains details of employees in department80.

Example 2:

CREATE VIEW empvu80 AS SELECT employee_id, last_name, salary FROM employees WHERE department_id=80;

Example:1 (**Using column aliases)**

CREATE VIEW salvu50
AS SELECT employee_id,id_number, last_name NAME, salary *12 ANN_SALARY
FROM employees
WHERE department_id=50;

Retrieving data from a view

Example:
SELECT * from salvu50;

Modifying a view

A view can be altered without dropping, re-creating.

Example: (Simple view)

Modify the EMPVU80 view by using CREATE OR REPLACE.

```
CREATE OR REPLACE VIEW empvu80 (id_number, name, sal, department_id)
 AS      SELECT employee_id,first_name, last_name, salary, department_id
FROM employees
WHERE department_id=80;
```

Example: (complex view)

```
CREATE VIEW dept_sum_vu (name, minsal, maxsal,avgsal)
AS      SELECT d.department_name, MIN(e.salary), MAX(e.salary), AVG(e.salary)
FROM employees e, department d
WHERE e.deparment_id=d.deparment_id
GROUP BY d.department_name;
```

Rules for performing DML operations on view

- Can perform operations on simple views
- Cannot remove a row if the view contains the following:
  - Group functions
  - Group By clause
  - Distinct keyword
- Cannot modify data in a view if it contains
  - Group functions
  - Group By clause
  - Distinct keyword
  - Columns contain by expressions
  -
- Cannot add data thr' a view if it contains
  - Group functions
  - Group By clause
  - Distinct keyword
  - Columns contain by expressions
  - NOT NULL columns in the base table that are not selected by the view

Example: (Using the WITH CHECK OPTION clause)

```
CREATE OR REPLACE VIEW empvu20
 AS      SELECT *
 FROM employees
 WHERE department_id=20
 WITH CHECK OPTION CONSTRAINT empvu20_ck;
```

Note: Any attempt to change the department number for any row in the view fails because it violates the WITH CHECK OPTION constraint.

Example – (Execute this and note the error)

```
UPDATE empvu20 SET department_id=10 WHERE employee_id=201;
```

Denying DML operations

Use of WITH READ ONLY option.
Any attempt to perform a DML on any row in the view results in an oracle server error.

Try this code:

```
CREATE OR REPLACE VIEW empvu10(employee_number, employee_name,job_title)
AS SELECT employee_id, last_name, job_id
FROM employees
WHERE department_id=10
WITH READ ONLY;
```

Find the Solution for the following:

1. Create a view called EMPLOYEE_VU based on the employee numbers, employee names and department numbers from the EMPLOYEES table. Change the heading for the employee name to EMPLOYEE.

2. Display the contents of the EMPLOYEES_VU view.

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3. Select the view name and text from the USER_VIEWS data dictionary views.

4. Using your EMPLOYEES_VU view, enter a query to display all employees names and department.

5. Create a view named DEPT50 that contains the employee number, employee last names and department numbers for all employees in department 50.Label the view columns EMPNO, EMPLOYEE and DEPTNO. Do not allow an employee to be reassigned to another department through the view.

6. Display the structure and contents of the DEPT50 view.

7. Attempt to reassign Matos to department 80.

8. Create a view called SALARY_VU based on the employee last names, department names, salaries, and salary grades for all employees. Use the Employees, DEPARTMENTS and JOB_GRADE tables. Label the column Employee, Department, salary, and Grade respectively.

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PL/SQL

Control Structures

In addition to SQL commands,PL/SQL can also process data usin 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:

Sequence of statements can be executed on satisfying certain condition .

If statements are being used and different forms of if are:

1.Simple IF

2.ELSIF

3.ELSE 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

```
  statementn;
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
        statementn;
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;
```

EXERCISE-12

PROCEDURES AND FUNCTIONS

PROCEDURES

DEFINITION

A procedure or function is a logically grouped set of SQL and PL/SQL statements that perform a specific task. They are essentially sub-programs. Procedures and functions are made up of,

- Declarative part
- Executable part
- Optional exception handling part

These procedures and functions do not show the errors.

KEYWORDS AND THEIR PURPOSES

REPLACE: It recreates the procedure if it already exists.

PROCEDURE: It is the name of the procedure to be created.

ARGUMENT: It is the name of the argument to the procedure. Paranthesis can be omitted if no arguments are present.

IN: Specifies that a value for the argument must be specified when calling the procedure ie. used to pass values to a sub-program. This is the default parameter.

OUT: Specifies that the procedure passes a value for this argument back to it's calling environment after execution ie. used to return values to a caller of the sub-program.

INOUT: Specifies that a value for the argument must be specified when calling the procedure and that procedure passes a value for this argument back to it's calling environment after execution.

RETURN: It is the datatype of the function's return value because every function must return a value, this clause is required.

PROCEDURES – SYNTAX

create or replace procedure <procedure name> (argument {in,out,inout} datatype) {is,as}
variable declaration; constant declaration; begin
PL/SQL subprogram body;
exception exception
PL/SQL block; end;

FUNCTIONS – SYNTAX

create or replace function <function name> (argument in datatype,……) return datatype {is,as}
variable declaration; constant declaration; begin
PL/SQL subprogram body;
exception exception
PL/SQL block;
end;

CREATING THE TABLE 'ITITEMS' AND DISPLAYING THE CONTENTS

SQL> create table ititems(itemid number(3), actualprice number(5), ordid number(4), prodid number(4));
Table created.

SQL> insert into ititems values(101, 2000, 500, 201); 1
row created.

SQL> insert into ititems values(102, 3000, 1600, 202); 1
row created.

```
SQL> insert into ititems values(103, 4000, 600, 202); 1
row created.

SQL> select * from ititems;
ITEMID  ACTUALPRICE    ORDID    PRODID
---------      -----------          --------      ---------
101         2000                500        201
102         3000               1600        202
103         4000                600        202
```

PROGRAM FOR GENERAL PROCEDURE – SELECTED RECORD'S PRICE IS INCREMENTED BY 500 , EXECUTING THE PROCEDURE CREATED AND DISPLAYING THE UPDATED TABLE

```
SQL> create procedure itsum(identity number, total number) is price number;
2  null_price exception;
3  begin
4  select actualprice into price from ititems where itemid=identity;   5  if price is
   null then
6    raise null_price;
7    else
8    update ititems set actualprice=actualprice+total where itemid=identity;
9    end if;
10  exception
11  when null_price then
12  dbms_output.put_line('price is null');
13  end;
14  /
Procedure created.

SQL> exec itsum(101, 500);
PL/SQL procedure successfully completed.

SQL> select * from ititems;
 ITEMID   ACTUALPRICE     ORDID     PRODID
---------         -----------          ---------     ---------
         101          2500                500         201
         102          3000               1600         202
         103          4000                600          202
```

<u>PROCEDURE FOR 'IN' PARAMETER – CREATION, EXECUTION</u>

```
SQL> set serveroutput on;

SQL> create procedure yyy (a IN number) is price number;
2  begin
3  select actualprice into price from ititems where itemid=a;
4  dbms_output.put_line('Actual price is ' || price);
5  if price is null then
6  dbms_output.put_line('price is null');
7  end if;
8  end;
9  /
Procedure created.

SQL> exec yyy(103);
Actual price is 4000
PL/SQL procedure successfully completed.
```

PROCEDURE FOR 'OUT' PARAMETER – CREATION, EXECUTION

```
SQL> set serveroutput on;

SQL> create procedure zzz (a in number, b out number) is identity number;
2   begin
3   select ordid into identity from ititems where itemid=a;
4   if identity<1000 then
5   b:=100;
6   end if;
7   end;
8   /
Procedure created.

SQL> declare
2  a number;
3  b number;
4  begin
5  zzz(101,b);
6  dbms_output.put_line('The value of b is '|| b);
7  end;
8  /
The value of b is 100
```

PL/SQL procedure successfully completed.

PROCEDURE FOR 'INOUT' PARAMETER – CREATION, EXECUTION

```
SQL> create procedure itit ( a in out number) is
2  begin
3  a:=a+1;
4  end;
5  /
  Procedure created.

SQL> declare
2  a number:=7;
3  begin
4  itit(a);
5  dbms_output.put_line('The updated value is '||a);
6  end;
7  /
The updated value is 8
PL/SQL procedure successfully completed.
```

CREATE THE TABLE 'ITTRAIN' TO BE USED FOR FUNCTIONS

```
SQL>create table ittrain ( tno number(10), tfare number(10)); Table
created.

SQL>insert into ittrain values (1001, 550);
1  row created.

SQL>insert into ittrain values (1002, 600); 1
row created.

SQL>select * from ittrain;
    TNO       TFARE
  ---------    ------------
1001         550
   1002         600
```

PROGRAM FOR FUNCTION AND IT'S EXECUTION

```
SQL> create function aaa (trainnumber number) return number is
2  trainfunction ittrain.tfare % type;
```

```
3  begin
4  select tfare into trainfunction from ittrain where tno=trainnumber;
5  return(trainfunction);
6  end;
7  /
```

Function created.

```
SQL> set serveroutput on;
```

```
SQL> declare
2  total number;
3  begin
4  total:=aaa (1001);
5  dbms_output.put_line('Train fare is Rs. '||total);
6  end;
7  /
```

Train fare is Rs.550

PL/SQL procedure successfully completed.

FACTORIAL OF A NUMBER USING FUNCTION — PROGRAM AND EXECUTION

```
 SQL>  create function itfact (a number) return number is
2     fact number:=1;
3     b number;
4     begin
5     b:=a;
6     while b>0
7     loop
8     fact:=fact*b;
9     b:=b-1;
10   end loop;
11   return(fact);
12   end;
13   /
```

Function created.

```
 SQL> set serveroutput on;
```

```
SQL> declare
2  a number:=7;
3  f number(10);
4  begin
5  f:=itfact(a);
6  dbms_output.put_line('The factorial of the given number is'||f);
7  end;
8  /
```

The factorial of the given number is 5040

PL/SQL procedure successfully completed.

EXERCISE-13

TRIGGER

DEFINITION

A trigger is a statement that is executed automatically by the system as a side effect of a modification to the database. The parts of a trigger are,

- **Trigger statement**: Specifies the DML statements and fires the trigger body. It also specifies the table to which the trigger is associated.

- **Trigger body or trigger action**: It is a PL/SQL block that is executed when the triggering statement is used.

- **Trigger restriction**: Restrictions on the trigger can be achieved

The different uses of triggers are as follows,

- *To generate data automatically*
- *To enforce complex integrity constraints*
- *To customize complex securing authorizations*
- *To maintain the replicate table*
- To audit data modifications

TYPES OF TRIGGERS

The various types of triggers are as follows,

- **Before**: It fires the trigger before executing the trigger statement.

- **After**: It fires the trigger after executing the trigger statement
- .
- **For each row**: It specifies that the trigger fires once per row
- .
- **For each statement**: This is the default trigger that is invoked. It specifies that the trigger fires once per statement.

VARIABLES USED IN TRIGGERS

- :new

- :old

These two variables retain the new and old values of the column updated in the database. The values in these variables can be used in the database triggers for data manipulation

SYNTAX

```
create or replace trigger triggername [before/after] {DML statements}
on [tablename] [for each row/statement]  begin
```


---------- exception
end;

USER DEFINED ERROR MESSAGE

The package "raise_application_error" is used to issue the user defined error messages

Syntax: raise_application_error(error number,'error message');

The error number can lie between -20000 and -20999.

The error message should be a character string.

TO CREATE THE TABLE 'ITEMPLS'

SQL> create table itempls (ename varchar2(10), eid number(5), salary number(10)); Table created.

SQL> insert into itempls values('xxx',11,10000); 1
row created.

SQL> insert into itempls values('yyy',12,10500); 1
row created.

SQL> insert into itempls values('zzz',13,15500); 1
row created.

SQL> select * from itempls;
ENAME EID SALARY
---------- --------- --------- xxx
11 10000 yyy 12
10500
zzz 13 15500

TO CREATE A SIMPLE TRIGGER THAT DOES NOT ALLOW INSERT UPDATE AND DELETE OPERATIONS ON THE TABLE

SQL> create trigger ittrigg before insert or update or delete on itempls for each row
2 begin

```
  3  raise_application_error(-20010,'You cannot do manipulation');
4  end;
  5
  6  /
Trigger created.

SQL> insert into itempls values('aaa',14,34000);
insert into itempls values('aaa',14,34000)
            *
ERROR at line 1:
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'

SQL> delete from itempls where ename='xxx';
delete from itempls where ename='xxx'
            *
ERROR at line 1:
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'

SQL> update itempls set eid=15 where ename='yyy';
update itempls set eid=15 where ename='yyy'
       *
ERROR at line 1:
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'
```

TO DROP THE CREATED TRIGGER

```
SQL> drop trigger ittrigg;

Trigger dropped.
```

TO CREATE A TRIGGER THAT RAISES AN USER DEFINED ERROR MESSAGE AND DOES NOT ALLOW UPDATION AND INSERTION

```
SQL> create trigger ittriggs before insert or update of salary on itempls for each row
2  declare
```

```
3   triggsal itempls.salary%type;
4   begin
5   select salary into triggsal from itempls where eid=12;
6   if(:new.salary>triggsal or :new.salary<triggsal) then
7   raise_application_error(-20100,'Salary has not been changed');
8   end if;
9   end;
10  /

Trigger created.

SQL> insert into itempls values ('bbb',16,45000);
insert into itempls values ('bbb',16,45000)
            *
ERROR at line 1:
ORA-04098: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation

SQL> update itempls set eid=18 where ename='zzz';
update itempls set eid=18 where ename='zzz'
       *
ERROR at line 1:
ORA-04298: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation
```

Cursor for loop

- Explicit cursor
- Implicit cursor

TO CREATE THE TABLE 'SSEMPP'

```
SQL> create table ssempp( eid number(10), ename varchar2(20), job varchar2(20), sal number
(10),dnonumber(5)); Table
created.

SQL> insert into ssempp values(1,'nala','lecturer',34000,11); 1
row created.

SQL> insert into ssempp values(2,'kala',' seniorlecturer',20000,12); 1
row created.

SQL> insert into ssempp values(5,'ajay','lecturer',30000,11); 1
row created.
```

```
SQL> insert into ssempp values(6,'vijay','lecturer',18000,11); 1
row created.

SQL> insert into ssempp values(3,'nila','professor',60000,12); 1
row created.

SQL> select * from ssempp;
   EID ENAME              JOB                  SAL       DNO
------ ------------------- -------------------  ---------  ---------
1      nala                lecturer             34000      11
2      kala                seniorlecturer       20000      12
5      ajay                lecturer             30000      11
6      vijay               lecturer             18000      11        3     nila
       professor           60000       12
```

