CS23332 DATABASE MANAGEMENT SYSTEMS

Laboratory Record Note Book

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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.
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 precision.

   - 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.

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'.

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. **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.

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

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=2
05) WHERE
employee_id=114;

REMOVING A ROW FROM A TABLE

DELETE STATEMENT

Syntax

DELETE FROM table_name WHERE conditions;

Example:

DELETE FROM department WHERE dept_name=‘finance‘‘;

Ex.No.: 1		CREATION OF BASE TABLE AND DML OPERATIONS
Date :		

AIM:

ALGORITHM:

STEP-1: Start.

STEP-2: Create a base Table

Syntax:

CREATE TABLE <table name> (column1 type, column2 type, …);

STEP-3: Describe the Table structure Syntax:

DESC <table name>

STEP-4: Add a new row to a Table using INSERT statement.

Syntax:

- INSERT INTO <table name> VALUES (value1, value2..);
- INSERT INTO <table name> (column1, column2..) VALUES (value1, value2..);
- INSERT INTO <table name>VALUES (&column1,'&column');

STEP-5: Modify the existing rows in the base Table with UPDATE statement.

Syntax:

UPDATE <table name> SET column1=value, column2 = 'value' WHERE (condition);

STEP-6: Remove the existing rows from the Table using DELETE statement. Syntax:

DELETE FROM <table name> WHERE <condition>;

STEP-7: Perform a Query using SELECT statement.

Syntax:

SELECT [DISTINCT] {*,<column1,,..>} FROM <table name> WHERE <condition>;

STEP-8: The truncate command deletes all rows from the table. Only the structure of the table remains.

Syntax:

TRUNCATE TABLE <table name>;

STEP-9: Alter the existing table using ALTER statement.

Syntax:

Add Column:

ALTER TABLE <table name> ADD (column data type [DEFAULTexpr][,column data type]);

Modify Column:

ALTER TABLE <table name> MODIFY (column data type [DEFAULT expr], [,column data type]);

Drop Column:

ALTER TABLE <table name> DROP COLUMN <column name>;

STEP-10: To drop the entire table using DROP statement.

Syntax:

DROP TABLE <table name>;

STEP-11: Exit.

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 MY_EMPLOYEE (ID NUMBER(4) NOT NULL, Last_name VARCHAR2(25), First_name VARCHAR2(25), Userid VARCHAR2(25), Salary

NUMBER(9,2), CONSTRAINT pk_employee PRIMARY KEY (ID));

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', NULL, 1100); INSERT INTO MY_EMPLOYEE (ID, Last_name, First_name, Userid, Salary) VALUES (4, 'Newman', 'Chad', NULL, 750);
UPDATE MY_EMPLOYEE SET Userid = LOWER(CONCAT(SUBSTR(First_name, 1, 1), SUBSTR(Last_name, 1, 7))) WHERE ID = 3 OR ID = 4;

5. Delete Betty dancs from MY _EMPLOYEE table.

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

6. 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;

7. Make the data additions permanent.

```
COMMIT;
```

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

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

9. Change the salary to 1000 for all the employees with a salary less than 900. UPDATE MY_EMPLOYEE SET Salary = 1000 WHERE Salary < 900;

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 2		DATA MANIPULATIONS
Date :		

Create the following tables with the given structure.

EMPLOYEES TABLE

CREATE TABLE EMPLOYEES (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), CONSTRAINT pk_employee_id PRIMARY KEY (Employee_id)); INSERT INTO EMPLOYEES VALUES (101, 'John', 'Doe', 'jdoe@example.com', '1234567890', TO_DATE('2022-06-15', 'YYYY-MM-DD'), 'IT_PROG', 5000, NULL, 100, 60); INSERT INTO
EMPLOYEES VALUES (102, 'Jane', 'Austin', 'jaustin@example.com', '0987654321', TO_DATE('2022- 08-20', 'YYYY-MM-DD'), 'HR_MAN', 4800,

```
NULL, 101, 70); INSERT INTO
EMPLOYEES VALUES (103, 'Mark', 'Smith', 'msmith@example.com',
'1230984567', TO_DATE('2023- 01-10', 'YYYY-MM-DD'), 'SA_REP', 4600,
0.10, 100, 80); INSERT INTO
EMPLOYEES VALUES (104, 'Chad', 'Newman', 'cnewman@example.com',
'7896541230', TO_DATE('2021-11-03', 'YYYY-MM-DD'), 'FI_MGR', 6000,
NULL, 102, 60); INSERT INTO
EMPLOYEES VALUES (105, 'Betty', 'Austin', 'baustin@example.com',
'9874563210', TO_DATE('2020- 12-25', 'YYYY-MM-DD'),
'HR_CLERK', 3900, NULL, 101, 70);
```

Job_id	Not null	Varchar(10)
Salary		Number(8,2)
Commission_pct		Number(2,2)
Manager_id		Number(6)
Department_id		Number(4)

(a)Find out the employee id, names, salaries of all the employees

SELECT Employee_id, First_Name, Last_Name, Salary FROM EMPLOYEES;

(b) List out the employees who works under manager 100

SELECT Employee_id, First_Name, Last_Name FROM EMPLOYEES WHERE Manager_id
= 100;

(c) Find the names of the employees who have a salary greater than or equal to 4800 SELECT First_Name, Last_Name FROM EMPLOYEES WHERE Salary >= 4800;

(d) List out the employees whose last name is _AUSTIN‘

SELECT First_Name, Last_Name FROM EMPLOYEES WHERE Last_Name = 'AUSTIN';

(e)Find the names of the employees who works in departments 60,70 and 80

SELECT First_Name, Last_Name FROMEMPLOYEES WHERE Department_id IN (60, 70, 80);

(f) Display the unique Manager_Id.

```
SELECT DISTINCT Manager_id FROM EMPLOYEES;
```

Create an Emp table with the following fields: (EmpNo, EmpName, Job,Basic, DA, HRA,PF,

GrossPay, NetPay) (Calculate DA as 30% of Basic and HRA as 40% of Basic)

```
CREATE TABLE EMP ( EmpNo NUMBER(6), EmpName VARCHAR2(25), Job
VARCHAR2(20), Basic NUMBER(8,2), DA NUMBER(8,2), HRA NUMBER(8,2),
PF
NUMBER(8,2), GrossPay NUMBER(8,2), NetPay NUMBER(8,2),
Department_id NUMBER(4) )
```

