

RAJALAKSHMI ENGINEERING COLLEGE
RAJALAKSHMI NAGAR, THANDALAM – 602 105



**CS23333 DATABASE MANAGEMENT
SYSTEMS LAB**

Laboratory Record Note

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Definition of a Relational Database

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

Terminologies Used in a Relational Database

1. A single **ROW** or table representing all data required for a particular employee. Each row should be identified by a primary key which allows no duplicate rows.
2. A **COLUMN** or attribute containing the employee number which identifies a unique employee. Here Employee number is designated as a primary key ,must contain a value and must be unique.
3. A column may contain foreign key. Here Dept_ID is a foreign key in employee table and it is a primary key in Department table.
4. A Field can be found at the intersection of a row and column. There can be only one value in it. Also it may have no value. This is called a null value.

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

Relational Database Properties

A relational database :

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

Relational Database Management Systems

RDBMS refers to a relational database plus supporting software for managing users and processing SQL queries, performing backups/restores and associated tasks.

(Relational Database Management System) Software for storing data using SQL (structured query language). A relational database uses SQL to store data in a series of tables that not only record existing relationships between data items, but which also permit the data to be joined in new relationships. SQL (pronounced 'sequel') is based on a system of algebra developed by E F Codd, an IBM scientist who first defined the relational model in 1970. Relational databases are optimized

for storing transactional data, and the majority of modern business software applications therefore use an RDBMS as their data store. The leading RDBMS vendors are Oracle, IBM and Microsoft.

The first commercial RDBMS was the Multics Relational Data Store, first sold in 1978. INGRES, Oracle, Sybase, Inc., Microsoft Access, and Microsoft SQL Server are well-known database products and companies. Others include PostgreSQL, SQL/DS, and RDB. A relational database management system (RDBMS) is a program that lets you create, update, and administer a relational database. Most commercial RDBMS's use the Structured Query Language (SQL) to access the database, although SQL was invented after the development of the relational model and is not necessary for its use.

The leading RDBMS products are Oracle, IBM's DB2 and Microsoft's SQL Server. Despite repeated challenges by competing technologies, as well as the claim by some experts that no current RDBMS has fully implemented relational principles, the majority of new corporate databases are still being created and managed with an RDBMS.

SQL Statements

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

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

EXERCISE-1 **Creating and Managing Tables**

OBJECTIVE

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

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

NAMING RULES

Table names and column names:

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

The CREATE TABLE Statement

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

Syntax: 1 Create table table_name (column_name1 data_type (size)
column_name2 data_type (size)....);

Syntax: 2 Create table table_name (column_name1 data_type (size) constraints,
column_name2 data_type constraints ...);

Example:

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

Tables Used in this course

Creating a table by using a Sub query

SYNTAX

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

Create table table_name as select column_name1,column_name2,.....column_namen from
table_name where predicate;

AS Subquery

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

Example

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

The ALTER TABLE Statement

The ALTER statement is used to

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

SYNTAX

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

ALTER TABLE table_name DROP COLUMN (Column_nname);

ALTER TABLE ADD CONSTRAINT Constraint_name PRIMARY KEY (Colum_Name);

Example:

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

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

DROPPING A TABLE

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

Syntax:

Drop table *tablename*;

Example:

Drop table dept80;

RENAMING A TABLE

To rename a table or view.

Syntax

RENAME *old_name* to *new_name*

Example:

Rename dept to detail_dept;

TRUNCATING A TABLE

Removes all rows from the table.

Releases the storage space used by that table.

Syntax

TRUNCATE TABLE *table_name*;

Example:

TRUNCATE TABLE copy_emp;

Find the Solution for the following:

Create the following tables with the given structure.

EMPLOYEES TABLE

NAME	NULL?	TYPE
Employee_id	Not null	Number(6)
First_Name		Varchar(20)
Last_Name	Not null	Varchar(25)
Email	Not null	Varchar(25)
Phone_Number		Varchar(20)

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

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)

- 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 VARCHAR(25));
SHOW DEPT;

Table created.