EXTRA PROGRAMS

TO WRITE A PL/SQL BLOCK TO DISPLAY THE EMPOYEE ID AND EMPLOYEE NAME USING CURSOR FOR LOOP

```
SQL> set serveroutput on;
SQL> declare
2  begin
3  for emy in (select eid,ename from ssempp)
4  loop
5  dbms_output.put_line('Employee id and employee name  are '|| emy.eid ‘and’|| emy.ename);   6
   end loop;
7  end;
8  /
Employee id and employee name are 1 and nala
Employee id and employee name are 2 and kala
Employee id and employee name are 5 and ajay
Employee id and employee name are 6 and vijay
Employee id and employee name are 3 and nila

PL/SQL procedure successfully completed.
```

TO WRITE A PL/SQL BLOCK TO UPDATE THE SALARY OF ALL EMPLOYEES WHERE DEPARTMENT NO IS 11 BY 5000 USING CURSOR FOR LOOP

AND TO DISPLAY THE UPDATED TABLE

```
SQL> set serveroutput on;
SQL> declare
2    cursor cem is select eid,ename,sal,dno from ssempp where dno=11;
3    begin
4    --open cem;
5    for rem in cem
6    loop
7    update ssempp set sal=rem.sal+5000 where eid=rem.eid;
8    end loop;
9    --close cem;
10  end;
11  /

PL/SQL procedure successfully completed.

SQL> select * from ssempp;

     EID      ENAME               JOB                SAL       DNO
---------    -------------------- -------------------- --------- ---------
       1       nala                      lecturer            39000        11
2       kala                seniorlecturer        20000        12
          5       ajay                     lecturer            35000        11
          6       vijay                     lecturer            23000        11         3     nila
                  professor           60000        12
```

TO WRITE A PL/SQL BLOCK TO DISPLAY THE EMPLOYEE ID AND EMPLOYEE NAME WHERE DEPARTMENT NUMBER IS 11 USING EXPLICIT CURSORS

```
1  declare
2  cursor cenl is select eid,sal from ssempp where dno=11;
3  ecode ssempp.eid%type;
4  esal empp.sal%type;
5  begin
6  open cenl;
7  loop
8  fetch cenl into ecode,esal;
9  exit when cenl%notfound;
10dbms_output.put_line(' Employee code and employee salary are' || ecode ‘and’|| esal);  11  end
   loop;
```

```
 12  close cenl;
 13* end;

SQL> /
Employee code and employee salary are 1 and 39000
Employee code and employee salary are 5 and 35000
Employee code and employee salary are 6 and 23000

PL/SQL procedure successfully completed.
```

TO WRITE A PL/SQL BLOCK TO UPDATE THE SALARY BY 5000 WHERE THE JOB IS LECTURER , TO CHECK IF UPDATES ARE MADE USING IMPLICIT CURSORS AND TO DISPLAY THE UPDATED TABLE

```
SQL> declare
2    county number;
3    begin
4    update ssempp set sal=sal+10000 where job='lecturer';
5    county:= sql%rowcount;
6    if county > 0 then
7    dbms_output.put_line('The number of rows are '|| county);
8    end if;
9    if sql %found then
10   dbms_output.put_line('Employee record modification successful');
11   else if sql%notfound then
12   dbms_output.put_line('Employee record is not found');
13   end if;
14   end if;
15   end;
16   /
The number of rows are 3

Employee record modification successful

PL/SQL procedure successfully completed.

SQL> select * from ssempp;

     EID   ENAME              JOB                  SAL       DNO
--------- -------------------- -------------------- ---------       ---------
```

1 nala lecturer 44000 11
2 kala seniorlecturer 20000 12 5
ajay lecturer 40000 11
6 vijay lecturer 28000 11
3 nila professor 60000 12

PROGRAMS

TO DISPLAY HELLO MESSAGE

```
SQL> set serveroutput on;
SQL> declare
2  a varchar2(20);
3  begin
4  a:='Hello';
5  dbms_output.put_line(a);
6  end;
7  /
Hello

PL/SQL procedure successfully completed.
```

TO INPUT A VALUE FROM THE USER AND DISPLAY IT

```
SQL> set serveroutput on;
SQL> declare
2  a varchar2(20);
3  begin
4  a:=&a;
5  dbms_output.put_line(a);
6  end;
7  /
Enter value for a: 5
old   4: a:=&a; new
4: a:=5;
5

PL/SQL procedure successfully completed.
```

GREATEST OF TWO NUMBERS

```
SQL> set serveroutput on;
```

```
SQL> declare
2    a number(7);
3    b number(7);
4    begin
5    a:=&a;
6    b:=&b;
7    if(a>b) then
8    dbms_output.put_line (' The grerater of the two is'|| a);
9    else
10   dbms_output.put_line (' The grerater of the two is'|| b);
11   end if;
12   end;
13   /
Enter value for a: 5
old   5: a:=&a; new
5: a:=5; Enter value
for  b:  9  old      6:
b:=&b;  new       6:
b:=9;
The grerater of the two is9

PL/SQL procedure successfully completed.
```

GREATEST OF THREE NUMBERS

```
SQL> set serveroutput on;

SQL> declare
2    a number(7);
3    b number(7);
4    c number(7);
5    begin
6    a:=&a;
7    b:=&b;
8    c:=&c;
9    if(a>b and a>c) then
10   dbms_output.put_line (' The greatest of the three is ' || a);
11   else if (b>c) then
12   dbms_output.put_line (' The greatest of the three is ' || b);
13   else
14   dbms_output.put_line (' The greatest of the three is ' || c);
```

```
15  end if;
16  end if;
17  end;
18  /
Enter value for a: 5
old   6: a:=&a; new
6: a:=5; Enter value
for b: 7 old      7:
b:=&b; new        7:
b:=7; Enter value
for c: 1 old      8:
c:=&c; new        8:
c:=1;
The greatest of the three is 7

PL/SQL procedure successfully completed.
```

PRINT NUMBERS FROM 1 TO 5 USING SIMPLE LOOP

```
SQL> set serveroutput on;

SQL> declare
2    a number:=1;
3    begin
4    loop
5    dbms_output.put_line (a);
6    a:=a+1;
7    exit when a>5;
8    end loop;
9    end;
10  /
1
2
3
4
5

PL/SQL procedure successfully completed.
```

PRINT NUMBERS FROM 1 TO 4 USING WHILE LOOP

```
SQL> set serveroutput on;

SQL> declare
2    a number:=1;
3    begin
4    while(a<5)
5    loop
6    dbms_output.put_line (a);
7    a:=a+1;
8    end loop;
9    end;
10  /
1
2
3
4
```

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 USING FOR LOOP

```
SQL> set serveroutput on;

SQL> declare
2  a number:=1;
3  begin
4  for a in 1..5
5  loop
6  dbms_output.put_line (a);
7  end loop;
8  end;
9  /
1
2
3
4
5
```

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 IN REVERSE ORDER USING FOR LOOP

```
SQL> set serveroutput on;
SQL> declare
2  a number:=1;
3  begin
```

```
4  for a in reverse 1..5
5  loop
6  dbms_output.put_line (a);
7  end loop;
8  end;
9  /
5
4
3
2
1
PL/SQL procedure successfully completed.
```

TO CALCULATE AREA OF CIRCLE

```
SQL> set serveroutput on;
SQL> declare
2    pi constant number(4,2):=3.14;
3    a number(20);
4    r number(20);
5    begin
6    r:=&r;
7    a:= pi* power(r,2);
8    dbms_output.put_line (' The area of circle is ' || a);
9    end;
10  /
Enter value for r: 2
old   6: r:=&r; new
6: r:=2;
The area of circle is 13
PL/SQL procedure successfully completed.
```

TO CREATE SACCOUNT TABLE

```
SQL> create table saccount  ( accno number(5), name varchar2(20), bal number(10)); Table
created.
SQL> insert into saccount values ( 1,'mala',20000); 1
row created.
SQL> insert into saccount values (2,'kala',30000); 1
row created.
SQL> select * from saccount;

   ACCNO NAME                 BAL
--------- -------------------- ---------
1 mala                  20000
2 kala                  30000
```

```
SQL> set serveroutput on;
SQL> declare
2    a_bal number(7);
3    a_no varchar2(20);
4    debit number(7):=2000;
5    minamt number(7):=500;
6    begin
7    a_no:=&a_no;
8    select bal into a_bal from saccount where accno= a_no;
9    a_bal:= a_bal-debit;
10  if (a_bal > minamt) then
11  update  saccount  set bal=bal-debit where accno=a_no;
12  end if;
13  end;
 14
 15  /
Enter value for a_no: 1 old
7: a_no:=&a_no;
new   7: a_no:=1;

PL/SQL procedure successfully completed.
SQL> select * from saccount;
  ACCNO NAME                 BAL
--------- -------------------- ---------
1 mala                  18000
2 kala                 30000
```

TO CREATE TABLE SROUTES

```
SQL> create table sroutes ( rno number(5), origin varchar2(20), destination varchar2(20), fare
numbe
r(10), distance number(10)); Table
created.
SQL> insert into sroutes values ( 2, 'chennai', 'dindugal', 400,230); 1
row created.
SQL> insert into sroutes values ( 3, 'chennai', 'madurai', 250,300); 1
row created.
SQL> insert into sroutes values ( 6, 'thanjavur', 'palani', 350,370); 1
row created.
SQL> select * from sroutes;

     RNO ORIGIN              DESTINATION              FARE  DISTANCE
--------- -------------------- -------------------- --------- ---------
```

```
     2 chennai          dindugal            400       230
3 chennai          madurai             250       300
     6 thanjavur        palani              350       370

SQL> set serveroutput on;

SQL> declare
2    route sroutes.rno % type;
3    fares sroutes.fare % type;
4    dist sroutes.distance % type;
5    begin
6    route:=&route;
7    select fare, distance into fares , dist from sroutes where rno=route;
8    if (dist < 250) then
9    update sroutes set fare=300 where rno=route;
10   else if dist between 250 and 370 then
11   update sroutes set fare=400 where rno=route;
12   else if (dist > 400) then
13   dbms_output.put_line('Sorry');
14   end if;
15   end if;
16   end if;
17   end;
18   /
Enter value for route: 3 old
6: route:=&route;
new   6: route:=3;

PL/SQL procedure successfully completed.

SQL> select * from sroutes;

    RNO ORIGIN             DESTINATION             FARE  DISTANCE
--------- -------------------- -------------------- --------- ---------
     2 chennai          dindugal            400       230
3 chennai          madurai             400       300
     6 thanjavur        palani              350       370
```

TO CREATE SCA LCULATE TABLE

```
SQL> create table scalculate ( radius number(3), area number(5,2)); Table
created.
```

```
SQL> desc scalculate;
 Name                                      Null?    Type
 ----------------------------------------- -------- ------------------------------------
 RADIUS                                             NUMBER(3)
 AREA                                               NUMBER(5,2)

SQL> set serveroutput on;

SQL> declare
2  pi constant number(4,2):=3.14;
3  area number(5,2);   4  radius number(3);
5    begin
6    radius:=3;
7    while (radius <=7)
8    loop
9    area:= pi* power(radius,2);
10  insert into scalculate values (radius,area);
11  radius:=radius+1;
12  end loop;
13  end;
14  /

PL/SQL procedure successfully completed.

SQL> select * from scalculate;
   RADIUS      AREA
--------- ---------
        3     28.26
        4     50.24
        5      78.5
        6    113.04
        7    153.86
```

TO CALCULATE FACTORIAL OF A GIVEN NUMBER

```
SQL> set serveroutput on;
SQL> declare
2    f number(4):=1;
3    i number(4);
4    begin
5    i:=&i;
6    while(i>=1)
```

```
7    loop
8    f:=f*i;
9    i:=i-1;
10   end loop;
11   dbms_output.put_line('The value is ' || f);
12   end;
13   /
Enter value for i: 5
old    5: i:=&i; new
5: i:=5;
The value is 120

PL/SQL procedure successfully completed.
```

EXERCISE-14

CS23332 DATABASE MANAGEMENT SYSTEM LABORATORY

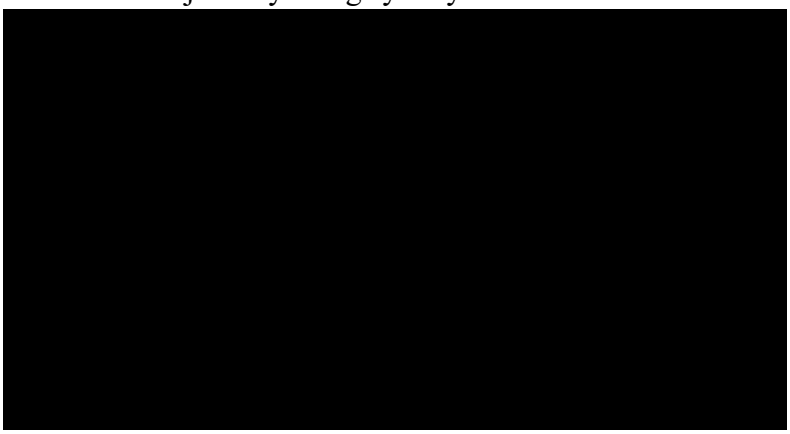
OTHER DATABASE OBJECTS

Objectives

After the completion of this exercise, the students will be able to do the following:
• Create, maintain, and use sequences
• Create and maintain indexes

Database Objects

Many applications require the use of unique numbers as primary key values. You can either build code into the application to handle this requirement or use a sequence to generate unique numbers. If you want to improve the performance of some queries, you should consider creating an index. You can also use indexes to enforce uniqueness on a column or a collection of columns. You can provide alternative names for objects by using synonyms.



What Is a Sequence?
A sequence:
• Automatically generates unique numbers
• Is a sharable object
• Is typically used to create a primary key value
• Replaces application code
• Speeds up the efficiency of accessing sequence values when cached in memory

The CREATE SEQUENCE Statement Syntax

Define a sequence to generate sequential numbers automatically:

CREATE SEQUENCE *sequence*
[INCREMENT BY *n*]

[START WITH *n*]
[{MAXVALUE *n* | NOMAXVALUE}]
[{MINVALUE *n* | NOMINVALUE}]
[{CYCLE | NOCYCLE}] [{CACHE
n | NOCACHE}];
In the syntax:
sequence is the name of the sequence generator
INCREMENT BY *n* specifies the interval between sequence numbers where *n* is an integer (If this clause is omitted, the sequence increments by 1.)