(a)Insert Five Records and calculate GrossPay and NetPay.

```
INSERT INTO EMP (EmpNo, EmpName, Job, Basic, Department_id)
VALUES (1, 'John Doe', 'Manager', 5000, 60);
INSERT INTO EMP (EmpNo, EmpName, Job, Basic, Department_id)
VALUES (2, 'Jane Austin', 'Clerk', 4000, 70);
INSERT INTO EMP (EmpNo, EmpName, Job, Basic, Department_id)
VALUES (3, 'Mark Smith', 'Sales', 3500, 80);
INSERT INTO EMP (EmpNo, EmpName, Job, Basic, Department_id) VALUES (4,
'Chad Newman', 'Manager', 6000, 60);
INSERT INTO EMP (EmpNo, EmpName, Job, Basic, Department_id) VALUES (5,
'Betty Austin', 'HR', 3900, 70);
UPDATE EMP SET DA = 0.30 * Basic, HRA = 0.40 * Basic, PF = 0.12 *
Basic; UPDATE EMP SET GrossPay = Basic + DA + HRA;
 UPDATE EMP SET NetPay = GrossPay - PF;
```

(b)Display the employees whose Basic is lowest in each department.

```
SELECT * FROM EMP e WHERE Basic = ( SELECT MIN(Basic) FROM EMP
WHERE
Department_id = e.Department_id );
```

(c)If Net Pay is less than

```
SELECT EmpName, NetPay FROM EMP WHERE NetPay < 7500;
```

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)

JOB_GRADE TABLE

NAME	NULL?	TYPE
Grade_level		Varchar(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)

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),
CONSTRAINT
pk_dept PRIMARY KEY (ID));

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 EMP (ID NUMBER(7), LAST_NAME VARCHAR2(25), FIRST_NAME VARCHAR2(25), DEPT_ID NUMBER(7), CONSTRAINT pk_emp PRIMARY KEY (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, Department_id AS Dept_id FROM EMPLOYEES;

5 Drop the EMP table.

DROP TABLE EMP

6 Rename the EMPLOYEES2 table as EMP.

ALTER TABLE EMPLOYEES2 RENAME TO EMP;

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

COMMENT ON TABLE DEPT IS 'Department Table';
COMMENT ON TABLE EMP IS 'Employees Table'; DESC DEPT; DESC EMP;

8 Drop the First_name column from the EMP table and confirm it. ALTER TABLE EMP DROP COLUMN First_Name; DESC EMP;

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 3		WRITING BASIC SQL SELECT STATEMENTS
Date :		

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;

SELECT Employee_id, Last_Name, Salary * 12 AS "ANNUAL SALARY" FROM EMPLOYEES;

Queries

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

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	

Total (15)	
Faculty Signature	

Ex.No.: 4		WORKING WITH CONSTRAINTS
Date :		

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:

- Setting null value is appropriate when the actual value is unknown, or when a value would not be meaningful.
- A null value is not equivalent to a value of zero.
- A null value will always evaluate to null in any expression.
- When a column name is defined as not null, that column becomes a mandatory i.e., the user has to enter data into it.
- 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 (Employee_id);

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 DEPARTMENTS ADD CONSTRAINT my_dept_id_pk PRIMARY KEY
(dept_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(4); ALTER TABLE EMP ADD CONSTRAINT my_emp_dept_id_fk FOREIGN KEY (DEPT_ID) REFERENCES

DEPARTMENTS(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 chk_commission_gt_zero CHECK (COMMISSION > 0);

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 5		**CREATING VIEWS**
Date :		

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.

```
CREATE VIEW EMPLOYEE_VU AS SELECT Employee_id, First_Name || ' ' ||
Last_Name AS EMPLOYEE, Dept_ID FROM EMPLOYEES;
```

2. Display the contents of the EMPLOYEES_VU view.

```
SELECT * FROM EMPLOYEE_VU;
```

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

```
SELECT VIEW_NAME, TEXT FROM USER_VIEWS WHERE
VIEW_NAME = 'EMPLOYEE_VU';
```

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

SELECT EMPLOYEE, Dept_ID FROM EMPLOYEE_VU;

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.

CREATE VIEW DEPT50 AS SELECT Employee_id AS EMPNO, Last_Name AS EMPLOYEE, Dept_ID AS DEPTNO FROM EMPLOYEES WHERE Dept_ID = 50;

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

DESC DEPT50; SELECT * FROM DEPT50;

7. Attempt to reassign Matos to department 80.

UPDATE EMPLOYEES SET Dept_ID = 80 WHERE Last_Name = 'Matos';

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.

CREATE VIEW SALARY_VU AS SELECT E.Last_Name AS Employee, D.dept_name AS Department, E.Salary AS Salary, J.Grade_level AS Grade FROM EMPLOYEES E JOIN DEPARTMENTS D ON E.Dept_ID = D.dept_id JOIN JOB_GRADE J ON E.Salary
BETWEEN J.Lowest_sal AND J.Highest_sal;

Evaluation Procedure	Marks awarded
Query(5)	

Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Date :		

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

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('1998-02-20',
        'YYYY-MM-DD') AND TO_DATE('1998-05-01',
            'YYYY-MM-DD') ORDER BY Hire_date;
```

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 Last_Name, Department_id FROM EMPLOYEES WHERE
Department_id IN (20, 50) ORDER BY Last_Name;
```

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;
```

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
TO_CHAR(Hire_date, 'YYYY') = '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_id 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);
```

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 7		**USING SET OPERATORS**
Date :		

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

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

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 set operators combine the results of two or more component queries

into one result. Queries containing set operators are called *compound*

queries.

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:

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 DEPARTMENTS MINUS SELECT department_id
FROM EMPLOYEES WHERE job_id = 'ST_CLERK';
```

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.