0.02 seconds

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)
);
```

```
Table created.
```

```
0.02 seconds
```

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))
```

```
Table altered.
```

```
0.05 seconds
```

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 EMP2(
    Id number (6)not null ,
    First_name varchar(20), Last_name varchar(25) not null,
    salary number(8,2) , Dept_id number(4)
);
```

```
Table created.
```

```
0.02 seconds
```

5. Drop the EMP table.

```
drop table emp1;
```

Table dropped.

0.07 seconds

6. Rename the EMPLOYEES2 table as EMP.

```
ALTER TABLE emp2  
RENAME TO EMP;
```

Table altered.

0.04 seconds

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

DEPT table is created . Emp table is also created then the size of a column is resized .
The table is dropped then.

8. Drop the First_name column from the EMP table and confirm it.

```
alter table emp  
drop column first_name;
```

Table altered.

0.05 seconds

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

EXERCISE-2

MANIPULATING DATA

OBJECTIVE

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

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

A DML statement is executed when you:

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

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

To Add a New Row

INSERT Statement

Syntax

INSERT INTO table_name VALUES (column1 values, column2 values, ..., column values);

Example:

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

Inserting rows with null values

Implicit Method: (Omit the column)

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

Explicit Method: (Specify NULL keyword)

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

Inserting Special Values

Example:

Using SYSDATE

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

Inserting Specific Date Values

Example:

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

To Insert Multiple Rows

& is the placeholder for the variable value

Example:

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

Copying Rows from another table

➤ Using Subquery

Example:

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

CHANGING DATA IN A TABLE

UPDATE Statement

Syntax1: (to update specific rows)

```
UPDATE table_name SET column=value WHERE condition;
```

Syntax 2: (To updae all rows)

```
UPDATE table_name SET column=value;
```

Updating columns with a subquery

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

REMOVING A ROW FROM A TABLE

DELETE STATEMENT

Syntax

```
DELETE FROM table_name WHERE conditions;
```

Example:

```
DELETE FROM department WHERE dept_name='finance';
```

Find the Solution for the following:

1. Create MY_EMPLOYEE table with the following structure

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

```
create table MY_EMP(
    Id number(4) not null, last_name varchar(25),
    first_name varchar(25), userid varchar(25),
    salary number(9,2));
```

Table created.

0.02 seconds

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

3. Display the table with values.

```
select * from my_emp;
```

ID	LAST_NAME	FIRST_NAME	USERID	SALARY	JOB_CODE	HIREDATE	DEPARTMENT	JOB_TITLE	MANAGER_ID
1	Patel	Ralph	rpatel	7000	234csd	5/24/1994	20	data scientist	vishnu
4	prabhuvu	dev	dprabhuvu	9000	461vsd	8/24/2006	50	data analyst	-
3	Drexler	Ben	bbiriyani	20000	256rsd	4/3/1998	30	stock clerk	Bala

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_emp values(3,'Biriyani','Ben','bbiriyani',1100);
insert into my_emp values(4,'Newmant','Chad','Cnewmant',750);
```

```
1 row affected
```

5. Make the data additions permanent.

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

```
update my_emp set last_name = 'Drexler' where id=3;
```

```
1 row(s) updated.
```

```
0.01 seconds
```

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

```
update my_emp set salary=1000 where salary<1000;
```

```
1 row(s) updated.
```

```
0.01 seconds
```

8. Delete Betty dancs from MY_EMPLOYEE table.

```
update my_emp set last_name = null  
where id = 2;  
update my_emp set first_name = null  
where id = 2;
```

```
1 row(s) updated.
```

```
0.01 seconds
```

9. Empty the fourth row of the emp table.

```
delete from my_emp where id=4;
```

```
Table altered.
```

```
0.05 seconds
```