START WITH *n* specifies the first sequence number to be generated (If this clause is omitted, the sequence starts with 1.)

MAXVALUE *n* specifies the maximum value the sequence can generate
NOMAXVALUE specifies a maximum value of 10^27 for an ascending sequence and –1 for a descending sequence (This is the default option.)

MINVALUE *n* specifies the minimum sequence value
NOMINVALUE specifies a minimum value of 1 for an ascending sequence and – (10^26) for a descending sequence (This is the default option.)

CYCLE | NOCYCLE specifies whether the sequence continues to generate values after reaching its maximum or minimum value (NOCYCLE is the default option.)

CACHE *n* | NOCACHE specifies how many values the Oracle server preallocates and keep in memory (By default, the Oracle server caches 20 values.)

Creating a Sequence
- Create a sequence named DEPT_DEPTID_SEQ to be used for the primary key of the DEPARTMENTS table.
- Do not use the CYCLE option.

EXAMPLE:

```
CREATE SEQUENCE dept_deptid_seq
INCREMENT BY 10
START WITH 120
MAXVALUE 9999
NOCACHE
NOCYCLE;
```

Confirming Sequences

• Verify your sequence values in the USER_SEQUENCES data dictionary table.

• The LAST_NUMBER column displays the next available sequence number if NOCACHE is specified.

EXAMPLE:

SELECT sequence_name, min_value, max_value, increment_by, last_number

NEXTVAL and CURRVAL Pseudocolumns

• NEXTVAL returns the next available sequence value. It returns a unique value every time it is referenced, even for different users.

• CURRVAL obtains the current sequence value.

• NEXTVAL must be issued for that sequence before CURRVAL contains a value.

Rules for Using NEXTVAL and CURRVAL

You can use NEXTVAL and CURRVAL in the following contexts:

• The SELECT list of a SELECT statement that is not part of a subquery
• The SELECT list of a subquery in an INSERT statement
• The VALUES clause of an INSERT statement
• The SET clause of an UPDATE statement

You cannot use NEXTVAL and CURRVAL in the following contexts:

• The SELECT list of a view
• A SELECT statement with the DISTINCT keyword
• A SELECT statement with GROUP BY, HAVING, or ORDER BY clauses
• A subquery in a SELECT, DELETE, or UPDATE statement
• The DEFAULT expression in a CREATE TABLE or ALTER TABLE statement

Using a Sequence

• Insert a new department named “Support” in location ID 2500.

• View the current value for the DEPT_DEPTID_SEQ sequence.

EXAMPLE:

```
INSERT INTO departments(department_id, department_name, location_id)
VALUES (dept_deptid_seq.NEXTVAL, 'Support', 2500);

SELECT dept_deptid_seq.CURRVAL FROM dual;
```

The example inserts a new department in the DEPARTMENTS table. It uses the DEPT_DEPTID_SEQ sequence for generating a new department number as follows:
You can view the current value of the sequence:
SELECT dept_deptid_seq.CURRVAL FROM dual;

Removing a Sequence

• Remove a sequence from the data dictionary by using the DROP SEQUENCE statement.

• Once removed, the sequence can no longer be referenced.

EXAMPLE:

```
DROP SEQUENCE dept_deptid_seq;
```

What is an Index?

An index:
• Is a schema object
• Is used by the Oracle server to speed up the retrieval of rows by using a pointer
• Can reduce disk I/O by using a rapid path access method to locate data quickly
• Is independent of the table it indexes
• Is used and maintained automatically by the Oracle server

How Are Indexes Created?

• Automatically: A unique index is created automatically when you define a PRIMARY KEY or UNIQUE constraint in a table definition.
• Manually: Users can create nonunique indexes on columns to speed up access to the rows.

Types of Indexes

Two types of indexes can be created. One type is a unique index: the Oracle server automatically creates this index when you define a column in a table to have a PRIMARY KEY or a UNIQUE key constraint. The name of the index is the name given to the constraint.

The other type of index is a nonunique index, which a user can create. For example, you can create a

FOREIGN KEY column index for a join in a query to improve retrieval speed.

Creating an Index

• Create an index on one or more columns.

• Improve the speed of query access to the LAST_NAME column in the EMPLOYEES table.

CREATE INDEX *index*
ON *table* (*column*[, *column*]...);
EXAMPLE:
CREATE INDEX emp_last_name_idx
ON employees(last_name); **In the syntax:**
index is the name of the index *table* is the name of the table
column is the name of the column in the table to be indexed

When to Create an Index

You should create an index if:
• A column contains a wide range of values
• A column contains a large number of null values
• One or more columns are frequently used together in a WHERE clause or a join condition
• The table is large and most queries are expected to retrieve less than 2 to 4 percent of the rows

When Not to Create an Index
It is usually not worth creating an index if:
• The table is small
• The columns are not often used as a condition in the query • Most queries are expected to retrieve more than 2 to 4 percent of the rows in the table • The table is updated frequently
• The indexed columns are referenced as part of an Expression
Confirming Indexes
• The USER_INDEXES data dictionary view contains the name of the index and its uniqueness.
• The USER_IND_COLUMNS view contains the index name, the table name, and the column name.
EXAMPLE:

```
SELECT ic.index_name, ic.column_name, ic.column_position col_pos,ix.uniqueness
FROM user_indexes ix, user_ind_columns ic
WHERE ic.index_name = ix.index_name
AND ic.table_name = 'EMPLOYEES';
```

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Removing an Index

• Remove an index from the data dictionary by using the DROP INDEX command.

• Remove the UPPER_LAST_NAME_IDX index from the data dictionary.

• To drop an index, you must be the owner of the index or have the DROP ANY INDEX privilege.

DROP INDEX upper_last_name_idx;

DROP INDEX *index*;

Find the Solution for the following:

1. Create a sequence to be used with the primary key column of the DEPT table. The sequence should start at 200 and have a maximum value of 1000. Have your sequence increment by ten numbers. Name the sequence DEPT_ID_SEQ.

2. Write a query in a script to display the following information about your sequences: sequence name, maximum value, increment size, and last number

3. Write a script to insert two rows into the DEPT table. Name your script lab12_3.sql. Be sure to use the sequence that you created for the ID column. Add two departments named Education and

Administration. Confirm your additions. Run the commands in your script.

4. Create a nonunique index on the foreign key column (DEPT_ID) in the EMP table.

5. Display the indexes and uniqueness that exist in the data dictionary for the EMP table.

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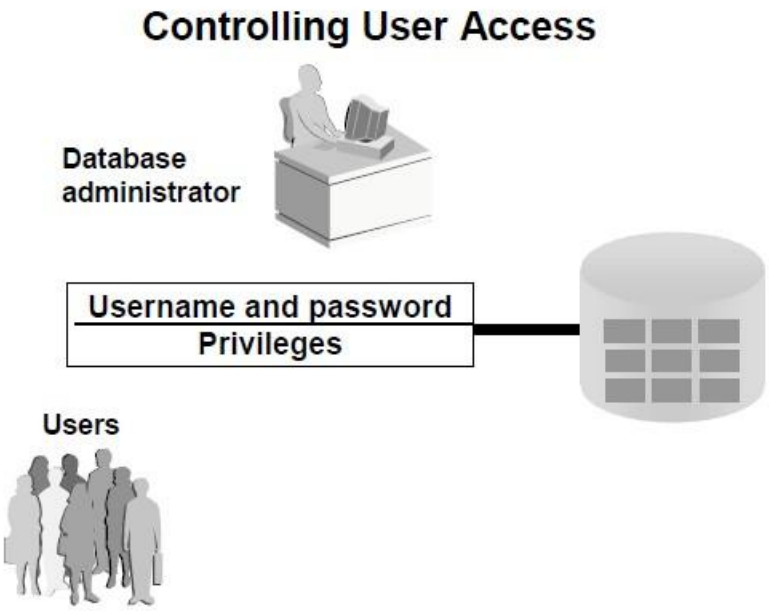
EXERCISE-15

Controlling User Access

Objectives

After the completion of this exercise, the students will be able to do the following:

- Create users
- Create roles to ease setup and maintenance of the security model
- Use the GRANT and REVOKE statements to grant and revoke object privileges
- Create and access database links



Controlling User Access

In a multiple-user environment, you want to maintain security of the database access and use. With Oracle server database security, you can do the following:

• Control database access
• Give access to specific objects in the database
• Confirm given and received *privileges* with the Oracle data dictionary
• Create synonyms for database objects

Privileges

• Database security:
– System security
– Data security
• System privileges: Gaining access to the database
• Object privileges: Manipulating the content of the database objects
• Schemas: Collections of objects, such as tables, views, and sequences

System Privileges

• More than 100 privileges are available.
• The database administrator has high-level system privileges for tasks such as:
– Creating new users
– Removing users
– Removing tables
– Backing up tables

Typical DBA Privileges

System Privilege	Operations Authorized
CREATE USER	Grantee can create other Oracle users (a privilege required for a DBA role).
DROP USER	Grantee can drop another user.
DROP ANY TABLE	Grantee can drop a table in any schema.
BACKUP ANY TABLE	Grantee can back up any table in any schema with the export utility.
SELECT ANY TABLE	Grantee can query tables, views, or snapshots in any schema.
CREATE ANY TABLE	Grantee can create tables in any schema.

Creating Users

The DBA creates users by using the CREATE USER statement.

EXAMPLE:

CREATE USER scott IDENTIFIED BY tiger;

User System Privileges

• Once a user is created, the DBA can grant specific system privileges to a user.
• An application developer, for example, may have the following system privileges:
– CREATE SESSION
– CREATE TABLE
– CREATE SEQUENCE
– CREATE VIEW
– CREATE PROCEDURE
GRANT *privilege* [, *privilege*...]
TO *user* [, *user*| *role, PUBLIC*...];

Typical User Privileges

System Privilege	Operations Authorized
CREATE SESSION	Connect to the database
CREATE TABLE	Create tables in the user's schema
CREATE SEQUENCE	Create a sequence in the user's schema
CREATE VIEW	Create a view in the user's schema
CREATE PROCEDURE	Create a stored procedure, function, or package in the user's schema

In the syntax:

privilege is the system privilege to be granted

user |role|PUBLIC is the name of the user, the name of the role, or PUBLIC designates that every user is granted the privilege

Note: Current system privileges can be found in the dictionary view SESSION_PRIVS.

Granting System Privileges

The DBA can grant a user specific system privileges.

GRANT create session, create table, create sequence, create view TO scott;

What is a Role?

A role is a named group of related privileges that can be granted to the user. This method makes it easier to revoke and maintain privileges.

A user can have access to several roles, and several users can be assigned the same role. Roles are typically created for a database application.

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Creating and Assigning a Role

First, the DBA must create the role. Then the DBA can assign privileges to the role and users to the role.

Syntax
CREATE ROLE *role*;
In the syntax: *role* is the name of the
role to be created
Now that the role is created, the DBA can use the GRANT statement to assign users to the role as well as assign privileges to the role.

Creating and Granting Privileges to a Role

CREATE ROLE manager;
Role created.

GRANT create table, create view TO manager;
Grant succeeded.

GRANT manager TO DEHAAN, KOCHHAR;
Grant succeeded.

• Create a role
• Grant privileges to a role
• Grant a role to users

Changing Your Password

• The DBA creates your user account and initializes your password.

• You can change your password by using the

ALTER USER statement.
ALTER USER scott IDENTIFIED
BY lion;
User altered**.**

Object Privileges

Object Privilege	Table	View	Sequence	Procedure
ALTER	√		√	
DELETE	√	√		
EXECUTE				√
INDEX	√			
INSERT	√	√		
REFERENCES	√	√		
SELECT	√	√	√	
UPDATE	√	√		

Object Privileges

• Object privileges vary from object to object.

• An owner has all the privileges on the object.

• An owner can give specific privileges on that owner's object.

GRANT *object_priv* [(*columns*)]
ON *object*
TO {*user*|*role*|PUBLIC}
[WITH GRANT OPTION];

In the syntax:

object_priv is an object privilege to be granted

ALL specifies all object privileges

columns specifies the column from a table or view on which privileges are granted

ON *object* is the object on which the privileges are granted

TO identifies to whom the privilege is granted

PUBLIC grants object privileges to all users

WITH GRANT OPTION allows the grantee to grant the object privileges to other users and roles

Granting Object Privileges

• Grant query privileges on the EMPLOYEES table.

• Grant privileges to update specific columns to users and roles.

```
GRANT select
ON employees
TO sue, rich;

GRANT update (department_name, location_id)
ON departments
TO scott, manager;
```

Using the WITH GRANT OPTION and PUBLIC Keywords

• Give a user authority to pass along privileges.

• Allow all users on the system to query data from Alice's DEPARTMENTS table.

```
GRANT select, insert
ON departments
TO scott
WITH GRANT OPTION;
 .
GRANT select
ON alice.departments
TO PUBLIC;
```

How to Revoke Object Privileges

• You use the REVOKE statement to revoke privileges granted to other users.

• Privileges granted to others through the WITH GRANT OPTION clause are also revoked.

```
  REVOKE {privilege [, privilege...]|ALL}
ON object
FROM {user[, user...]|role|PUBLIC}
```

[CASCADE CONSTRAINTS];

In the syntax:

CASCADE is required to remove any referential integrity constraints made to the CONSTRAINTS object by means of the REFERENCES privilege

Revoking Object Privileges

As user Alice, revoke the SELECT and INSERT privileges given to user Scott on the DEPARTMENTS table.

```
REVOKE select, insert
ON departments
FROM scott;
```

Find the Solution for the following:

1. What privilege should a user be given to log on to the Oracle Server? Is this a system or an object privilege?

_____

2. What privilege should a user be given to create tables?

_____

3. If you create a table, who can pass along privileges to other users on your table?

_____

4. You are the DBA. You are creating many users who require the same system privileges. What should you use to make your job easier?

_____

5. What command do you use to change your password?

_____

6. Grant another user access to your DEPARTMENTS table. Have the user grant you query access to his or her DEPARTMENTS table.

7. Query all the rows in your DEPARTMENTS table.

8. Add a new row to your DEPARTMENTS table. Team 1 should add Education as department number 500. Team 2 should add Human Resources department number 510. Query the other team's table.

9. Query the USER_TABLES data dictionary to see information about the tables that you own.

10. Revoke the SELECT privilege on your table from the other team.

11. Remove the row you inserted into the DEPARTMENTS table in step 8 and save the changes.

------END-----

[ANSWERS FOR ABOVE PROBLEMS – STUDENTS WILL NOT TAKE PRINTOUT OF THE BELOW PAGES]

EXNO: **CREATING AND MANAGING TABLES**

AIM:

To create tables, to describe the data types that can be used when specifying column definition, to alter table definitions, to drop, rename, and truncate tables.