```
SELECT country_id, country_name FROM COUNTRIES WHERE
```

country_id IN (SELECT country_id FROM COUNTRIES MINUS SELECT DISTINCT country_id FROM DEPARTMENTS WHERE department_name='HR');

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

```
SELECT job_id, department_id FROM EMPLOYEES WHERE department_id =
10 UNION ALL SELECT job_id, department_id FROM EMPLOYEES WHERE
department_id = 50 UNION ALL SELECT job_id, department_id FROM
EMPLOYEES WHERE department_id
= 20;
```

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).

SELECT employee_id, job_id, hire_date FROM EMPLOYEES INTERSECT SELECT employee_id, job_id, hire_date FROM JOB_HISTORY ORDER BY hire_date ASC;

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.

SELECT last_name, department_id, NULL AS department_name FROM EMPLOYEES UNION SELECT NULL AS last_name, department_id, department_name FROM DEPARTMENTS;

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 8		**WORKING WITH MULTIPLE TABLES**
Date :		

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
• 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 aconcatenated 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;
```

<u>Additional Search</u>
<u>Conditions</u> Using the
AND Operator <u>Example:</u>

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, d.LOCATION_ID, l.COUNTRY 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, d.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 ana(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
LOWER(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, e.JOB_ID, e.DEPARTMENT_ID,
d.DEPARTMENT_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 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 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, e2.LAST_NAME AS "CoWorkers" FROM EMPLOYEES e1 JOIN EMPLOYEES e2 ON e1.DEPARTMENT_ID = e2.DEPARTMENT_ID WHERE e1.EMPLOYEE_ID = 106 AND e1.EMPLOYEE_ID <> e2.EMPLOYEE_ID;
```

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

DESCRIBE JOB_GRADES; SELECT e.LAST_NAME, e.JOB_ID, d.DEPARTMENT_NAME, e.SALARY, jg.GRADE_LEVEL FROM EMPLOYEES e JOIN DEPARTMENTS d ON e.DEPARTMENT_ID = d.DEPARTMENT_ID JOIN JOB_GRADES jg ON e.SALARY BETWEEN jg.LOW_SALARY AND jg.HIGH_SALARY;

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

SELECT e.LAST_NAME AS "Employee", e.HIRE_DATE AS "Hire Date" FROM

```
EMPLOYEES e JOIN EMPLOYEES r ON r.LAST_NAME = 'Davies'
WHERE e.HIRE_DATE > r.HIRE_DATE;
```

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 AND e.EMPLOYEE_ID <> m.EMPLOYEE_ID;
```

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 9		SUB QUERIES
Date :		

Objectives

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

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 = 'Zlotkey'
) AND last_name != 'Zlotkey';
```

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;
```

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 department_id FROM employees WHERE
last_name LIKE '%u%' );
```

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 last_name, department_id, job_id FROM employees WHERE
department_id IN ( SELECT department_id FROM departments WHERE
location_id=1700 );
```

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

```
SELECT last_name, salary FROM employees e WHERE EXISTS( SELECT
last_name FROM employees m WHERE e.manager_id = m.employee_id AND
m.last_name='King' );
```

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

```
SELECT department_id, last_name, job_id FROM employees WHERE
department_id = ( SELECT department_id FROM departments WHERE
department_name = 'Executive' );
```

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 e.employee_id, e.last_name, e.salary FROM employees e WHERE
e.salary > (SELECT AVG(salary) FROM employees) AND EXISTS ( SELECT
* FROM employees e2 WHERE e.department_id = e2.department_id AND
e2.last_name LIKE '%u%' );
```

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 10		**AGGREGATING DATA USING GROUP FUNCTIONS**
Date :		

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

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

TRUE

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

FALSE

3. The WHERE clause restricts rows prior to inclusion in a group

calculation.

True/False TRUE

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_id, 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_id;

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_id, COUNT(*) AS Number_of_People FROM employees WHERE job_id = 'Developer' GROUP BY job_id;

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

goups where the minimum salary is $6,000 or less. Sort the output in descending order of salrary.

SELECT manager_id, 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, SUM(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1995 THEN 1 ELSE 0 END) AS Employees_1995, SUM(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1996 THEN 1 ELSE 0 END) AS Employees_1996, SUM(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1997 THEN 1 ELSE 0 END) AS Employees_1997, SUM(CASE WHEN EXTRACT(YEAR FROM hire_date) = 1998 THEN 1 ELSE 0 END) AS Employees_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_id, department_id, SUM(salary) AS Total_Salary, AVG(salary) AS Average_Salary FROM employees WHERE department_id IN (20, 50, 80, 90) GROUP BY job_id, department_id ORDER BY department_id, job_id;

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 AS "Name-Location", d.location_id AS 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_id;
```

Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 11		**PL SQL PROGRAMS**
Date :		

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 /
Hell
o
```

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.
```

PROGRAM 1

Write a PL/SQL block to calculate the incentive of an employee whose ID is 110.

```
DECLARE emp_salary employees.salary%TYPE; incentive NUMBER(8,2);
BEGIN SELECT salary INTO emp_salary FROM employees WHERE employee_id
= 110; incentive := emp_salary
* 0.1; DBMS_OUTPUT.PUT_LINE('Incentive for Employee ID 110: ' ||
incentive); END; /
```

PROGRAM 2

Write a PL/SQL block to show an invalid case-insensitive reference to a quoted and without quoted user-defined identifier.

```
DECLARE "EmployeeID" NUMBER := 110;
BEGIN
DBMS_OUTPUT.PUT_LINE(EmployeeID);
END;
```

PROGRAM 3

Write a PL/SQL block to adjust the salary of the employee whose ID 122. Sample table: employees

```
BEGIN UPDATE employees SET salary = salary + 5000 WHERE employee_id = 122;
DBMS_OUTPUT.PUT_LINE('Salary adjusted for Employee ID 122'); END; /
```

PROGRAM 4

Write a PL/SQL block to create a procedure using the "IS [NOT] NULL Operator" and showAND operator returns TRUE if and only if both operands are TRUE.

CREATE OR REPLACE PROCEDURE CheckNullAndOperator IS value1 BOOLEAN := TRUE; value2 BOOLEAN := TRUE; BEGIN IF value1 IS NOT NULL AND value2 IS NOT NULL AND
value1 AND value2 THEN DBMS_OUTPUT.PUT_LINE('Both conditions are TRUE'); ELSE DBMS_OUTPUT.PUT_LINE('One or both conditions are FALSE'); END IF; END;

PROGRAM 5

Write a PL/SQL block to describe the usage of LIKE operator including wildcard characters andescape character.

```
DECLARE
 emp_name
employees.first_name%TYPE; BEGIN
 FOR rec IN (SELECT first_name FROM employees WHERE first_name
 LIKE 'J%') LOOP
DBMS_OUTPUT.PUT_LINE('Employee name starting with J: ' ||
rec.first_name);
 END
LOOP;
END;
```

PROGRAM 6

Write a PL/SQL program to arrange the number of two variable in such a way that the smallnumber will store in num_small variable and large number will store in num_large variable.