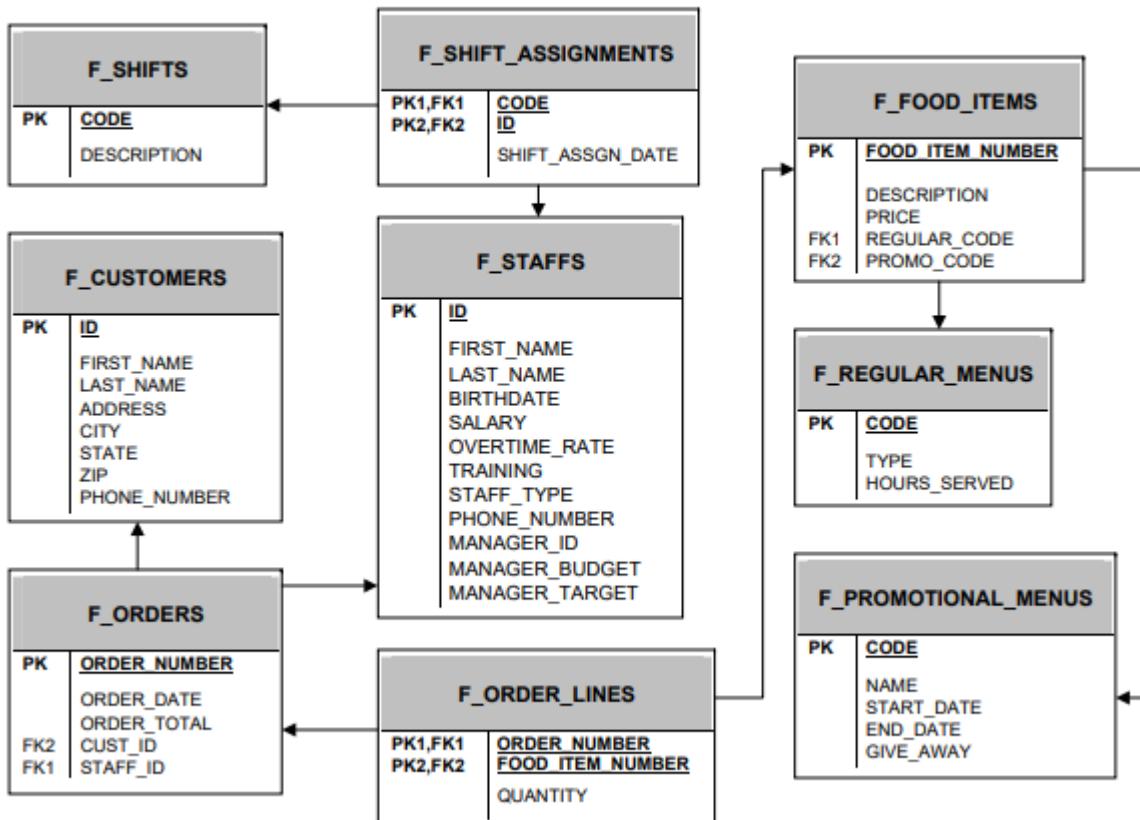
Evaluation Procedure	Marks awarded
Query(5)	
Execution (5)	
Viva(5)	
Total (15)	
Faculty Signature	

PRACTICE QUESTIONS

Date:

Working with Columns, Characters, and Rows

Global Fast Foods Database Tables



1. The manager of Global Fast Foods would like to send out coupons for the upcoming sale. He wants to send one coupon to each household. Create the SELECT statement that returns the customer last name and a mailing address.

2. Each statement below has errors. Correct the errors and execute the query in Oracle Application Express.

a.

```
SELECT first name FROM
f_staffs;
```

b.

```
SELECT first_name |" " | last_name AS "DJs on Demand Clients" FROM
d_clients;
```

c.

```
SELECT DISTINCT f_order_lines
FROM quantity;
```

d.

```
SELECT order number
FROM f_orders;
```

3. Sue, Bob, and Monique were the employees of the month. Using the f_staffs table, create a SELECT statement to display the results as shown in the Super Star chart.

Super Star
*** Sue *** Sue ***
*** Bob *** Bob ***
*** Monique *** Monique ***

4. Which of the following is TRUE about the following query?

```
SELECT first_name, DISTINCT birthdate  
FROM f_staffs;
```

- a. Only two rows will be returned.
- b. Four rows will be returned.
- c. Only Fred 05-Jan-1988 and Lizzie 10-Nov-1987 will be returned.
- d. No rows will be returned.

5. Global Fast Foods has decided to give all staff members a 5% raise. Prepare a report that presents the output as shown in the chart.

EMPLOYEE LAST NAME	CURRENT SALARY	SALARY WITH 5% RAISE

6. Create a query that will return the structure of the Oracle database EMPLOYEES table. Which columns are marked “nullable”? What does this mean?