SAMPLE TABLES:

EMPLOYEETABLE:

SQL> create table employeetable (employee_id number(6) NOT NULL,first_name varchar2(20),last_name varchar2(25) NOT NULL,email varchar2(25) NOT NULL,phone_number varchar2(20),hire_date date NOT NULL,job_id varchar2(10) NOT NULL,salary number(8,2),commision number(2,2),manager_id number(6),department_id number(4));

Table created.

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SQL> desc employeetable;

Name Null? Type

EMPLOYEE_ID NOT NULL NUMBER(6)

FIRST_NAME VARCHAR2(20) LAST_NAME NOT NULL VARCHAR2(25)

EMAIL NOT NULL VARCHAR2(25)

PHONE_NUMBER VARCHAR2(25)

HIRE_DATE NOT NULL DATE

JOB_ID NOT NULL VARCHAR2(20)

SALARY NUMBER(8,2)

COMMISSION_PCT NUMBER(2,2)

MANAGER_ID NUMBER(6)

DEPARTMENT_ID NUMBER(4)

SQL>select * from employeetable;

EMPLOYEE_ID FIRST_NAME LAST_NAME

EMAIL PHONE_NUMBER HIRE_DATE

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

---

100 stevan king

sking 515.123.4567 17-JUN-87 ad_pres

24000 90 101 neena kochhar

nkochhar 515.123.4568 21-SEP-89 ad_vp

17000 100 90

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

---------- ---------- ---------- ---------- ---------- 102 lex dehaan

ldehaan 515.123.4569 13-JAN-93 ad_vp

17000 100 90

103 alexandar hunold ahunold 590.423.4567 03-JAN-93

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

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

it_prog 9000 102 60

104 bruce ernst bernst

590.423.4568 21-MAY-91 it_prog

6000 103 60

107 diana lorentz

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

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

dlorentz 590.423.4568 07-FEB-99

it_prog 4200 103 60 124

kevin mourgas kmourgas

650.123.5234 16-NOV-99 st_man

5800 100 50

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID -

------------------- ---------- ------------- ---------- ------------ 141 trenna rajs

trajs 650.121.8009 17-OCT-95 st_clerk 3500

124 50

142 curtis davies cdavies

650.121.2994 29-JAN-97 st_clerk 3100

124 50

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

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

143 randall matos rmatos

650.121.2874 15-MAR-98 st_clerk 2600

124 50 144 peter vargas pvargas

650.121.2004 09-JUL-98

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

---------- ---------- ---------- ---------- ---------- st_clerk

2500 124 50

149 eleni zlotkey

ezlotkey 011.44.1344.429018 29-JAN-00 sa_man

10500 .2 100 80

174 ellen abel

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

---------- ---------- ---------- ---------- ---------- eabel

011.44.1644.429267 11-MAY-96 sa_rep

11000 .3 149 80

176 jonathan taylor jtaylor

011.44.1644.429265 24-MAR-98 sa_rep

8600 .2 149 80

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

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

178 kimberly grant
kgrant 011.44.1644.429263 24-MAY-99 sa_rep

7000 .15 149

200 jennifer] whalen

jwhalen 515.123.4444 17-SEP-87

ad_asst 4400 101 10

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

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

201 micheal hartstein

mhartstein 515.123.5555 17-FEB-96

mk_man 13000 100 20

202 pat fay

pfay 606.123.6666 17-AUG-97

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

---------- ---------- ---------- ---------- - mk_rep

6000 201 20 205 sheliey

higgins shiggins

515.123.8080 07-JUN-94 ac_mgr

12000 101 110

EMPLOYEE_ID FIRST_NAME LAST_NAME

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

EMAIL PHONE_NUMBER HIRE_DATE

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

JOB_ID SALARY COMMISSION_PCT MANAGER_ID DEPARTMENT_ID

---------- ---------- ---------- ---------- - wgeitz

515.123.8181 07-JUN-94 ac_account

8300 205 110

20 rows selected.

DEPARTMENT TABLE:

SQL> create table department(department_id number(6) NOT NULL,dept_name varchar2(20) NOT NULL,manager_id number(6),location_id number(4));

Table created.

SQL> desc department

Name	Null?	Type
DEPARTMENT_ID	NOT NULL	NUMBER(6)
DEPT_NAME	NOT NULL	VARCHAR2(20)
MANAGER_ID		NUMBER(6)
LOCATION_ID		NUMBER(4)

SQL> select * from department;

DEPARTMENT_ID DEPARTMENT_NAME MANAGER_ID LOCATION_ID

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

10 administration 200 1700

20 marketing 201 1800

50 shipping 124 1500

60 it 103 1400

80 sales 149 2500

90 executive 100 1700

110 accounting 205 1700

190 contracting 0 1700

8 rows selected.

JOB_GRADE TABLE:

SQL> create table job_grade(grade_level varchar2(2),lowest_sal number,highest_sal number);

Table created.

SQL> desc job_grade

Name	Null?	Type
GRADE_LEVEL		VARCHAR2(2)
LOWEST_SAL		NUMBER
HIGHEST_SAL		NUMBER

SQL> select * from locations;

LOCATION_ID STREET_ADDRESS POSTAL_CODE

CITY STATE_PROVINCE CO

1400 2014 jabberwocky rd 26192 southlake

texas us

1500 2011 interior blvd 99236 south

san francisco california us

1700 2004 charade rd 98199 seattle

washington us

LOCATION_ID STREET_ADDRESS POSTAL_CODE

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

CITY STATE_PROVINCE CO

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

1800 460 bloor st on m5s 1xb torondo

ontario ca

2500 magdalen centre,the oxford science park on99zb

oxford oxford uk

LOCATION TABLE:

SQL> create table location(location_id number(4) not null,street_address varchar2(40),postal_code varchar2(12),city varchar2(30) not null,state_province varchar2(25),country_id char(2));

Table created.

SQL> desc location;

Name	Null?	Type
LOCATION_ID	NOT NULL	NUMBER(4)
STREET_ADDRESS		VARCHAR2(40)
POSTAL_CODE		VARCHAR2(12)
CITY	NOT NULL	VARCHAR2(30)
STATE_PROVINCE		VARCHAR2(25)
COUNTRY_ID		CHAR(2)

SQL> select * from job_grades;

GRA LOWEST_SAL HIGHEST_SAL

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

a

1000 2999

b

3000 5999

c

```
6000        9999                                    d

10000       14999                                   e

15000       24999                                   f

25000       40000

6 rows selected.


SQL> select * from job_history;

EMPLOYEE_ID START_DAT END_DATE  JOB_ID     DEPARTMENT_ID

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

       103 13-JAN-93 24-JUL-98 it_prog             60

       101 21-SEP-89 27-OCT-93 ac_account          110
       101 28-OCT-89 15-MAR-97 ac_mgr              110

       201 17-FEB-96 19-DEC-99 mk_rep              20

       114 24-MAR-98 31-DEC-99 mk_rep              50

       122 01-JAN-99 31-DEC-98 st_clerk            50

       200 17-SEP-87 17-JUN-93 ad_asst             90

       176 24-MAR-98 31-DEC-98 sa_rep              80

       176 01-JAN-99 31-DEC-99 sa_man              80

       200 01-JUL-94 31-DEC-98 ac_account          90


10 rows selected.

SQL> spool off;
```

SOLUTION FOR THE EXERCISES

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9. 1. Create the DEPT table based on the following table instance chart. Confirm that the table is created.

Column name	ID	NAME
Key Type		
Nulls/Unique		
FK table		
FK column		
Data Type	Number	Varchar2
Length	7	25

create table dept(id number(7),name varchar(25));

Table created.

SQL> desc dept;

Name	Null?	Type
ID		NUMBER(7)
NAME		VARCHAR2(25)

10. Populate the DEPT table with data from the DEPARTMENT table.Include only the columns that are needed.

SQL> alter table dept add(manager_id number(10),location_id number(10));

Table altered.

SQL> desc dept;

Name	Null?	Type

ID NUMBER(7)

NAME VARCHAR2(25)

MANAGER_ID NUMBER(10)

LOCATION_ID NUMBER(10)

11. Create the EMP table based on the following instance chart. Confirm that the table is created.

Column name	ID	LAST_NAME	FIRST_NAME	DEPT_ID
Key Type				
Nulls/Unique				
FK table				
FK column				
Data Type	Number	Varchar2	Varchar2	Number
Length	7	25	25	7

SQL> create table empdb(id number(7),firstname varchar(25),lastname varchar(25),dept_id number(25));
Table created.

SQL> desc empdb

Name Null? Type

ID NUMBER(7)

FIRSTNAME VARCHAR2(25)

LASTNAME VARCHAR2(25)

DEPT_ID NUMBER(25)

12. Modify the EMP table to allow for longer employee last names. Confirm the modification.(Hint: Increase the size to 50)
SQL> alter table empdb modify(lastname varchar(50));

Table altered.

SQL> desc empdb;

Name	Null?	Type
ID		NUMBER(7)
FIRSTNAME		VARCHAR2(25)
LASTNAME		VARCHAR2(50)
DEPT_ID		NUMBER(25)

13. Create the EMPLOYEES2 table based on the structure of EMPLOYEES table. Include Only the Employee_id, First_name, Last_name, Salary and Dept_id coloumns. Name the columns Id, First_name, Last_name, salary and Dept_id respectively.

SQL>
create table employee2(id number(10),firstname varchar(10),lastname varchar(10),salary number(8,2),deptid number(10));

Table created.

SQL> desc employee2;

Name	Null?	Type
ID		NUMBER(10)
FIRSTNAME		VARCHAR2(10)
LASTNAME		VARCHAR2(10)
SALARY		NUMBER(8,2)
DEPTID		NUMBER(10)

14. Drop the EMP table. SQL> drop table empdb;

Table dropped.

15. Rename the EMPLOYEES2 table as EMP. SQL>
rename employee2 to employee3;

Table renamed.

16. Add a comment on DEPT and EMP tables.
Confirm the modification by describing the table.
SQL> comment on table dept is'this is department database..';

Comment created.

SQL> select * from user_tab_comments;

TABLE_NAME	TABLE_TYPE	COMMENTS
STUDENT	TABLE	
EMPLOYEE	TABLE	

EMPLOYEE_DETAIL TABLE

TABLE_NAME TABLE_TYPE

------------------------------ ----------- COMMENTS

----------EMPLOYEES TABLE

EMP TABLE this

is a employee database..

BIN$JYmxGClpS7KBH/ciI85irw==$0 TABLE

TABLE_NAME TABLE_TYPE

------------------------------ ----------- COMMENTS

DEPT TABLE this

is department database..

EMPLOYEE3 TABLE rows

selected.

17. Drop the First_name column frim the EMP table and confirm it. SQL>
alter table employee3 drop column firstname;

Table altered.

desc employee3;

Name Null? Type

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

ID NUMBER(10)

SQL>

LASTNAME	VARCHAR2(10)
SALARY	NUMBER(8,2)
DEPTID	NUMBER(10)

18. In the DEPT table mark the column Dept_id as UNUSED and confirm it. SQL> alter table employee3 set unused(deptid);

Table altered.

SQL> desc employee3;

Name	Null?	Type
ID		NUMBER(10)
LASTNAME		VARCHAR2(10)
SALARY		NUMBER(8,2)

11.Drop all the UNUSED columns from the EMP table and Confirm the modification

SQL> drop table employee3;

Table dropped.

EXNO:2 MANIPULATING DATA

AIM:

To describe each DML statement, to insert rows into tables, to update rows into tables, to delete rows from tables, to execute control transactions,

SOLUTION FOR THE EXERCISES

10. Create MY_EMPLOYEE table with the following structure

NAME	NULL?	TYPE
ID	Not null	Number(4)

Last_name		Varchar(25)
First_name		Varchar(25)
Userid		Varchar(25)
Salary		Number(9,2)

create table emp(id number(4) not null, firstname varchar(10),lastname varchar(10),userid number(10), salary number(9,2));

Table created.

SQL> desc emp;

Name	Null?	Type
ID	NOTNULL	NUMBER(4)
FIRSTNAME		VARCHAR2(10)
LASTNAME		VARCHAR2(10)
USERID		NUMBER(10)
SALARY		NUMBER(9,2)

11. Add the first and second rows data to MY_EMPLOYEE table from the following sample data.

ID	**Last_name**	**First_name**	**Userid**	**salary**
1	Patel	Ralph	rpatel	895
2	Dancs	Betty	bdancs	860
3	Biri	Ben	bbiri	1100
4	Newman	Chad	Cnewman	750
5	Ropebur	Audrey	aropebur	1550

SQL> insert into my_employee values(1,'patel','ralph','rpatel',895);

1 row created.

insert into my_employee values(2,'dancs','betty','bdancs',860);

SQL>
1 row created.

SQL> select * from my_employe ID LAST_NAME   FIRST_NAME

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

USER_ID   SALARY

------------------------- ----------   1 patel   ralph

rpatel   895

2 dancs   betty   bdancs   860

12. Display the table with values.

SQL> select * from my_employee;

ID LAST_NAME FIRST_NAME USER_ID SALARY

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

1 patel ralph rpatel 895

2 dancs betty bdancs 860

13. Populate the next two rows of data from the sample data. Concatenate the first letter of the first_name with the first seven characters of the last_name to produce Userid.

SQL> insert into my_employee
values(&id,'&last_name','&first_name',lower(substr('&first_name',1,1)||substr('&last_name',1,7))
,&salary);

Enter value for id: 3

Enter value for last_name: biri

Enter value for first_name: ben
Enter value for first_name: ben

Enter value for last_name: biri Enter

value for salary: 1100

old 1: insert into my_employee
values(&id,'&last_name','&first_name',lower(substr('&first_name',1,1)||substr('&last_name',1,7))
,&salary)

new 1: insert into my_employee
values(3,'biri','ben',lower(substr('ben',1,1)||substr('biri',1,7)),1100)

1 row created.

SQL> /

Enter value for id: 4

Enter value for last_name: newman

Enter value for first_name: chad

Enter value for first_name: chad

Enter value for last_name: newman Enter

value for salary: 750

old 1: insert into my_employee
values(&id,'&last_name','&first_name',lower(substr('&first_name',1,1)||substr('&last_name',1,7))
,&salary)

new 1: insert into my_employee
values(4,'newman','chad',lower(substr('chad',1,1)||substr('newman',1,7)),750)

1 row created.