DECLARE num1 NUMBER := 10; num2 NUMBER := 5; num_small NUMBER; num_large NUMBER; BEGIN IF num1 < num2 THEN num_small := num1; num_large := num2; ELSE num_small := num2; num_large := num1; END IF; DBMS_OUTPUT.PUT_LINE('Small Number: '
|| num_small || ', Large Number: ' || num_large); END;

PROGRAM 7

Write a PL/SQL procedure to calculate the incentive on a target achieved and display the message either the record updated or not.

```
CREATE OR REPLACE PROCEDURE UpdateIncentive IS target NUMBER := 100000; sales NUMBER := 120000; incentive NUMBER; BEGIN IF sales >= target THEN incentive := sales * 0.1; DBMS_OUTPUT.PUT_LINE('Incentive updated to ' || incentive); ELSE DBMS_OUTPUT.PUT_LINE('Target not met. No incentive.'); END IF; END;
```

PROGRAM 8

Write a PL/SQL procedure to calculate incentive achieved according to the specific sale limit.

```
CREATE OR REPLACE PROCEDURE CalculateIncentive(sales_limit IN NUMBER) IS
incentive NUMBER; BEGIN IF sales_limit > 50000 THEN incentive := sales_limit *
0.15; ELSE incentive := sales_limit * 0.1; END IF;
DBMS_OUTPUT.PUT_LINE('Incentive: ' || incentive); END;
```

PROGRAM 9 Write a PL/SQL program to count number of employees in department 50 and check whether this department have any vacancies or not. There are 45 vacancies in this department.

```
DECLARE emp_count NUMBER; vacancies NUMBER := 45; BEGIN SELECT COUNT(*) INTO
emp_count FROM employees WHERE department_id = 50; IF emp_count <
vacancies THEN DBMS_OUTPUT.PUT_LINE('Vacancies available: ' || (vacancies
- emp_count)); ELSE DBMS_OUTPUT.PUT_LINE('No vacancies'); END IF;
END; /
```

PROGRAM 10 Write a PL/SQL program to count number of employees in a specific department and check whether this department have any vacancies or not. If any vacancies, how many vacancies are in that department.

```
DECLARE emp_count NUMBER; dept_id NUMBER := 80; vacancies NUMBER := 45;
BEGIN SELECT COUNT(*) INTO emp_count FROM employees WHERE department_id =
dept_id; IF emp_count < vacancies THEN DBMS_OUTPUT.PUT_LINE('Vacancies in
Department ' || dept_id || ': ' || (vacancies - emp_count)); ELSE
DBMS_OUTPUT.PUT_LINE('No vacancies'); END IF; END;
```

PROGRAM 11

Write a PL/SQL program to display the employee IDs, names, job titles, hire dates, and salaries of all employees.

```
DECLARE CURSOR emp_cursor IS SELECT employee_id, first_name, job_id,
hire_date, salary FROM employees; BEGIN FOR emp IN emp_cursor LOOP
DBMS_OUTPUT.PUT_LINE('ID: ' || emp.employee_id || ', Name: ' ||
emp.first_name || ', Job: ' || emp.job_id || ', Hire Date: ' || emp.hire_date || ', Salary: '
|| emp.salary); END LOOP; END;
```

PROGRAM 12

Write a PL/SQL program to display the employee IDs, names, and department names of all employees.

DECLARE CURSOR emp_dept_cursor IS SELECT e.employee_id, e.first_name, d.department_name FROM employees e JOIN departments d ON e.department_id = d.department_id; BEGIN FOR emp IN emp_dept_cursor LOOP DBMS_OUTPUT.PUT_LINE('ID: ' || emp.employee_id || ', Name: ' || emp.first_name || ', Dept: ' || emp.department_name); END LOOP; END;

PROGRAM 13

Write a PL/SQL program to display the job IDs, titles, and minimum salaries of all jobs.

```
DECLARE CURSOR job_cursor IS SELECT job_id, job_title, min_salary FROM jobs;
BEGIN FOR job IN job_cursor LOOP DBMS_OUTPUT.PUT_LINE('Job ID: ' ||
job.job_id || ', Title: ' || job.job_title || ', Min Salary: ' || job.min_salary); END LOOP;
END;
```

PROGRAM 14

Write a PL/SQL program to display the employee IDs, names, and job history start dates of all employees.

```
DECLARE CURSOR job_hist_cursor IS SELECT employee_id, start_date
FROM job_history; BEGIN FOR job_hist IN job_hist_cursor LOOP
DBMS_OUTPUT.PUT_LINE('Employee ID: ' || job_hist.employee_id || ', Start
Date: ' || job_hist.start_date); END LOOP; END;
```

PROGRAM 15

Write a PL/SQL program to display the employee IDs, names, and job history end dates of all employees.

```
DECLARE CURSOR job_hist_cursor IS SELECT employee_id, end_date
FROM job_history; BEGIN FOR job_hist IN job_hist_cursor LOOP
DBMS_OUTPUT.PUT_LINE('Employee ID: ' || job_hist.employee_id || ',
End Date: ' || job_hist.end_date); END LOOP; END;
```

Evaluation Procedure	**Marks awarded**
PL/SQL Procedure(5)	
Program/Execution (5)	
Viva(5)	

Total (15)	
Faculty Signature	

Ex.No.: 12		WORKING WITH CURSOR, PROCEDURES AND FUNCTIONS
Date:		

AIM:

Create PL/SQL Blocks to perform the Item Transaction Operations using CURSOR, FUNCTION and PROCEDUERE.

ALGORITHM:

STEP-1: Start.

STEP-2: Create two tables Item Master and Item Trans. itemmaster(itemid , itemname, stockonhand) itemtrans(itemid ,itemname ,dateofpurchase ,quantity)

STEP-3: Create a PROCEDURE with id, name and quantity as parameters which make a call to the FUNCTION by passing id, name, dop, and quantity as parameters dop is set as sysdate.

STEP-4: Using FUNCTION fetch each record from the table Item Master using CURSOR inside a Loop statement,

If Item Master‘s ItemId is equal to the entered ID value then exit the loop otherwise fetch the next record.

```
loop
        fetch master into
        masterrec exit when
        master%notfound if
        masterrec.itemid=id
        then
    exit;
end
if; end
```

loop;

STEP-5: If Itemmaster's itemid = id then,

Add the Itemmaster's stockonhand with the given quantity and update the ItemMaster table and insert the Item information into the ItemTrans table.

STEP-6: Else, if the inputed item is not present in the ItemMaster table then insert the

new Item in both the tables.

STEP-7: Call the Procedure by passing the Item informations which calls the Function.

STEP-8: Exit.

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    160    202
                        0
   103        4000    600    202
```

PROCEDURE FOR 'IN' PARAMETER – CREATION, EXECUTION

```
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.