7. The owners of DJs on Demand would like a report of all items in their D_CDs table with the following column headings: Inventory Item, CD Title, Music Producer, and Year Purchased. Prepare this report.

8. True/False – The following SELECT statement executes successfully: SELECT last_name, job_id, salary AS Sal FROM employees;

9. True/False – The following SELECT statement executes successfully: SELECT * FROM job_grades;

10. There are four coding errors in this statement. Can you identify them?

SELECT employee_id, last_name sal x 12 ANNUAL SALARY FROM employees;

11. In the arithmetic expression salary*12 - 400, which operation will be evaluated first?

12. Which of the following can be used in the SELECT statement to return all columns of data in the Global Fast Foods f_staffs table?

- a. column names
- b. *
- c. DISTINCT id
- d. both a and b

13. Using SQL to choose the columns in a table uses which capability?

- a. selection
- b. projection
- c. partitioning
- d. join

14. SELECT last_name AS "Employee". The column heading in the query result will appear as:

- a. EMPLOYEE
- b. employee
- c. Employee
- d. "Employee:

15. Which expression below will produce the largest value?

- a. SELECT salary*6 + 100
- b. SELECT salary* (6 + 100)
- c. SELECT 6(salary+ 100)
- d. SELECT salary+6*100

16. Which statement below will return a list of employees in the following format?
Mr./Ms. Steven King is an employee of our company.
- a. SELECT "Mr./Ms."||first_name||' '|last_name 'is an employee of our company.' AS "Employees"
FROM employees;
 - b. SELECT 'Mr./Ms. 'first_name, last_name ||' '| 'is an employee of our company.' FROM
employees;
 - c. SELECT 'Mr./Ms. '||first_name||' '|last_name ||' '| 'is an employee of our company.' AS
"Employees" FROM employees ;
 - d. SELECT Mr./Ms. ||first_name||' '|last_name ||' '| "is an employee of our company." AS
"Employees" FROM employees

17. Which is true about SQL statements?
- a. SQL statements are case-sensitive
 - b. SQL clauses should not be written on separate lines.
 - c. Keywords cannot be abbreviated or split across lines.
 - d. SQL keywords are typically entered in lowercase; all other words in uppercase.
18. Which queries will return three columns each with UPPERCASE column headings?
- a. SELECT "Department_id", "Last_name", "First_name"
FROM employees;
 - b. SELECT DEPARTMENT_ID, LAST_NAME, FIRST_NAME
FROM employees;
 - c. SELECT department_id, last_name, first_name AS UPPER CASE
FROM employees
 - d. SELECT department_id, last_name, first_name
FROM employees;
19. Which statement below will likely fail?
- a. SELCT * FROM employees;
 - b. Select * FROM employees;
 - c. SELECT * FROM EMPLOYEES;
 - d. SelecT* FROM employees;
20. Click on the History link at the bottom of the SQL Commands window. Scroll or use the arrows at the bottom of the page to find the statement you wrote to solve problem 3 above. (The one with the column heading SuperStar). Click on the statement to load it back into the command window. Execute the command again, just to make sure it is the correct one that works. Once you know it works, click on the SAVE button in the top right corner of the SQL Commands window, and enter a name for your saved statement. Use your own initials and “_superstar.sql”, so if your initials are CT then the filename will be CT_superstar.sql.

Log out of OAE, and log in again immediately. Navigate back to the SQL Commands window, click the Saved SQL link at the bottom of the page and load your saved SQL statement into the Edit window. This is done by clicking on the script name. Edit the statement, to make it display + instead of *. Run your amended statement and save it as initials_superuser.sql.

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE-3

INCLUDING CONSTRAINTS

OBJECTIVE

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

- Describe the constraints
- Create and maintain the constraints

What are Integrity constraints?