SQL> select * from my_employee;

ID LAST_NAME FIRST_NAME USER_ID SALARY

---------- ---------- 1 patel
ralph rpatel 895

2 dancs betty bdancs 860 3 biri ben bbiri 1100

LAST_NAME FIRST_NAME USER_ID SALARY

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

4 newman chad cnewman 750

14. Make the data additions permanent.

SQL> commit;

Commit complete.

Change the last name of employee 3 to Drexler

SQL> update my_employee set last_name='drexler'where id=3;

1 row updated.

SQL> select * from my_employee;

ID LAST_NAME FIRST_NAME USER_ID SALARY

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

1 patel ralph rpatel 895

2 dancs betty bdancs 860

3 drexler ben bbiri 1100

LAST_NAME FIRST_NAME USER_ID SALARY

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

4 newman chad cnewman 750

7.Change the salary to 1000 for all the employees with a salary less than 900.

Update my_employee set salary=1000 where salary<900;

SQL> select * from my_employee;

ID LAST_NAME FIRST_NAME USER_ID SALARY

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

1 patel ralph rpatel 895

3 drexler ben bbiri 1000

4 newman chad cnewman 750

8.Verify the changes to the table

SQL> select * from my_employee;

ID LAST_NAME FIRST_NAME USER_ID SALARY

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

1 patel ralph rpatel 895

3 drexler ben bbiri 1100

4 newman chad cnewman 750

ID LAST_NAME FIRST_NAME USER_ID SALARY

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

5 ropebur audrey aropebur 1550

9.Delete Betty dancs from MY _EMPLOYEE table. SQL>

delete from my_employee where last_name='dancs';

1 row deleted.

10.Confirm the changes.

SQL> select * from my_employee;

ID LAST_NAME FIRST_NAME USER_ID SALARY

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

1 patel ralph rpatel 895

3 drexler ben bbiri 1100

4 newman chad cnewman 750 Commit the changes.

Commit;

12) Populate the last row of sample data as by Q:4

```
SQL> insert into my_employee
values(&id,'&last_name','&first_name',lower(substr('&first_name',1,1)||
substr('&last_name',1,7)),&salary);

Enter value for id: 5

Enter value for last_name: Ropebur

Enter value for first_name: Audrey

Enter value for first_name: Audrey

Enter value for last_name: Ropebur Enter

value for salary: 1550

old   1: insert into my_employee
values(&id,'&last_name','&first_name',lower(substr('&first_name',1,

new   1: insert into my_employee
values(5,'Ropebur','Audrey',lower(substr('Audrey',1,1)||substr('Ropebur',1,7)),

1 row created.
```

13) Confirm the table.

```
SQL> select * from my_employee;

ID LAST_NAME          FIRST_NAME   USERID    SALARY

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

  1 Patel          Ralph       rpatel         1000

3 drexler        Ben         bbiri          1100

4 Newman         Chad        cnewman        1000

5 Ropebur        Audrey    aropebur         1550
```

14) Mark an intermediate point in the processing of the transaction.

```
SQL> savepoint q14;

Savepoint created.
```

15) Empty the fourth row of the emp table

SQL> truncate table my_employee;

Table truncated.

16) Confirm the table is empty. SQL> select * from my_employee; no rows

selected

17) Discard the most recent DELETE operation without discarding the earlier INSERT operation.

Rollback Q14;

SQL> rollback;

18) Confirm that the new row is still intact.

SQL> select * from my_employee;

ID LAST_NAME FIRST_NAME USERID SALARY

---

1 Patel Ralph rpatel 1000

3 drexler Ben bbiri 1100

4 Newman Chad cnewman 1000

5 Ropebur Audrey aropebur 1550

EXNO:3 INCLUDING CONSTRAINTS

AIM:

To describe the constraints, and to create and maintain constrainsts

SOLUTION FOR THE EXERCISES

5. Add a table-level PRIMARY KEY constraint to the EMP table on the ID column.The constraint should be named at creation. Name the constraint my_emp_id_pk. SQL> alter table dept add constraint my_dept_id_pk primary key(id);

Table altered.

6. Create a PRIMAY KEY constraint to the DEPT table using the ID colum. The constraint should be named at creation. Name the constraint my_dept_id_pk. Alter table dept add constraint my_dept_id_pk primary key(id);

SQL> alter table emp add(dept_id number(7));

Table altered.

7. Add a column DEPT_ID to the EMP table. Add a foreign key reference on the EMP table that ensures that the employee is not assigned to nonexistent deparment. Name the constraint my_emp_dept_id_fk.

SQL> alter table emp add constraint my_emp_dept_id_fk foreign key(dept_id) references dept(id);

Table altered.

8. Modify the EMP table. Add a COMMISSION column of NUMBER data type, precision 2, scale 2. Add a constraint to the commission column that ensures that a commission value is greater than zero.

SQL> alter table emp add commission float constraints ck check(commission>=0);

Table altered.

5. Confirm that the constraints were added by querying the USER_CONSTRAINTS view.

SQL> select constraint_name,constraint_type from user_constraints where table_name in('emp','dept');
No rows selected.

EXNO:4 WRITING BASIC SQL SELECT STATEMENTS

AIM:

To list the capabilities of SQL SELECT statement and to execute a basic SELECT statement.

SOLUTIONS FOR THE EXERCISES:

1. Show the structure of departments the table. Select all the data from it.

SQL> desc department;

Name	Null?	Type

DEPARTMENT_ID	NOT NULL	NUMBER(4)
DEPARTMENT_NAME		VARCHAR2(30)
MANAGER_ID		NUMBER(6)
LOCATION_ID		NUMBER(4)

SQL> select * from department;

DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
10	administration	200	1700
20	marketing	201	1800
50	shipping	124	1500
60	it	103	1400
80	sales	149	2500
90	executive	100	1700
110	accounting	205	1700
190	contracting	0	1700

8 rows selected.

2.Show the structure of the employees the table. Create a query to display the last name, job code, hire date, and employee number for each employee, with employee number appearing first

DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
10	admin	200	1700
20	Marketing	201	1800
50	shipping	124	1500
60	IT	103	1400
80	sales	149	2500
90	executive	100	1700
110	accounting	205	1700

```
190 contracting                   1700
 70 public relations         100      1700
 70 public relations
```

3.Provide an alias STARTDATE for the hire date

SQL> select employee_id ,last_name,job_id,hire_date start_date from employeetable;

```
EMPLOYEE_ID LAST_NAME        JOB_ID          START_DAT

----------- ------------------------ ----------          100 king                 ad_pres
17-JUN-87         101 kochhar                 ad_vp            21-SEP-89

102 dehaan                ad_vp            13-JAN-93          103 hunold               it_prog
03-JAN-93          104 ernst                 it_prog          21-MAY-91          107 lorentz
it_prog           07-FEB-99

124 mourgas               st_man           16-NOV-99          141 rajs                 st_clerk
17-OCT-95

142 davies                st_clerk         29-JAN-97

143 matos                 st_clerk         15-MAR-98          144 vargas
      st_clerk          09-JUL-98
```

```
EMPLOYEE_ID LAST_NAME          JOB_ID       START_DAT

----------- ------------------------ ----------          149 zlotkey              sa_man
29-JAN-00          174 abel                  sa_rep          11-MAY-96

176 taylor                sa_rep           24-MAR-98

178 grant                 sa_rep           24-MAY-99          200 whalen               ad_asst          17-
SEP-87
201 hartstein             mk_man           17-FEB-96          202 fay                  mk_rep
17-AUG-97

205 higgins               ac_mgr           07-JUN-94

206 gietz                 ac_account       07-JUN-94

20 rows selected.
```

4.Create a query to display unique job codes from the employee table.

SQL> select distinct job_id from employeetable;

JOB_ID ------

---------- sa_rep

mk_rep

ad_pres ad_vp

it_prog

st_man

ac_account

sa_man

ad_asst

ac_mgr

st_clerk

JOB_ID ----------

---------- mk_man

12 rows selected.

5. Display the last name concatenated with the job ID , separated by a comma and space, and name the column EMPLOYEE and TITLE.

SQL> select last_name||','||job_id"employee and title" from employeetable;

employee and title

---------- king,ad_pres

kochhar,ad_vp

dehaan,ad_vp

hunold,it_prog

ernst,it_prog

lorentz,it_prog

mourgas,st_man

rajs,st_clerk

davies,st_clerk

matos,st_clerk

vargas,st_clerk

employee and title

---

zlotkey,sa_man

abel,sa_rep

taylor,sa_rep

grant,sa_rep

whalen,ad_asst

hartstein,mk_man

fay,mk_rep

higgins,ac_mgr

gietz,ac_account

20 rows selected.

6.Create a query to display all the data from the employees table. Separate each column by a comma. Name the column THE_OUTPUT.

SQL> select
employee_id||','||first_name||','||last_name||','||email||','||phone_number||','||job_id||','||manager_id||','||hire_date||','||salary||','||commission_pct||','||department_id the_output from employeetable;

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THE_OUTPUT

----------100,stevan,king,sking,515.123.4567,ad_pres,,17-JUN-87,24000,,90

101,neena,kochhar,nkochhar,515.123.4568,ad_vp,100,21-SEP-89,17000,,90

102,lex,dehaan,ldehaan,515.123.4569,ad_vp,100,13-JAN-93,17000,,90

103,alexandar,hunold,ahunold,590.423.4567,it_prog,102,03-JAN-93,9000,,60

104,bruce,ernst,bernst,590.423.4568,it_prog,103,21-MAY-91,6000,,60

107,diana,lorentz,dlorentz,590.423.4568,it_prog,103,07-FEB-99,4200,,60

124,kevin,mourgas,kmourgas,650.123.5234,st_man,100,16-NOV-99,5800,,50

141,trenna,rajs,trajs,650.121.8009,st_clerk,124,17-OCT-95,3500,,50

142,curtis,davies,cdavies,650.121.2994,st_clerk,124,29-JAN-97,3100,,50

143,randall,matos,rmatos,650.121.2874,st_clerk,124,15-MAR-98,2600,,50

144,peter,vargas,pvargas,650.121.2004,st_clerk,124,09-JUL-98,2500,,50

THE_OUTPUT

149,eleni,zlotkey,ezlotkey,011.44.1344.429018,sa_man,100,29-JAN-00,10500,.2,80
174,ellen,abel,eabel,011.44.1644.429267,sa_rep,149,11-MAY-96,11000,.3,80

176,jonathan,taylor,jtaylor,011.44.1644.429265,sa_rep,149,24-MAR-98,8600,.2,80

178,kimberly,grant,kgrant,011.44.1644.429263,sa_rep,149,24-MAY-99,7000,.15,

200,jennifer],whalen,jwhalen,515.123.4444,ad_asst,101,17-SEP-87,4400,,10

201,micheal,hartstein,mhartstein,515.123.5555,mk_man,100,17-FEB-96,13000,,20

202,pat,fay,pfay,606.123.6666,mk_rep,201,17-AUG-97,6000,,20

205,sheliey,higgins,shiggins,515.123.8080,ac_mgr,101,07-JUN-94,12000,,110

206,william,gietz,wgeitz,515.123.8181,ac_account,205,07-JUN-94,8300,,110

20 rows selected.

EXNO:5 RESTRICTING AND SORTING DATA

AIM:

To limit the rows retrieved by the queries, and to sort the rows retrived by the queries.

SOLUTIONS FOR THE EXERCISES:

14. Create a query to display the last name and salary of employees earning more than 12000.

SQL> select last_name,salary from employeetable where salary>12000;

LAST_NAME SALARY

---------- ---------- king

24000 kochhar

17000 dehaan

17000 hartstein

13000

15. Create a query to display the employee last name and department number for employee number 176.

SQL> select last_name,department_id from employeetable where employee_id=176;

LAST_NAME DEPARTMENT_ID

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

taylor

80

16. Create a query to display the last name and salary of employees whose salary is not in the range of 5000 and 12000. (hints: not between)

SQL> select last_name,salary from employeetable where salary not between 5000 and 12000;

LAST_NAME SALARY

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

king 24000

kochhar 17000

dehaan 17000

lorentz 4200

rajs

3500

davies

3100

matos

2600

vargas

2500

whalen

4400

hartstein

13000

10 rows selected.

17. Display the employee last name, job ID, and start date of employees hired between February 20,1998 and May 1,1998.order the query in ascending order by start date.

SQL> select last_name,job_id,hire_date from employeetable where hire_date between '20-feb-98' and '1-may-98';

LAST_NAME JOB_ID HIRE_DATE

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

matos

st_clerk 15-MAR-98

taylor

sa_rep 24-MAR-98

18. Display the last name and department number of all employees in departments 20 and 50 in alphabetical order by name.

SQL> select last_name,department_id from employeetable where department_id in(20,50) order by last_name;

LAST_NAME DEPARTMENT_ID

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

davies 50

fay 20

hartstein 20

matos 50

mourgas 50

rajs 50

vargas 50

7 rows selected.

19. Display the last name and salary of all employees who earn between 5000 and 12000 and are in departments 20 and 50 in alphabetical order by name. Label the columns EMPLOYEE, MONTHLY SALARY respectively.

SQL> select last_name,department_id from employeetable where department_id in(20,50) order by last_name;

SQL> select last_name employee,salary monthly_salary from employeetable where salary between 5000 and 12000 and department_id in(20,50) order by last_name;

EMPLOYEE MONTHLY_SALARY

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

fay

6000

mourgas

5800

20. Display the last name and hire date of every employee who was hired in 1994.

SQL> select last_name,hire_date from employeetable where hire_date between '1-jan-94' and '31-dec-94';

LAST_NAME HIRE_DATE

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

higgins

07-JUN-94

gietz 07-

JUN-94

8.Display the last name and job title of all employees who do not have a manager

SQL> select last_name,job_id from employeetable where manager_id is NULL;

LAST_NAME JOB_ID

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

king

ad_pres

9.Display the last name, salary, and commission for all employees who earn commissions. Sort data in descending order of salary and commissions.

SQL> select last_name,salary,commission_pct from employeetable where commission_pct is not null;

LAST_NAME SALARY COMMISSION_PCT

---

zlotkey 10500 .2

abel 11000 .3

taylor 8600 .2 grant

7000 .15

10.Display the last name of all employees where the third letter of the name is ***a***.