Program 1

FACTORIAL OF A NUMBER USING FUNCTION

```
CREATE OR REPLACE FUNCTION factorial(n NUMBER) RETURN
NUMBER IS
 result NUMBER := 1;
BEGIN
 IF n < 0 THEN
 RETURN NULL;
 ELSIF n = 0
 THEN RETURN
 1;
 ELSE
 FOR i IN 1..n LOOP
 result := result *
 i; END LOOP;
 END IF;
 RETURN
result; END
factorial; /
DECLARE
 num NUMBER := 5;
 fact NUMBER;
BEGIN
 fact := factorial(num);
 DBMS_OUTPUT.PUT_LINE('Factorial of ' || num || ' is: ' ||
fact); END; /
```

Program 2

Write a PL/SQL program using Procedures IN,INOUT,OUT parameters to retrieve the corresponding book information in library

```
CREATE OR REPLACE PROCEDURE
 get_book_info ( p_book_id IN NUMBER,
 p_title IN OUT VARCHAR2,
 p_author OUT VARCHAR2,
 p_genre OUT VARCHAR2,
 p_publication_year OUT
 NUMBER
) IS
BEGI
N
 SELECT title, author, genre, publication_year
 INTO p_title, p_author, p_genre,
 p_publication_year FROM books
 WHERE book_id =
p_book_id; EXCEPTION
 WHEN NO_DATA_FOUND THEN
 DBMS_OUTPUT.PUT_LINE('No book found with ID: ' ||
p_book_id); END get_book_info; /
DECLARE
 book_id NUMBER := 3;
 title VARCHAR2(100) := 'Default
 Title'; author VARCHAR2(100);
 genre VARCHAR2(50);
 publication_year
NUMBER; BEGIN
 get_book_info(book_id, title, author, genre, publication_year);
DBMS_OUTPUT.PUT_LINE('Title: ' || title);
DBMS_OUTPUT.PUT_LINE('Author: ' || author);
DBMS_OUTPUT.PUT_LINE('Genre: ' || genre);
DBMS_OUTPUT.PUT_LINE('Publication Year: ' ||
publication_year); END; /
```

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;
10 dbms_output.put_line(' Employee code and employee salary are' || ecode _and‘|| esal);
```

```
11 end loop;
12       clos
e 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

Evaluation Procedure	Marks awarded
PL/SQL Procedure(5)	
Program/Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 13		WORKING WITH TRIGGER TRIGGER
Date:		

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
  ----------------
  ----------------
  ----------------
excepti
on 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.

TABLE CREATION:

create table employeebonus(empno number(5)constraint emppk

primary key, empname varchar2(25)not null, experience

number(2)not null, bonus number(7,2)); Table created.

TRIGGER CREATION FOR BONUS CALCULATION:

SQL> set serveroutput on

SQL> create or replace trigger

employeebonus_tgr after insert on

employeebonus

```
declare
cursor emp is select * from
employeebonus; emprec
employeebonus%rowtype;
begin
```

```
open
emp;
loop
fetch emp into emprec;
exit when
emp%notfound;
if(emprec.experience<
5) then
emprec.bonus:=5000;
elsif(emprec.experience>=5 and emprec.experience<8) then
emprec.bonus:=8000;
else
emprec.bonus:=10
000; end if;
update employeebonus set bonus=emprec.bonus where
empno=emprec.empno; end loop;
close emp;
dbms_output.put_line('Bonus calculated and Updated
Sucessfully'); end;
/
```

Trigger created.

TABLE DESCRIPTION:

SQL> desc employeebonus;

Name Null? Type

EMPNO NOT NULL NUMBER(5)

EMPNAME NOT NULL

VARCHAR2(25) EXPERIENCE

NOT NULL NUMBER(2)

BONUS NUMBER(7,2)

RECORD INSERTION:

SQL> insert into employeebonus(empno,empname,experience)

values(&empno,'&empname',&experience);

Enter value for empno: 101

Enter value for empname: murugan

Enter value for experience: 25

old 1: insert into employeebonus(empno,empname,experience)

values(&empno,'&empname',&experience)

new 1: insert into

employeebonus(empno,empname,experience)

values(101,'murugan',25)

Bonus calculated and Updated

Sucessfully 1 row created.

RECORD SELECTION:

SQL> select * from employeebonus;

EMPNO EMPNAME EXPERIENCE BONUS

---

101 murugan 25 10000

102 suresh 3 5000

103 akash 7 8000

104 mahesh 2 5000

Program 1

Write a code in PL/SQL to develop a trigger that enforces referential integrity by preventing the deletion of a parent record if child records exist.

CREATE OR REPLACE TRIGGER prevent_parent_delete BEFORE DELETE ON items FOR EACH ROW DECLARE child_count NUMBER; BEGIN SELECT COUNT(*) INTO
child_count FROM orders WHERE item_id = :OLD.item_id; IF child_count > 0 THEN RAISE_APPLICATION_ERROR(-20001, 'Cannot delete item; dependent orders exist.'); END IF; END;

Program 2

Write a code in PL/SQL to create a trigger that checks for duplicate values in a specific column and raises an exception if found.

CREATE OR REPLACE TRIGGER check_for_duplicates BEFORE INSERT OR UPDATE ON orders FOR EACH ROW DECLARE duplicate_count NUMBER; BEGIN SELECT COUNT(*) INTO duplicate_count FROM orders WHERE item_id = :NEW.item_id AND order_id != :NEW.order_id; IF duplicate_count > 0 THEN RAISE_APPLICATION_ERROR(-20002, 'Duplicate item entry found in orders.'); END IF; END;

Program 3

Write a code in PL/SQL to create a trigger that restricts the insertion of new rows if the total of a column's values exceeds a certain threshold.

```
CREATE OR REPLACE TRIGGER restrict_insertion BEFORE INSERT ON
orders FOR EACH ROW DECLARE total_quantity NUMBER; BEGIN
SELECT SUM(quantity) INTO total_quantity FROM orders; IF (total_quantity +
:NEW.quantity) > 500 THEN RAISE_APPLICATION_ERROR(-20003, 'Cannot
insert order; total quantity exceeds threshold.'); END IF; END;
```

Program 4

Write a code in PL/SQL to design a trigger that captures changes made to specific columns and logs them in an audit table.

```
CREATE OR REPLACE TRIGGER log_changes AFTER UPDATE ON orders FOR EACH
ROW BEGIN INSERT INTO audit_log (log_id, table_name, operation,
user_id, details) VALUES (audit_log_seq.NEXTVAL, 'orders', 'UPDATE',
:NEW.user_id, 'Order ' ||
:NEW.order_id || ' changed from ' || :OLD.quantity || ' to ' || :NEW.quantity ); END;
```