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

The following types of integrity constraints are valid

a) Domain Integrity

- ✓ NOT NULL
- ✓ CHECK

b) Entity Integrity

- ✓ UNIQUE
- ✓ PRIMARY KEY

c) Referential Integrity

- ✓ FOREIGN KEY

Constraints can be created in either of two ways

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

Defining Constraints

Create table tablename (column_name1 data_type constraints, column_name2 data_type constraints ...);

Example:

```
Create table employees ( employee_id number(6), first_name varchar2(20), ..job_id varchar2 (10),
CONSTRAINT emp_emp_id_pk PRIMARY KEY (employee_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,
CONSTRAINT 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 test1 DROP(pk) CASCADE CONSTRAINTS;
```

(OR)

```
ALTER TABLE test1 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.

```
er table EMPAlt
```

```
Add constraint my_emp_id_pk primary key(ID);
```

```
Table altered.
```

```
0.08 seconds
```

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

```
Alter table DEPT
```

```
ADD constraint my_dept_id_pk primary key(ID);
```

```
Table altered.
```

```
0.08 seconds
```

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 department. Name the constraint my_emp_dept_id_fk.

```
Alter table EMP
```

```
add constraint my_emp_dept_id_fk foreign key(dept_id)references DEPT(id);
```

```
Table altered.
```

```
0.08 seconds
```

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)
```

```
add constraint cmp_pk check(commission>0);
```

```
Table altered.
```

```
0.05 seconds
```

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

PRACTICE QUESTIONS

Limit Rows Selected

1. Using the Global Fast Foods database, retrieve the customer's first name, last name, and address for the customer who uses ID 456.

2. Show the name, start date, and end date for Global Fast Foods' promotional item "ballpen and highlighter" giveaway.

3. Create a SQL statement that produces the following output:
Oldest
The 1997 recording in our database is The Celebrants Live in Concert

4. The following query was supposed to return the CD title "Carpe Diem" but no rows were returned. Correct the mistake in the statement and show the output.

```
SELECT produce, title  
FROM d_cds  
WHERE title = 'carpe diem' ;
```

5. The manager of DJs on Demand would like a report of all the CD titles and years of CDs that were produced before 2000.

6. Which values will be selected in the following query?

```
SELECT salary  
FROM employees  
WHERE salary <= 5000;
```

- a. 5000
- b. 0 - 4999
- c. 2500
- d. 5

7. Write a SQL statement that will display the student number (studentno), first name (fname), and last name (lname) for all students who are female (F) in the table named students.

8. Write a SQL statement that will display the student number (studentno) of any student who has a PE major in the table named students. Title the studentno column Student Number.

9. Write a SQL statement that lists all information about all male students in the table named students.

10. Write a SQL statement that will list the titles and years of all the DJs on Demand's CDs that were not produced in 2000.

11. Write a SQL statement that lists the Global Fast Foods employees who were born before 1980.

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE-4

Writing Basic SQL SELECT Statements

OBJECTIVES

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

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

Capabilities of SQL SELECT statement

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

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

Basic SELECT Statement

Syntax

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

NOTE:

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

Example: 1

```
SELECT * FROM departments;
```

Example: 2

```
SELECT location_id, department_id FROM departments;
```

Writing SQL Statements

- SQL statements are not case sensitive
- SQL statements can be on one or more lines.
- Keywords cannot be abbreviated or split across lines
- Clauses are usually placed on separate lines
- Indents are used 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 department_id FROM employees;
```

Displaying Table Structure

- Using DESC keyword.

Syntax

```
DESC table_name;
```

Example:

```
DESC employees;
```

Find the Solution for the following:

True OR False

1. The following statement executes successfully.

Identify the Errors

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

Queries

Select employee_id, last_name, sal*12 'Annual Salary'
From employees;

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

desc dept;
select * from dept;

DEPT_ID	NAME	DEPARTMENTS
1	patel	20
4	prabhuu	50
2	drexler	30

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 id, last_name, job_code, hiredate  
from my_emp;
```

ID	LAST_NAME	JOB_CODE	HIREDATE
1	Patel	234csd	5/24/1994
4	prabhoo	461vsd	8/24/2006
3	Drexler	256rsd	4/3/1998

4. Provide an alias STARTDATE for the hire date.

```
select hireDate as startdate  
from my_emp;
```

STARTDATE
5/24/1994
8/24/2006
4/3/1998

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

```
select distinct job_code  
from my_emp;
```