SQL> select last_name from employeetable where last_name like '__a%';

LAST_NAME -

--- grant

whalen

11.Display the last name of all employees who have an a and an ***e*** in their last name

SQL> select last_name from employeetable where last_name like '%a%e%';

LAST_NAME

---

davies abel

whalen

hartstein

12.Display the last name and job and salary for all employees whose job is sales representative or stock clerk and whose salary is not equal to 2500 ,3500 or 7000

SQL> select last_name,job_id,salary from employeetable where job_id in('sa_rep','st_clerk') and salary not in(2500,3500,7000);

LAST_NAME JOB_ID SALARY

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

davies st_clerk 3100

matos st_clerk 2600 abel

sa_rep 11000 taylor

sa_rep 8600

19. Display the last name, salary, and commission for all employees whose commission amount is 20%.

SQL> select last_name ,salary, commission_pct from employeetable where commission_pct=.2;

LAST_NAME SALARY COMMISSION_PCT

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

zlotkey 10500 .2 taylor

8600 .2

EXNO:6 SINGLE ROW FUNCTIONS

AIM:

To describe the various types of functions available in SQL, and to use character, number and date functions in SELECT statement and to describe the use of conversion functions.

SOLUTION FOR THE EXERCISES:

1) Write a query to display the current date. Label the column Date.

SQL> select sysdate "date" from dual; date

13-FEB-12

1 row selected.

2) The HR department needs a report to display the employee number, last name, salary, and increased by 15.5% (expressed as a whole number) for each employee. Label the column New Salary.

SQL> select employee_id,last_name,salary,round(salary*1.15,0)"new salary" from employees;

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EMPLOYEE_ID LAST_NAME SALARY new salary

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

100 King 24000 27600

101 Kochar 17000 19550

102 Dehaan 17000 19550

103 Hunold 9000 10350

104 Ernst 6000 6900

107 Lorentz 4200 4830

124 Mourgos 5800 6670

141 Rajs 3500 4025

142 Davies 3100 3565

143 Matos 2600 2990
144 Vargas 2500 2875

149 Zlotkey 10500 12075

174 Abel 11000 12650

176 taylor 8600 9890

178 grant 7000 8050

200 whalen 4400 5060

201 harstein 13000 14950

202 fay 6000 6900

205 higgins 12000 13800

206 Gietz 8300 9545 113 popp

6900 7935

21 rows selected.

3) Modify your query lab_03_02.sql to add a column that subtracts the old salary from the new salary.

Label the column Increase.

```
SQL>  select employee_id,last_name,salary,round(salary*1.15,0)"new
salary",round(salary*1.15,0)-salary "Increase" from employees;

EMPLOYEE_ID LAST_NAME                 SALARY new salary   Increase

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

100 King                       24000      27600       3600

101 Kochar                      17000      19550       2550

102 Dehaan                      17000      19550       2550

103 Hunold                       9000      10350       1350

104 Ernst                       6000       6900        900

      107 Lorentz                    4200       4830        630
      124 Mourgos                     5800       6670        870

141 Rajs                        3500       4025        525

142 Davies                       3100       3565        465

143 Matos                        2600       2990        390

144 Vargas                       2500       2875        375

      149 Zlotkey                    10500      12075       1575

      174 Abel                       11000      12650       1650

      176 taylor                      8600       9890       1290

      178 grant                       7000       8050       1050

200 whalen                       4400       5060        660

201 harstein                    13000      14950       1950

202 fay                         6000       6900        900

205 higgins                      12000      13800       1800
```

206 Gietz 8300 9545 1245

113 popp 6900 7935 1035

21 rows selected.

4) Write a query that displays the last name (with the first letter uppercase and all other letters lowercase) and the length of the last name for all employees whose name starts with the letters J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names

SQL> select initcap(last_name)"Name",length(last_name)"Length" from employees where last_name like 'j%' or last_name like 'M%' or last_name like 'A%' order by last_name;

Name Length
---------- ----------

Abel 4

Matos 5 Mourgos

7

3 rows selected.

5)The HR department wants to find the length of employment for each employee. For each employee,display the last name and calculate the number of months between today and the date on which the employee was hired. Label the column MONTHS_WORKED. Order your results by the number of months employed. Round the number of months up to the closest whole number.

SQL> select last_name,round(MONTHS_BETWEEN(SYSDATE,hire_date)) MONTHS_WORKED from employees order by MONTHS_BETWEEN(SYSDATE,hire_date);

LAST_NAME MONTHS_WORKED

---------- ---------- popp

0

Zlotkey 145

Mourgos 147

grant 153

Lorentz 156

Vargas 163

taylor 167

Matos 167

fay 174

Davies 181

Abel 189

harstein 192

Rajs 196

Gietz 212

higgins 212

Dehaan 229

Ernst 249

Hunold 265

Kochar 269 whalen

293

King 296

21 rows selected.

7) Create a query to display the last name and salary for all employees. Format the salary to be 15 characters long, left-padded with the $ symbol. Label the column SALARY.

SQL> select last_name,lpad(salary,15,'$')salary from employees;

LAST_NAME	SALARY
King	$$$$$$$$$$24000
Kochar	$$$$$$$$$$17000
Dehaan	$$$$$$$$$$17000
Hunold	$$$$$$$$$$$9000
Ernst	$$$$$$$$$$$6000
Lorentz	$$$$$$$$$$$4200
Mourgos	$$$$$$$$$$$5800
Rajs	$$$$$$$$$$$3500
Davies	$$$$$$$$$$$3100
Matos	$$$$$$$$$$$2600
Vargas	$$$$$$$$$$$2500
Zlotkey	$$$$$$$$$$10500
Abel	$$$$$$$$$$11000
taylor	$$$$$$$$$$$8600
grant	$$$$$$$$$$$7000
whalen	$$$$$$$$$$$4400
harstein	$$$$$$$$$$13000
fay	$$$$$$$$$$$6000
higgins	$$$$$$$$$$12000
Gietz	$$$$$$$$$$$8300
popp	$$$$$$$$$$$6900

21 rows selected.

8) Display each employee's last name, hire date, and salary review date, which is the first Monday after six months of service. Label the column REVIEW. Format the dates to appear in the format similar to

```
SQL>  selectlast_name,hire_date,to_char(next_day(Add_months(hire_date,6),

'monday'),'fmday"the"ddspth"of" month,YYYY') review from employees;

LAST_NAME                 HIRE_DATE REVIEW

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

King                      17-JUN-87 mondaythetwenty-firstof december,1987

Kochar                    21-SEP-89 mondaythetwenty-sixthof march,1990

Dehaan                    13-JAN-93 mondaythenineteenthof july,1993

Hunold                    03-JAN-90 mondaytheninthof july,1990
Ernst                     21-MAY-91 mondaythetwenty-fifthof november,1991

Lorentz                   07-FEB-99 mondaytheninthof august,1999

Mourgos                   16-NOV-99 mondaythetwenty-secondof may,2000

Rajs                      17-OCT-95 mondaythetwenty-secondof april,1996

Davies                    29-JAN-97 mondaythefourthof august,1997

Matos                     15-MAR-98 mondaythetwenty-firstof september,1998

Vargas                    09-JUL-98 mondaytheeleventhof january,1999

Zlotkey                   29-JAN-00 mondaythethirty-firstof july,2000

21 rows selected.
```

9) Display the last name, hire date, and day of the week on which the employee started. Label the column DAY. Order the results by the day of the week, starting with Monday.

```
SQL> select last_name,hire_date,to_char(hire_date,'DAY')DAY from employees order by
to_char(hire_date-1,'d');
```

LAST_NAME	HIRE_DATE	DAY
grant	24-MAY-99	MONDAY
popp	30-JAN-12	MONDAY
taylor	24-MAR-98	TUESDAY
Gietz	07-JUN-94	TUESDAY
higgins	07-JUN-94	TUESDAY
Rajs	17-OCT-95	TUESDAY
Mourgos	16-NOV-99	TUESDAY
Ernst	21-MAY-91	TUESDAY
Davies	29-JAN-97	WEDNESDAY
Dehaan	13-JAN-93	WEDNESDAY
King	17-JUN-87	WEDNESDAY
Hunold	03-JAN-90	WEDNESDAY
Vargas	09-JUL-98	THURSDAY
Kochar	21-SEP-89	THURSDAY
whalen	17-SEP-87	THURSDAY
harstein	17-FEB-96	SATURDAY
Zlotkey	29-JAN-00	SATURDAY
Abel	11-MAY-96	SATURDAY
Lorentz	07-FEB-99	SUNDAY fay
17-AUG-97	SUNDAY	
Matos	15-MAR-98	SUNDAY

21 rows selected.

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EXNO:7 DISPLAYING DATA FROM MULTIPLE TABLE

AIM:
To write SELECT statement to access data from more than one table using equality and nonequality joins, and to view data that generally does not meet a join condition by using outer joins and to join a table to itself by using a self join.

SOLUTIONS FOR THE EXERCISES:

1. Write a query to display the last name, department number, and department name for all employees.

SQL> select e.last_name,e.department_id,d.department_name from employeetable e,department d where e.department_id=d.department_id;

LAST_NAME DEPARTMENT_ID DEPARTMENT_NAME

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

king 90 executive

kochhar 90 executive

dehaan 90 executive

hunold 60 it

ernst 60 it

lorentz 60 it

mourgas 50 shipping

rajs 50 shipping

davies 50 shipping

matos 50 shipping

vargas 50 shipping

LAST_NAME DEPARTMENT_ID DEPARTMENT_NAME

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

zlotkey 80 sales

abel 80 sales

taylor 80 sales

whalen 10 administration

hartstein 20 marketing

fay 20 marketing

higgins 110 accounting

gietz 110 accounting

19 rows selected.

2. Create a unique listing of all jobs that are in department 80. Include the location of the department in the output

SQL> select distinct job_id,location_id from employeetable,department where employeetable.department_id=department.department_id and employeetable.department_id=80;

JOB_ID LOCATION_ID

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

sa_man 2500 sa_rep

2500

3. Write a query to display the employee last name, department name, location ID, and city of all employees who earn a commission

SQL> select e.last_name,d.department_name ,d.location_id ,l.city from employeetable e,department d,locations l where e.department_id=d.department_id and d.location_id=l.location_id and e.commission_pct is not null;

LAST_NAME DEPARTMENT_NAME LOCATION_ID CITY

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

lotkey sales 2500 oxford

abel sale 2500 oxford

tay sales 2500 oxford

4. Display the employee last name and department name for all employees who have an a(lowercase) in their last names

SQL> select last_name,department_name from employeetable,department where employeetable.department_id=department.department_id and last_name like '%a%';

LAST_NAME DEPARTMENT_NAME

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

whalen administration

fay marketing

hartstein marketing

vargas shipping

matos shipping

davies shipping

rajs shipping

mourgas shipping

taylor sales

abel sales

dehaan executive kochhar

executive

12 rows selected.

5.rite a query to display the last name, job, department number, and department name for all employees who work in Toronto no rows selected

6. Display the employee last name and employee number along with their manager's last name and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, Respectively

SQL> select w.last_name "employee",w.employee_id "emp#",m.last_name "manager",m.employee_id from employeetable w join employeetable m on (w.manager_id=m.employee_id);

emplo	emp#	manager	EMPLOYEE_ID
hartstein	201	king	100
zlotkey	149	king	100
mourgas	124	king	100
dehaan	102	king	100
kochhar	101	king	100
higgins	205	kochhar	101
whalen	200	kochhar	101
hunold	103	dehaan	102
lorentz	107	hunold	103
ernst	104	hunold	103

vargas 144 mourgas 124

matos 143 mourgas 124

davies 142 mourgas 124 rajs

141 mourgas 124

grant 178 zlotkey 149

employee emp# manager EMPLOYEE_ID
---------- ---------- ----------

taylor 176 zlotkey 149

abel 174 zlotkey 149 fay

202 hartstein 201 gietz

206 higgins 205

19 rows selected.

7. Modify lab4_6.sql to display all employees including King, who has no manager. Order the results by the employee number.

SQL> select w.last_name"employee",w.employee_id"emp#",m.last_name "manager",m.employee_id "mgr#" from employeetable w left outer join employeetable m on(w.manager_id=m.employee_id);

employee emp# manager mgr#

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

hartstein 201 king 100 zlotkey

149 king 100 mourgas 124

king 100 dehaan 102 king

100 kochhar 101 king 100

higgins 205 kochhar 101 whalen

200 kochhar 101 hunold 103

dehaan 102 lorentz 107 hunold

103 ernst 104 hunold 103

vargas 144 mourgas 124

employee emp# manager mgr#

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

matos 143 mourgas 124

davies 142 mourgas 24

rajs 141 mourgas 124

grant 178 zlotkey 149

taylor 176 zlotkey 149

abel 174 zlotkey 149 fay

202 hartstein 201 gietz

206 higgins 205 king

100

20 rows selected.

8. Create a query that displays employee last names, department numbers, and all the employees who work in the same department as a given employee. Give each column an appropriate label

SQL> select e.department_id department,e.last_name employee,c.last_name colleague from employeetable e join employeetable c on(e.department_id=c.department_id)where e.employee_id<>c.employee_id order by e.department_id ,e.last_name,c.last_name;

DEPARTMENT EMPLOYEE COLLEAGUE

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

20 fay hartstein

20 hartstein fay

50 davies matos

DEPARTMENT EMPLOYEE COLLEAGUE

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

50 davies mourgas
50 davies rajs
50 davies vargas
50 matos davies
50 matos mourgas
50 matos rajs
50 matos vargas
50 mourgas davies
50 mourgas matos
50 mourgas rajs
50 mourgas vargas
50 rajs davies
50 rajs matos
50 rajs mourgas
50 rajs vargas
50 vargas davies
50 vargas matos
50 vargas mourgas
50 vargas rajs
60 ernst hunold
60 ernst lorentz
60 hunold ernst
60 hunold lorentz

DEPARTMENT	EMPLOYEE	COLLEAGUE
60	lorentz	ernst
60	lorentz	hunold
80	abel	taylor
80	abel	zlotkey
80	taylor	abel
80	taylor	zlotkey
80	zlotkey	abel
80	zlotkey	taylor
90	dehaan	king
90	dehaan	kochhar
90	king	dehaan
90	king	kochhar
90	kochhar	dehaan
90	kochhar	king
110	gietz	higgins
110	higgins	gietz

42 rows selected.

9.Show the structure of the JOB_GRADES table. Create a query that displays the name, job,department name, salary, and grade for all employees

SQL> desc job_grades;

Name	Null?	Type

```
 ----------------------------------------- -------- -------
 GRADE_LEVEL                               VARCHAR2(3)

 LOWEST_SAL                                NUMBER(10)

 HIGHEST_SAL                               NUMBER
```

SQL> select * from job_grades;

GRA LOWEST_SAL HIGHEST_SAL

--- ---------- ----------- a

1000 2999 b

3000 5999 c

6000 9999 d

10000 14999 e

15000 24999 f

25000 40000

6 rows selected.