Program 5

Write a code in PL/SQL to implement a trigger that records user activity (inserts, updates, deletes) in an audit log for a given set of tables.

```
CREATE OR REPLACE TRIGGER log_user_activity AFTER INSERT OR DELETE OR
UPDATE ON orders FOR EACH ROW BEGIN INSERT INTO audit_log
(log_id, table_name, operation, user_id, details) VALUES
(audit_log_seq.NEXTVAL, 'orders', CASE WHEN INSERTING THEN
'INSERT' WHEN UPDATING THEN 'UPDATE' WHEN DELETING THEN
'DELETE' END, NVL(:NEW.user_id, :OLD.user_id), 'User
action recorded on order ' || NVL(:NEW.order_id, :OLD.order_id)); END;
```

Program 7

Write a code in PL/SQL to implement a trigger that automatically calculates and updates a running total column for a table whenever new rows are inserted.

```
CREATE OR REPLACE TRIGGER
```

update_running_total AFTER INSERT ON orders

FOR EACH

ROW BEGIN

UPDATE orders SET running_total = (SELECT SUM(quantity)

FROM orders) WHERE order_id = :NEW.order_id;

END;

Program 8

Write a code in PL/SQL to create a trigger that validates the availability of items before allowing an order to be placed, considering stock levels and pending orders.

CREATE OR REPLACE TRIGGER validate_item_availability BEFORE INSERT ON orders FOR EACH ROW DECLARE available_stock NUMBER; BEGIN SELECT stock_level - pending_orders INTO available_stock FROM items WHERE item_id = :NEW.item_id; IF :NEW.quantity > available_stock THEN RAISE_APPLICATION_ERROR(-20004, 'Insufficient stock available for the order.'); END IF; UPDATE items SET pending_orders = pending_orders + :NEW.quantity WHERE item_id = :NEW.item_id; END;

Evaluation Procedure	**Marks awarded**
PL/SQL Procedure(5)	
Program/Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 14		MONGO DB
Date:		

MongoDB is a free and open-source cross-platform document-oriented database. Classified as a NoSQL database, MongoDB avoids the traditional table-based relational database structure in favor of JSON-like documents with dynamic schemas, making the integration of data in certain types of applications easier and faster.

Create Database using mongosh

After connecting to your database using mongosh, you can see which database you are using by typing db in your terminal.

If you have used the connection string provided from the MongoDB Atlas dashboard, you should be connected to the myFirstDatabase database.

Show all databases

To see all available databases, in your terminal type show dbs.

Notice that myFirstDatabase is not listed. This is because the database is empty.

An empty database is essentially non-existant.

Change or Create a Database

You can change or create a new database by typing use then the name of the database. Create Collection using mongosh

You can create a collection using the createCollection() database method.

Insert Documents

insertOne()

```
db.posts.insertO
ne({
  title: "Post Title 1",
  body: "Body of
  post.", category:
  "News", likes: 1,
```

tags: ["news", "events"],

date: Date()

})

EXERCISE 18

Structure of 'restaurants' collection:


```
{
 "address": {
  "building":"100
  7",
  "coord": [ -73.856077, 40.848447 ],
  "street": "Morris Park Ave",
  "zipcode": "10462"
 },
 "borough": "Bronx",
 "cuisine": "Bakery",
 "grades": [
  { "date": { "$date": 1393804800000 }, "grade": "A", "score": 2 },
  { "date": { "$date": 1378857600000 }, "grade": "A", "score": 6 },
  { "date": { "$date": 1358985600000 }, "grade": "A", "score": 10 },
  { "date": { "$date": 1322006400000 }, "grade": "A", "score": 9 },
  { "date": { "$date": 1299715200000 }, "grade": "B", "score": 14 }
 ],
 "name": "Morris Park Bake
 Shop", "restaurant_id":
 "30075445"
}
```


1. Write a MongoDBquery to find the restaurant Id, name, borough andcuisine for those restaurants which prepareddish except 'American' and 'Chinees' or restaurant's name begins with letter 'Wil'. db.restaurants.find({ $or: [{ cuisine: { $nin: ["American", "Chinese"] } }, { name: /^Wil/ }] },
{ restaurant_id: 1, name: 1, borough: 1, cuisine: 1 })

2. Write a MongoDBquery tofindthe restaurant Id, name, andgrades for those restaurants which achieved a grade of "A" and scored 11 on an ISODate "2014-08-11T00:00:00Z" among many of survey dates..

db.restaurants.find({ grades: { $elemMatch: { grade: "A", score: 11, date: ISODate("2014-08- 11T00:00:00Z") } } }, { restaurant_id: 1, name: 1, grades: 1 })

3. Write a MongoDBquery to find the restaurant Id, name andgrades for thoserestaurants where the 2nd element of grades array contains a grade of "A" and score 9 on an ISODate "2014-08- 11T00:00:00Z".

db.restaurants.find({ "grades.1.grade": "A", "grades.1.score": 9, "grades.1.date": ISODate("2014-08-11T00:00:00Z") }, { restaurant_id: 1, name: 1, grades: 1 })

4. Write a MongoDB query to find the restaurant Id, name, address and geographical location for those restaurants where 2nd element of coord array contains a value which is more than 42 and upto 52.. db.restaurants.find({ "address.coord.1": { $gt: 42, $lte: 52 } }, { restaurant_id: 1, name: 1, address: 1, "address.coord": 1 })

5. Write a MongoDB querytoarrange the name of the restaurants in ascendingorderalong with all the columns.

db.restaurants.find().sort({ name: 1 })

6. Write a MongoDB query to arrange the nameof the restaurants in descending along with all the columns.

db.restaurants.find().sort({ name: -1 })

7. Write a MongoDB query to arranged the nameof thecuisine in ascendingorder and for that same cuisine borough should be in descending order.

```
db.restaurants.find().sort({ cuisine: 1, borough: -1 })
```

8. Write a MongoDBquery to knowwhether all the addressescontains the street or not.

```
db.restaurants.find({
"address.street": { $exists: true } })
```

9. Write a MongoDB query which will select alldocuments in the restaurants collection where the coord field value is Double.

db.restaurants.find({ "address.coord": { $type: "double" } })