9. Create a query to display the name and hire date of any employee hired after employee Davies.

SQL> select e.last_name,e.hire_date from employeetable e,employeetable davies where davies.last_name='davies' and davies.hire_date<e.hire_date;

LAST_NAME HIRE_DATE

------------------------- --------- lorentz

07-FEB-99 mourgas 16-

NOV-99 matos 15-

MAR-98 vargas 09-

JUL-98 zlotkey 29-JAN-

00 taylor 24-MAR-98

grant 24-MAY-99 fay

17-AUG-97

8 rows selected.

11. Display the names and hire dates for all employees who were hired before their managers, along with their manager's names and hire dates. Label the columns Employee, Emp Hired, Manager, and Mgr Hired, respectively.

SQL> select w.last_name,w.hire_date,m.last_name,m.hire_date from employeetable w,employeetable m where w.manager_id=m.employee_id and w.hire_date <m.hire_date;

LAST_NAMe HIRE_DATE LAST_NAME HIRE_DATE

---------- --------- ---------- whalen

17-SEP-87 kochhar 21-SEP-89 hunold

03-JAN-93 dehaan 13-JAN-93 ernst

21-MAY-91 hunold 03-JAN-93 vargas

09-JUL-98 mourgas 16-NOV-99 matos

15-MAR-98 mourgas 16-NOV-99

davies 29-JAN-97 mourgas 16-NOV-99

rajs 17-OCT-95 mourgas 16-NOV-99

grant 24-MAY-99 zlotkey 29-JAN-00

taylor 24-MAR-98 zlotkey 29-JAN-00

abel 11-MAY-96 zlotkey 29-JAN-00

10 rows selected.

EXNO:8 AGGREGATING DATA USING GROUP FUNCTIONS

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AIM: To identify the available group functions, to describe the use of group functions, to group data by using the GROUP BY clause, to include or exclude grouped rows by using the HAVING clause.

SOLUTION FOR THE EXERCISE:

1. Find the highest, lowest, sum, and average salary of all employees. Label the columns

Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number

```
SQL> select round(max(salary),0)"maximum",round(min(salary),0)"minimum",round(sum(salary),0)"sum",round(avg(salary),0)"average" from employeetable;

   maximum    minimum        sum    average

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

         24000       2500     175500       8775
```

2. Modify the above query to display the minimum, maximum, sum, and average salary

for each job type.

```
SQL>Selectround(max(salary),0)"maximum",round(min(salary),0)
"minimum",round(sum(salary),0)"sum",round(avg(salary),0)"average"       from    employeetable group by job_id;

 maximum    minimum        sum    average

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

11000       7000      26600       8867

     6000       6000       6000       6000

          24000       24000      24000      24000

    17000      17000      34000      17000

     9000       4200      19200       6400

     5800       5800       5800       5800
     8300       8300       8300       8300
```

10500 10500 10500 10500

4400 4400 4400 4400

maximum minimum sum average

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

12000 12000 12000 12000

3500 2500 11700 2925

13000 13000 13000 13000

12 rows selected.

3. Write a query to display the number of people with the same job. Generalize the query so that the user in the HR department is prompted for a job title.

SQL> select job_id,count(*) from employeetable group by job_id;

JOB_ID COUNT(*)

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

sa_rep 3

mk_rep 1

ad_pres 1 ad_vp

2 it_prog 3

st_man 1

ac_account 1

sa_man 1

ad_asst 1

ac_mgr 1

st_clerk 4

mk_man 1

12 rows selected.

4.Determine the number of managers without listing them. Label the column Number of Managers.

SQL> select count(distinct manager_id)"number of managers" from employeetable;

number of managers

8

5. Find the difference between the highest and lowest salaries. Label the column

DIFFERENCE.

SQL> select max(salary)-min(salary)"difference" from employeetable;

difference

21500

6. Create a report to display the manager number and the salary of the lowest-paid employee for that manager. Exclude anyone whose manager is not known. Exclude any groups where the minimum salary is $6,000 or less. Sort the output in descending order of salary.

SQL> select manager_id,min(salary)from employeetable where manager_id is not null group by manager_id having min(salary)>6000 order by min(salary)desc;

MANAGER_ID MIN(SALARY)

---

102 9000

205 8300

149 7000

7. Create a query to display the total number of employees and, of that total, the number of employees hired in 1995, 1996, 1997, and 1998. Create appropriate column headings

SQL> select

count(*)"total",sum(decode(to_char(hire_date,'YYYY'),1995,1,0))"1995",sum(decode(to_char(hire_date,'YYYY'),1996,1,0))"1996",sum(decode(to_char(hire_date,'YYYY'),1996,1,0))"1997",sum(decode(to_char(hire_date,'YYYY'),1998,1,0))"1998" from employeetable;

total	1995	1996	1997	1998
20	1	2	2	3

8. Create a matrix query to display the job, the salary for that job based on department number, and the total salary for that job, for departments 20, 50, 80, and 90, giving each column an appropriate heading.

SQL>

Selectjob_id"job",sum(decode(department_id,20,salary))"department20",sum(decode(department_id,50,salary))"department50",sum(decode(department_id,80,salary))"department80",sum(decode(department_id,90,salary))"department90",sum(salary)"total" from employeetable group by job_id; job department20 department50 department80 department90 total

sa_rep 19600 26600

mk_rep 6000 6000

ad_pres 24000 24000

ad_vp 34000 4000

it_prog 19200 st_man

5800 5800

ac_account 8300

sa_man 10500 10500 ad_asst

4400

ac_mgr 12000

st_clerk 11700 11700

mk_man 13000 13000

12 rows selected.

9. Write a query to display each department's name, location, number of employees, and the average salary for all the employees in that department. Label the column name-Location, Number of people, and salary respectively. Round the average salary to two decimal places.

SQL> select d.department_name "name" ,d.location_id "location",count(*)"no of people",round(avg(salary),2)"salary" from employeetable e,department d where e.department_id =d.department_id group by d.department_name,d.location_id;

name	location	no of people	salary
it	1400	3	6400
shipping	1500	5	3500
administration	1700	1	4400
marketing	1800	2	9500
executive	1700	3	19333.33
sales	2500	3	10033.33
accounting	1700	2	10150

7 rows selected.

EXNO:9 **SUB QUERIES**

AIM:

To define subqueries, to describe the types of problems that sub queries can solve, to list the types of subqueries, and to write single row and multiple row subqueries.

SOLTUIONS FOR THE EXERCISES

1. The HR department needs a query that prompts the user for an employee last name.

The query then displays the last name and hire date of any employee in the same department

as the employee whose name they supply (excluding that employee). For example, if the user enters Zlotkey, find all employees who work with Zlotkey (excluding Zlotkey).

SQL> select last_name,hire_date from employeetable where department_id=(select department_id from employeetable where last_name='zlotkey')and last_name<>'zlotskey';

LAST_NAME HIRE_DATE

--- ---

zlotkey 29-JAN-00 abel

11-MAY-96 taylor 24-

MAR-98

2. Create a report that displays the employee number, last name, and salary of all employees who earn more than the average salary. Sort the results in order of ascending salary

SQL> select employee_id,last_name,salary from employeetable where salary>(select avg(salary) from employeetable)order by salary;

EMPLOYEE_ID LAST_NAME SALARY

--- --- ---

103 hunold 9000

149 zlotkey 10500

174 abel 11000

205 higgins 12000
201 hartstein 13000

101 kochhar 17000

102 dehaan 17000

100 king 24000

8 rows selected.

3. Write a query that displays the employee number and last name of all employees who work in a department with any employee whose last name contains a *u*.

SQL> select last_name,hire_date from employeetable where department_id in(select department_id from employeetable where last_name like '%u%');

LAST_NAME HIRE_DATE

--- ---

lorentz 07-FEB-99

ernst 21-MAY-91

hunold 03-JAN-93

vargas 09-JUL-98

matos 15-MAR-98

davies 29-JAN-97 rajs

17-OCT-95 mourgas

16-NOV-99

8 rows selected.

4. The HR department needs a report that displays the last name, department number, and job ID of all employees whose department location ID is 1700.

SQL> select last_name ,department_id,job_id from employeetable where department_id in(select department_id from department where location_id=1700);

LAST_NAME DEPARTMENT_ID JOB_ID

--- --- ---

whalen 10 ad_asst

dehaan 90 ad_vp

kochhar 90 ad_vp

king 90 ad_pres

gietz 110 ac_account

higgins 110 ac_mgr

6 rows selected.

5. Create a report for HR that displays the last name and salary of every employee who reports to King.

SQL> select last_name,salary from employeetable where manager_id=(select employee_id from employeetable where last_name='king');

LAST_NAME SALARY

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

kochhar 17000 dehaan

17000 mourgas 5800

zlotkey 10500

hartstein 13000

6. Create a report for HR that displays the department number, last name, and job ID for every employee in the Executive department.

SQL> select last_name,department_id,job_id from employeetable where department_id in(select department_id from department where department_name='executive');

LAST_NAME DEPARTMENT_ID JOB_ID

------------------------ ------------ ---------- dehaan

90 ad_vp kochhar 90 ad_vp

king 90 ad_pres

7. Modify the query 3 to display the employee number, last name, and salary of all employees who earn

more than the average salary and who work in a department with any employee whose last name contains a *u*.

```
SQL> select employee_id,last_name,salary from employeetable where department_id in(select
department_id from employeetable where last_name like '%u%') and salary>(select avg(salary)
from employeetable);

EMPLOYEE_ID LAST_NAME                 SALARY

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

        103 hunold                    9000
```

EXNO:10 USING THE SET OPERATORS

AIM:

To describe the set operators, to use a set operator to combine multiple queries into a single query, and to control the order of rows returned.

FIND THE SOLUTIONS:

1. The HR department needs a list of department IDs for departments that do not contain the job ID ST_CLERK. Use set operators to create this report.

select department_id from department minus select department_id from employeetable where job_id='ST_CLERK';

DEPARTMENT_ID

10

20

50

60

80

90

110

190

8 rows selected.

2. The HR department needs a list of countries that have no departments located in them.

Display the country ID and the name of the countries. Use set operators to create this report.

SQL> select country_id,country_name from countries minus select l.country_id,c.country_name from locations l,countries c where l.country_id=c.country_id;

CO COUNTRY_NAME

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

de germany

3. Produce a list of jobs for departments 10, 50, and 20, in that order. Display job ID and

department ID using set operators.

SQL> select job_id,department_id from employeetable where department_id=10 union select job_id,department_id from employeetable where department_id=50 union select job_id,department_id from employeetable where department_id=20;

JOB_ID DEPARTMENT_ID

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

ad_asst 10

mk_man 20

mk_rep 20

st_clerk 50 st_man

50

4. Create a report that lists the employee IDs and job IDs of those employees who currently have a job title that is the same as their job title when they were initially hired by the company (that is, they changed jobs but have now gone back to doing their original job).

SQL> select employee_id,job_id from employeetable intersect select employee_id,job_id from job_history;

EMPLOYEE_ID JOB_ID

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

103 it_prog

176 sa_rep

200 ad_asst

5. The HR department needs a report with the following specifications:

- Last name and department ID of all the employees from the EMPLOYEES table, regardless of whether or not they belong to a department.
- Department ID and department name of all the departments from the DEPARTMENTS table, regardless of whether or not they have employees working in them Write a compound query to accomplish this.

SQL> select last_name,department_id,to_char(null) from employeetable union select to_char(null),department_id,department_name from department;

LAST_NAME DEPARTMENT_ID TO_CHAR(NULL)

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

abel 80

davies 50

dehaan 90

ernst 60

fay 20

gietz 110

grant

hartstein 20

higgins 110

hunold 60

king 90

kochhar 90

lorentz 60

matos 50

LAST_NAME DEPARTMENT_ID TO_CHAR(NULL)

---------- ---------- ---------- mourgas 50

rajs 50 taylor 80

vargas 50

whalen 10

zlotkey 80

administration 10

8 rows selected.

EXNO:11 CREATING VIEWS

AIM:

To describe a view, to create, alter the definition of , and drop a view, to retrieve the data through a view, to insert, update, and delete data through a view, to create and use an inline view.

SOLUTIONS:

1) Create a view called EMPLOYEE_VU based on the employee numbers, employee names and department numbers from the EMPLOYEES table. Change the heading for the employee name to EMPLOYEE.

SQL> create view employee_VU as select employee_id,last_name "employee",department_id from employees;

View created.

2) Display the contents of the EMPLOYEES_VU view.

SQL> select *from employee_VU;

EMPLOYEE_ID EMPLOYEE DEPARTMENT_ID

---

1 king 90

101 kocchar 90

102 dehaan 90

103 hunold 60

104 ernst 60

107 lorentz 4200

124 mourgos 50

141 rajs 50

143 matos 50

9 rows selected.

3) Select the view name and text from the USER_VIEWS data dictionary views.

SQL> select *from tab;

TNAME TABTYPE CLUSTERID

--- ---

STUDENT TABLE

EMP TABLE

DEPT TABLE

EMPLOYEES TABLE

JOB TABLE

DEPARTMENT TABLE

MY_EMPLOYEE TABLE

EMPLOYEES1 TABLE

DEPARTMENT1 TABLE

JOB_GRADE TABLE

LOCATION TABLE

MY_EMPLOYEES TABLE

JOBS TABLE

COUNTRIES TABLE

LOCATIONS TABLE

EMPLOYEE_VU VIEW

16 rows selected.

SQL> select view_name,text from user_views;

VIEW_NAME TEXT EMPLOYEE_VU

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

4) using your EMPLOYEES_VU view, enter a query to display all employees names and department.

SQL> select employee_id,department_id from employee_VU;

EMPLOYEE_ID DEPARTMENT_ID

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

1 90

101 90

102 90

103 60

104 60

107 4200

124 50

141 50

143 50

9 rows selected.

5) Create a view named DEPT50 that contains the employee number, employee last names and department numbers for all employees in department 50.Label the view columns EMPNO, EMPLOYEE and DEPTNO. Do not allow an employee to be reassigned to another department through the view.

SQL> create view dept50 as select employee_id"empno",last_name"employees",department_id"deptno" from employees where department_id=50 with check option constraints emp_department_50;

View created.

6) Display the structure and contents of the DEPT50 view.

SQL> desc dept50;

Name	Null?	Type
emp no	NOT NULL	NUMBER(6)
employees	NOT NULL	VARCHAR2(25)
dept no		NUMBER(4)

SQL> select *from dept50; emp no

employees dept no

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

124 mourgos 50

141 rajs 50

143 matos 50

7) Attempt to reassign Matos to department 80.

SQL> update dept50 set deptno=80 where employee='matos';

1 row updated.

SQL> select *from dept50;

emp no	employees	dept no
124	mourgos	50
141	rajs	50
143	matos	80

8) Create a view called SALARY_VU based on the employee last names, department names, salaries, and salary grades for all employees. Use the Employees, DEPARTMENTS and JOB_GRADE tables. Label the column Employee, Department, salary, and Grade respectively.

SQL> create view salary_VU as select e.last_name"employee",d.dept_name"dept",e.salary"salary",j.grade_level"grades" from employees e,department d,job j where e.department_id=d.dept_id and e.salarybetween j.lowest_sal and j.highest_sal;

View created.

EXNO:12 PROCEDURES AND FUNCTIONS

AIM:

To implement the concept of procedures and functions which is a logically grouped set of SQL and PL/SQL statements that perform a specific task.

PROGRAM FOR GENERAL PROCEDURE – SELECTED RECORD'S PRICE IS INCREMENTED BY 500 , EXECUTING THE PROCEDURE CREATED AND DISPLAYING THE UPDATED TABLE

SQL> create procedure itsum(identity number, total number) is price number;

2 null_price exception;

3 begin

4 select actualprice into price from ititems where itemid=identity;

5 if price is null then

6 raise null_price;

7 else

```
8    update ititems set actualprice=actualprice+total where itemid=identity;
9    end if;
10  exception
11  when null_price then
12  dbms_output.put_line('price is null');
13  end;
14  /
```

Procedure created.

```
SQL> exec itsum(101, 500);
```

PL/SQL procedure successfully completed.

```
SQL> select * from ititems;
 ITEMID   ACTUALPRICE      ORDID     PRODID
---------          -----------          ---------     ---------
         101           2500                500         201
         102           3000               1600         202
         103           4000                600          202
```

CREATE THE TABLE 'ITTRAIN' TO BE USED FOR FUNCTIONS

```
SQL>create table ittrain (tno number(10), tfare number(10));
```

Table created.

```
SQL>insert into ittrain values (1001, 550); 1
```

row created.

```
SQL>insert into ittrain values (1002, 600);
```

1 row created.

```
SQL>select * from ittrain;
    TNO       TFARE
```

| --- | --- |
| 1001 | 550 |
| 1002 | 600 |

PROGRAM FOR FUNCTION AND IT'S EXECUTION

```
SQL> create function aaa (trainnumber number) return number is
2  trainfunction ittrain.tfare % type;
3  begin
4  select tfare into trainfunction from ittrain where tno=trainnumber;
5  return(trainfunction);
6  end;
7  /
```

Function created.

```
SQL> set serveroutput on;
SQL> declare
2  total number;
3  begin
4  total:=aaa (1001);
5  dbms_output.put_line('Train fare is Rs. '||total);
6  end;
7  /
```

Train fare is Rs.550

PL/SQL procedure successfully completed.

FACTORIAL OF A NUMBER USING FUNCTION — PROGRAM AND EXECUTION

```
SQL>  create function itfact (a number) return number is
```

```
2   fact number:=1;
3   b number;
4   begin
5   b:=a;
6   while b>0
7   loop
8   fact:=fact*b;
9   b:=b-1;
10  end loop;
11  return(fact);
12  end;
13  /
```

Function created.

```
SQL> set serveroutput on;
SQL> declare
2  a number:=7;
3  f number(10);
4  begin
5  f:=itfact(a);
6  dbms_output.put_line('The factorial of the given number is'||f);
7  end;
8  /
```

The factorial of the given number is 5040

PL/SQL procedure successfully completed.

PROGRAMS

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TO DISPLAY HELLO MESSAGE

```
SQL> set serveroutput on;

SQL> declare

2  a varchar2(20);

3  begin

4  a:='Hello';

5  dbms_output.put_line(a);

6  end;
7  /

Hello

PL/SQL procedure successfully completed.
```

TO INPUT A VALUE FROM THE USER AND DISPLAY IT

```
SQL> set serveroutput on;

SQL> declare

2  a varchar2(20);

3  begin

4  a:=&a;

5  dbms_output.put_line(a);

6  end;

7  /

Enter value for a: 5

old   4: a:=&a; new

4: a:=5;

5

PL/SQL procedure successfully completed.
```

CS23332 DATABASE MANAGEMENT SYSTEM LABORATORY

GREATEST OF TWO NUMBERS

```
SQL> set serveroutput on;

SQL> declare

2    a number(7);

3    b number(7);

4    begin

5    a:=&a;
6    b:=&b;

7    if(a>b) then

8    dbms_output.put_line (' The grerater of the two is'|| a);

9    else

10   dbms_output.put_line (' The grerater of the two is'|| b);

11   end if;

12   end;

13   /

Enter value for a: 5

old   5: a:=&a; new

5: a:=5; Enter value

for  b:  9  old       6:

b:=&b;   new       6:

b:=9;

The grerater of the two is9

PL/SQL procedure successfully completed.
```

GREATEST OF THREE NUMBERS

```
SQL> set serveroutput on;
```

```
SQL> declare
2    a number(7);
3    b number(7);
4    c number(7);
5    begin
6    a:=&a;
7    b:=&b;
8    c:=&c;
9    if(a>b and a>c) then
10   dbms_output.put_line (' The greatest of the three is ' || a);
11   else if (b>c) then
12   dbms_output.put_line (' The greatest of the three is ' || b);
13   else
14   dbms_output.put_line (' The greatest of the three is ' || c);
15   end if;
16   end if;
17   end;
18   /
Enter value for a: 5
old   6: a:=&a; new
6: a:=5; Enter value
for  b:  7  old      7:
b:=&b;  new      7:
b:=7;  Enter  value
for  c:  1  old      8:
```

c:=&c; new 8:

c:=1;

The greatest of the three is 7

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 USING SIMPLE LOOP SQL> set serveroutput on;

SQL> declare

2 a number:=1;

3 begin

4 loop

5 dbms_output.put_line (a);

6 a:=a+1;

7 exit when a>5;

8 end loop;

9 end;

10 /

1

2

3

4

5

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 4 USING WHILE LOOP

SQL> set serveroutput on;

```
SQL> declare
2    a number:=1;
3    begin
4    while(a<5)
5    loop
6    dbms_output.put_line (a);
7    a:=a+1;
8    end loop;
9    end;
10  /
1
2
3
4
```

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 USING FOR LOOP

```
SQL> set serveroutput on;
SQL> declare
2  a number:=1;
3  begin
4  for a in 1..5
5  loop
6  dbms_output.put_line (a);
7  end loop;
8  end;
```

```
9  /

1

2
3

4

5
```

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 IN REVERSE ORDER USING FOR LOOP

```
SQL> set serveroutput on;

SQL> declare

2  a number:=1;

3  begin

4  for a in reverse 1..5

5  loop

6  dbms_output.put_line (a);

7  end loop;

8  end;

9  /

5

4

3

2

1
```

PL/SQL procedure successfully completed.

TO CALCULATE AREA OF CIRCLE

```
SQL> set serveroutput on;

SQL> declare
2    pi constant number(4,2):=3.14;

3    a number(20);

4    r number(20);

5    begin

6    r:=&r;

7    a:= pi* power(r,2);

8    dbms_output.put_line (' The area of circle is ' || a);

9    end;

10  /

Enter value for r: 2

old   6: r:=&r; new

6: r:=2;

The area of circle is 13

PL/SQL procedure successfully completed.
```

TO CREATE SACCOUNT TABLE

```
SQL> create table saccount  ( accno number(5), name varchar2(20), bal number(10));

Table created.

SQL> insert into saccount values ( 1,'mala',20000); 1

row created.

SQL> insert into saccount values (2,'kala',30000);


1    row created.

SQL> select * from saccount;
```

```
   ACCNO NAME                 BAL
--------- -------------------- ---------

         1 mala                20000

         2 kala                30000

SQL> set serveroutput on;

SQL> declare

2    a_bal number(7);

3    a_no varchar2(20);

4    debit number(7):=2000;

5    minamt number(7):=500;

6    begin

7    a_no:=&a_no;

8    select bal into a_bal from saccount where accno= a_no;

9    a_bal:= a_bal-debit;

10  if (a_bal > minamt) then

11  update  saccount  set bal=bal-debit where accno=a_no;

12  end if;

13  end;

 14

 15  /

Enter value for a_no: 1

old    7: a_no:=&a_no;

new   7: a_no:=1;

PL/SQL procedure successfully completed.

SQL> select * from saccount;
```

ACCNO NAME BAL

--- --- ---

1 mala 18000

2 kala 30000

TO CREATE TABLE SROUTES

SQL> create table sroutes (rno number(5), origin varchar2(20), destination varchar2(20), fare number(10), distance number(10));

Table created.

SQL> insert into sroutes values (2, 'chennai', 'dindugal', 400,230); 1

row created.

SQL> insert into sroutes values (3, 'chennai', 'madurai', 250,300); 1

row created.

SQL> insert into sroutes values (6, 'thanjavur', 'palani', 350,370);

1 row created.

SQL> select * from sroutes;

RNO ORIGIN DESTINATION FARE DISTANCE

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

2 chennai dindugal 400 230

3 chennai madurai 250 300

6 thanjavur palani 350 370

SQL> set serveroutput on;

SQL> declare

2 route sroutes.rno % type;

```
3    fares sroutes.fare % type;
4    dist sroutes.distance % type;
5    begin
6    route:=&route;
7    select fare, distance into fares , dist from sroutes where rno=route;
8    if (dist < 250) then
9    update sroutes set fare=300 where rno=route;
10   else if dist between 250 and 370 then
11   update sroutes set fare=400 where rno=route;
12   else if (dist > 400) then
13   dbms_output.put_line('Sorry');
14   end if;
15   end if;
16   end if;
17   end;
18   /
Enter value for route: 3
old    6: route:=&route;
new    6: route:=3;
PL/SQL procedure successfully completed.


SQL> select * from sroutes;
RNO ORIGIN          DESTINATION        FARE  DISTANCE
--------- -------------------- -------------------- -------
2  chennai           dindugal           400      230
```

3 chennai madurai 400 300

6 thanjavur palani 350 370

TO CREATE SCALCULATE TABLE

```
SQL> create table scalculate ( radius number(3), area number(5,2));

Table created.

SQL> desc scalculate;
 Name                      ?    Type
 ----------------------------------------------------- ----
 RADIUS                         NUMBER(3)
 AREA                           NUMBER(5,2)

SQL> set serveroutput on;

SQL> declare
2    pi constant number(4,2):=3.14;
3    area number(5,2);
4    radius number(3);
5    begin
6    radius:=3;
7    while (radius <=7)
8    loop
9    area:= pi* power(radius,2);
10   insert into scalculate values (radius,area);
11   radius:=radius+1;
12   end loop;
13   end;
14   /
```

PL/SQL procedure successfully completed.

SQL> select * from scalculate;

```
   RADIUS      AREA
--------- ---------
         3      28.26
         4      50.24
         5      78.5
         6     113.04
         7     153.86
```

TO CALCULATE FACTORIAL OF A GIVEN NUMBER

```
SQL> set serveroutput on;
SQL> declare
2    f number(4):=1;
3    i number(4);
4    begin
5    i:=&i;
6    while(i>=1)
7    loop
8    f:=f*i;
9    i:=i-1;
10   end loop;
11   dbms_output.put_line('The value is ' || f);
12   end;
13   /
```

Enter value for i: 5

old 5: i:=&i; new

5: i:=5;

The value is 120

PL/SQL procedure successfully completed.

Ex No:13

TRIGGERS

TO CREATE THE TABLE 'ITEMPLS'

SQL> create table itempls (ename varchar2(10), eid number(5), salary number(10));

Table created.

SQL> insert into itempls values('xxx',11,10000); 1

row created.

SQL> insert into itempls values('yyy',12,10500); 1

row created.

SQL> insert into itempls values('zzz',13,15500);

1 row created.

SQL> select * from itempls;

ENAME EID SALARY

---------- --------- --------- xxx

11 10000 yyy 12

10500 zzz 13

15500

CS23332 DATABASE MANAGEMENT SYSTEM LABORATORY

TO CREATE A SIMPLE TRIGGER THAT DOES NOT ALLOW INSERT UPDATE AND DELETE OPERATIONS ON THE TABLE

```
SQL> create trigger ittrigg before insert or update or delete on itempls for each row
2  begin
3  raise_application_error(-20010,'You cannot do manipulation');
4  end;
 5
 6  /
Trigger created.
SQL> insert into itempls values('aaa',14,34000); insert
into itempls values('aaa',14,34000)
        *
ERROR at line 1:
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'
SQL> delete from itempls where ename='xxx'; delete from itempls
where ename='xxx'
         *
ERROR at line 1:
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'
SQL> update itempls set eid=15 where ename='yyy'; update
itempls set eid=15 where ename='yyy'
```

*

ERROR at line 1:

ORA-20010: You cannot do manipulation

ORA-06512: at "STUDENT.ITTRIGG", line 2

ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'**TO DROP THE CREATED TRIGGER**

SQL> drop trigger ittrigg;

Trigger dropped.

TO CREATE A TRIGGER THAT RAISES AN USER DEFINED ERROR MESSAGE AND DOES NOT ALLOW UPDATION AND INSERTION

SQL> create trigger ittriggs before insert or update of salary on itempls for each row

2 declare

3 triggsal itempls.salary%type;

4 begin

5 select salary into triggsal from itempls where eid=12;

6 if(:new.salary>triggsal or :new.salary<triggsal) then

7 raise_application_error(-20100,'Salary has not been changed');

8 end if;

9 end;

10 /

Trigger created.

SQL> insert into itempls values ('bbb',16,45000); insert

into itempls values ('bbb',16,45000)

*

ERROR at line 1:

ORA-04098: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation

SQL> update itempls set eid=18 where ename='zzz'; update itempls set eid=18

where ename='zzz'

*

ERROR at line 1:

ORA-04298: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation

13/8/2025 Function Example:

```
DECLARE
 a INT;  b FLOAT;
myexp EXCEPTION;

 FUNCTION sqroot(x INT)
  RETURN FLOAT
 AS    answer
FLOAT;  BEGIN
  IF x < 0 THEN
    RAISE myexp;
  ELSE      answer :=
SQRT(x);    END IF;
  RETURN answer;
 EXCEPTION
```

```
   WHEN myexp THEN
     DBMS_OUTPUT.PUT_LINE('Square root of a negative number is not allowed, so returning the same number');
     RETURN x;
  END;


BEGIN
  b := sqroot(4);
  DBMS_OUTPUT.PUT_LINE('The value is ' || b);
END;
```