10. Write a MongoDB query which will select the restaurant Id, name andgradesfor those restaurants which returns 0 as a remainder after dividing the score by 7. db.restaurants.find({ "grades.score": { $mod: [7, 0] } }, { restaurant_id: 1, name: 1,
grades: 1 })

11. Write a MongoDB query to find the restaurant name, borough, longitude and attitude and cuisine for those restaurants which contains 'mon' as three letters somewhere in its name. db.restaurants.find({ name: /mon/i }, { name: 1, borough: 1, "address.coord": 1, cuisine: 1 }
)

12. Write a MongoDB query to find the restaurant name, borough, longitude and latitude and cuisine for those restaurants which contain 'Mad' as first three letters of its name. db.restaurants.find({ name: /^Mad/ }, { name: 1, borough: 1, "address.coord": 1, cuisine: 1 }
)

13. Write a MongoDB query to find the restaurants that haveat least one grade with a score of less than 5.

```
db.restaurants.find({ "grades.score": { $lt: 5 } })
```

14. Write a MongoDB query to find the restaurants that have at least one grade with a score of less

than 5 and that are located in the borough of Manhattan.

db.restaurants.find({ "grades.score": { $lt: 5 }, borough: "Manhattan" })

15. Write a MongoDB query to find the restaurants that haveat least one grade with a score of less than 5 and that are located in the borough of Manhattan or Brooklyn.

db.restaurants.find({ "grades.score": { $lt: 5 }, borough: { $in: ["Manhattan", "Brooklyn"] } })

16. Write a MongoDB query to find the restaurants that have at least one grade with a score of less than 5 and that are located in the borough of Manhattan or Brooklyn, and theircuisine is not American.

db.restaurants.find(
{ "grades.score": { $lt: 5 }, borough: { $in: ["Manhattan", "Brooklyn"] }, cuisine: { $ne: "American" } }
)

17. Write a MongoDB query to find the restaurants that have at least one grade with a score of less than 5 and that are located in the borough of Manhattan or Brooklyn, and their cuisine is not American or Chinese.

db.restaurants.find({ "grades.score": { $lt: 5 }, borough: { $in: ["Manhattan", "Brooklyn"] }, cuisine: { $nin: ["American", "Chinese"] } })

18. Write a MongoDB query to find the restaurants that havea grade witha score of 2 and a grade with a score of 6.

db.restaurants.find({ grades: { $all: [{ $elemMatch: { score: 2 } }, { $elemMatch: { score: 6 } }] } }

19. Write a MongoDB query to find the restaurants that havea grade witha score of 2 and a grade with a score of 6 and are located in the borough of Manhattan.

db.restaurants.find({ grades: { $all: [{ $elemMatch: { score: 2 } }, { $elemMatch: { score: 6 } }] }, borough: "Manhattan" })

20. Write a MongoDB query to find the restaurants that havea grade witha score of 2 and a grade with a score of 6 and are located in the borough of Manhattan or Brooklyn.

```
db.restaurants.find({ grades: { $all: [ { $elemMatch: { score: 2 } }, { $elemMatch: { score: 6 } } ] }, borough: { $in: ["Manhattan", "Brooklyn"] } })
```

21. Write a MongoDBquery to find the restaurants that havea grade with a score of 2 and a grade with a score of 6 and are located in theborough of Manhattan or Brooklyn, andtheir cuisine is not American.

```
db.restaurants.find({ grades: { $all: [ { $elemMatch: { score: 2 } }, { $elemMatch: { score: 6 } } ] }, borough: {
$in: ["Manhattan", "Brooklyn"] }, cuisine: { $ne: "American" } })
```

22. Write a MongoDBquery to find the restaurants that havea grade with a score of 2 and a grade with a score of 6 and are located in the borough of Manhattan or Brooklyn, and their cuisine is not American or Chinese.

```
db.restaurants.find({ grades: { $all: [ { $elemMatch: { score: 2 } }, { $elemMatch: { score: 6 } } ] }, borough: { $in: ["Manhattan", "Brooklyn"] }, cuisine: { $nin: ["American", "Chinese"] } })
```

23. Write a MongoDB query to find the restaurants that have a grade with a score of 2 or a grade with a score of 6.

```
db.restaurants.find({ grades: { $elemMatch: { score: { $in: [2, 6] } } } })
```

Sample document of 'movies' collection

```
{
  _id:  ObjectId("573a1390f29313caabcd42e8"),
plot: 'A group of bandits stage a brazen train hold-up, only to find a determined posse hot on their heels.',
genres: [ 'Short', 'Western' ],
runtime: 11,
cast: [
    'A.C. Abadie',
    "Gilbert M. 'Broncho Billy'
    Anderson", 'George Barnes',
    'Justus D. Barnes'
```

],
poster: 'https://m.media-amazon.com/images/M/MV5BMTU3NjE5NzYtYTYyNS00MDVmLWIwYjgtMmYwYWIxZD YyNzU2XkEyXkFqcGdeQXVyNzQzNzQxNzI@._V1_SY1000_SX677_AL_.jpg',
title: 'The Great Train Robbery',
fullplot: "Among the earliest existing films in American cinema - notable as the first film that presented a narrative story to tell - it depicts a group of cowboy outlaws who hold up a train and rob the passengers. They are then pursued by a Sheriff's posse. Several scenes have color included - all hand tinted.",

languages: ['English'],
released: ISODate("1903-12-01T00:00:00.000Z"),
directors: ['Edwin S. Porter'],
rated: 'TV-G',
awards: { wins: 1, nominations: 0, text: '1
win.' }, lastupdated: '2015-08-13
00:27:59.177000000',
year: 1903,
imdb: { rating: 7.4, votes: 9847, id:
439 }, countries: ['USA'],
type: 'movie',
tomatoes: {
viewer: { rating: 3.7, numReviews: 2559, meter: 75 },
fresh: 6,
critic: { rating: 7.6, numReviews: 6, meter: 100 },
rotten: 0,
lastUpdated: ISODate("2015-08-08T19:16:10.000Z")
}

1. Find all movies withfull information from the 'movies' collection that released in theyear 1893.

db.movies.find({ year: 1893 })

2. Find all movies with full information from the 'movies' collection that have a runtime greater than 120 minutes.

db.movies.find({ runtime: { $gt: 120 } })

3. Find all movies with full information from the 'movies' collection that have "Short" genre. db.movies.find({ genres: "Short" })

4. Retrieve all movies from the 'movies' collection that were directed by "William K.L. Dickson" and include complete information for each movie.

db.movies.find({ directors: "William K.L. Dickson" })

5. Retrieve all movies from the 'movies' collection that were released in the USA and include complete information for each movie.

db.movies.find({ countries: "USA" })

6. Retrieve allmoviesfrom the 'movies' collection that have complete information and arerated as "UNRATED".

```
db.movies.find({ rated: "UNRATED" })
```

7. Retrieve all movies from the 'movies' collection that havecomplete information and have received more than 1000 votes on IMDb.

```
db.movies.find({ "imdb.votes": { $gt: 1000 } })
```

8. Retrieve allmoviesfrom the 'movies' collection that have completeinformation and havean IMDb rating higher than 7.

```
db.movies.find({ "imdb.rating": { $gt: 7 } })
```

9. Retrieve allmoviesfrom the 'movies' collection that have complete information and have a viewer rating higher than 4 on Tomatoes.

```
db.movies.find({ "tomatoes.viewer.rating": { $gt: 4 } })
```

10. Retrieve all moviesfrom the 'movies' collection that have receivedan award.

```
db.movies.find({ "awards.wins": { $gt: 0 } })
```

11. Find all movies with title, languages, released, directors, writers, awards, year, genres, runtime, cast, countries from the 'movies' collection in MongoDB that have at least one nomination.

```
db.movies.find({ "awards.nominations": { $gte: 1 } }, { title: 1, languages: 1, released: 1, directors: 1, writers: 1, awards: 1, year: 1, genres: 1, runtime: 1, cast: 1, countries: 1 })
```

12. Find all movies with title, languages, released, directors, writers, awards, year, genres, runtime, cast, countries from the 'movies' collection in MongoDB with cast including "Charles Kayser".

```
db.movies.find({ cast: "Charles Kayser" }, { title: 1, languages: 1, released: 1, directors: 1, writers: 1,
awards: 1, year: 1, genres: 1, runtime: 1, cast: 1, countries: 1 })
```

13. Retrieve all movies with title, languages, released, directors, writers, countries from the 'movies' collection in MongoDB that released on May 9, 1893.

```
db.movies.find({ released: new Date("1893-05-09") }, { title: 1, languages: 1, released: 1, directors: 1, writers: 1, countries: 1 })
```

14. Retrieve all movies with title, languages, released, directors,

writers, countries from the 'movies' collection in MongoDB that have a
word "scene" in the title.

db.movies.find({ title: /scene/i }, { title: 1, languages: 1, released: 1, directors: 1, writers: 1, countries: 1 })

Evaluation Procedure	**Marks awarded**

PL/SQL Procedure(5)	
Program/Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

Ex.No.: 15		OTHER DATABASE OBJECTS
Date:		

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 thenext 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';
```

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.

CREATE SEQUENCE DEPT_ID_SEQ INCREMENT BY 10 START
WITH 200 MAXVALUE 1000 NOCYCLE;

2. Write a query in a script to display the followinginformation aboutyour sequences: sequence name, maximum value, increment size, and last number

SELECT sequence_name, max_value, increment_by, last_number FROM user_sequences;

3. Write a script toinsert two rowsintothe DEPT table. Name your script lab12_3.sql. Be sure to use the sequencethat you created for the ID column. Add two departments named Education and Administration. Confirm your additions. Run the commands in your script.

INSERT INTO DEPT (ID, DEPARTMENT_NAME) VALUES (DEPT_ID_SEQ.NEXTVAL, 'Education'); INSERT INTO DEPT (ID, DEPARTMENT_NAME) VALUES (DEPT_ID_SEQ.NEXTVAL, 'Administration'); SELECT * FROM DEPT;

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

CREATE INDEX emp_dept_id_idx ON EMP(DEPT_ID);

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

SELECT ic.index_name, ic.column_name, ic.column_position AS col_pos, ix.uniqueness FROM user_indexes ix JOIN user_ind_columns ic ON ic.index_name = ix.index_name WHERE ic.table_name = 'EMP';

Evaluation Procedure	**Marks awarded**
PL/SQL Procedure(5)	
Program/Execution (5)	
Viva(5)	
Total (15)	

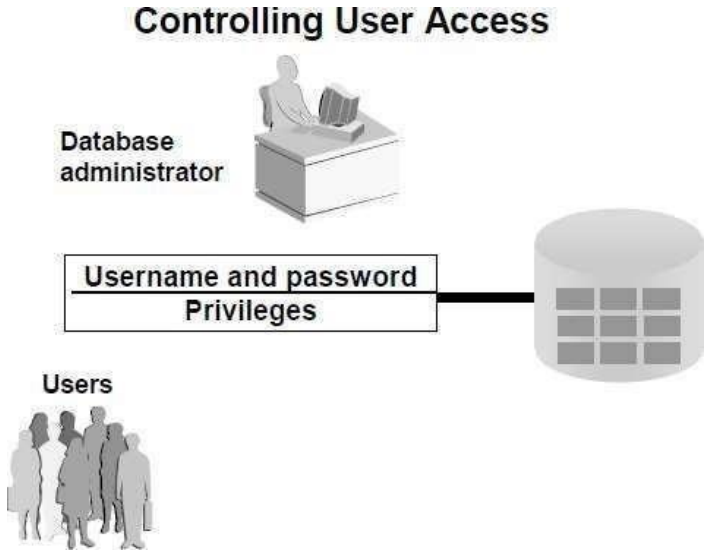
Faculty Signature	

Ex.No.: 16		CONTROLLING USER ACCESS
Date:		

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.

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 changeyour 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 givespecific privilegeson 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 toothers 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?

The user should be given the CREATE SESSION privilege. This is a system privilege.

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

The user should be given the CREATE TABLE privilege.

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

Only the owner of the table (the user who created the table) can pass along privileges to other users on that 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?

You should create a role with the necessary privileges and then grant this role to each user.

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

ALTER USER username IDENTIFIED BY new_password;

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

GRANT SELECT ON departments TO other_user; GRANT SELECT ON departments TO original_user;

7. Query all the rows in your DEPARTMENTS table.

SELECT * FROM departments;

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.

INSERT INTO departments (department_id, department_name) VALUES (500, 'Education'); INSERT INTO departments (department_id, department_name) VALUES (510, 'Human Resources');

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

SELECT * FROM other_team_user.departments;

10. Revoke the SELECT privilege on your table from the other team. REVOKE SELECT ON departments FROM other_team_user;

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

DELETE FROM departments WHERE department_id = 500; COMMIT;
DELETE FROM departments WHERE department_id = 510; COMMIT;

Evaluation Procedure	**Marks awarded**
PL/SQL Procedure(5)	
Program/Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	