JOB_CODE
234csd
461vsd
-
256rsd

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_code as "employee and title"  
      from my_emp;
```

employee and title
Patel,234csd
prabhoo,461vsd
Drexler,256rsd

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 id ||','|| first_name||','||last_name||','||job_code||','||hiredate||','||salary as "The_output"  
      from my_emp;
```

The_output

1,Ralph,Patel,234csd,5/24/1994,7000

4,dev,prabhoo,461vsd,8/24/2006,9000

3,Ben,Drexler,256rsd,4/3/1998,20000

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

Practice Questions

COMPARISON OPERATORS

1. Who are the partners of DJs on Demand who do not get an authorized expense amount?

2. Select all the Oracle database employees whose last names end with “s”. Change the heading of the column to read Possible Candidates.

3. Which statement(s) are valid?

- a. WHERE quantity <> NULL;
- b. WHERE quantity = NULL;
- c. WHERE quantity IS NULL;
- d. WHERE quantity != NULL;

4. Write a SQL statement that lists the songs in the DJs on Demand inventory that are type code 77, 12, or 1.

Logical Comparisons and Precedence Rules

1. Execute the two queries below. Why do these nearly identical statements produce two different results? Name the difference and explain why.

```
SELECT code, description  
FROM d_themes  
WHERE code >200 AND description IN('Tropical', 'Football', 'Carnival');  
SELECT  
code, description  
FROM d_themes  
WHERE code >200 OR description IN('Tropical', 'Football', 'Carnival');
```

2. Display the last names of all Global Fast Foods employees who have “e” and “i” in their last names.

3. "I need to know who the Global Fast Foods employees are that make more than \$6.50/hour and their position is not order taker."

4. Using the employees table, write a query to display all employees whose last names start with "D" and have "a" and "e" anywhere in their last name.

5. In which venues did DJs on Demand have events that were not in private homes?

6. Which list of operators is in the correct order from highest precedence to lowest precedence?
 - a. AND, NOT, OR
 - b. NOT, OR, AND
 - c. NOT, AND, OR

For questions 7 and 8, write SQL statements that will produce the desired output.

7. Who am I?

I was hired by Oracle after May 1998 but before June of 1999. My salary is less than \$8000 per month, and I have an "en" in my last name.

8. What's my email address?

Because I have been working for Oracle since the beginning of 1996, I make more than \$9000 per month. Because I make so much money, I don't get a commission

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE-5

Restricting and Sorting data

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

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

Limits the Rows selected

- Using WHERE clause
- Alias cannot be used in WHERE clause

Syntax

SELECT-----

FROM-----

WHERE condition;

Example:

```
SELECT employee_id, last_name, job_id, department_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, department_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 *from emp  
where salary>12000;
```

ID	LAST_NAME	SALARY	DEPT_ID	COMMISSION
1	vishnu	40000	334	%20
3	farzad	24000	176	%12
4	nizam	14000	184	%9
176	sakhl	32000	226	%17

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

```
select last_name,dept_id from emp
where id=176;
```

LAST_NAME	DEPT_ID
sakhl	226

1 rows returned in 0.01 seconds [Download](#)

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 emp
where salary not between 5000 and 12000;
```

LAST_NAME	SALARY
vishnu	40000
farzad	24000
nizam	14000
sakhl	32000

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_code,hiredate from my_emp
where hiredate between '02-20-1998' and '05-01-1998';
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME	JOB_CODE	HIREDATE		
Drexler	256rsd	4/3/1998		

1 rows returned in 0.01 seconds [Download](#)

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, id FROM my_emp
WHERE id IN (SELECT dept_id FROM dept WHERE departments in(20, 50))
order by Last_name Asc;

```

LAST_NAME	ID
Patel	1
prabhoo	4

2 rows returned in 0.00 seconds [Download](#)

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 my_emp
where salary between 5000 and 12000
and department in(20, 50)
order by last_name asc;

```

EMPLOYEE	MONTHLY_SALARY
Patel	7000
prabhoo	9000

2 rows returned in 0.01 seconds [Download](#)

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

```

select last_name,hiredate
from my_emp
where hiredate like '%1994';

```

LAST_NAME	HIREDATE
Patel	5/24/1994

1 rows returned in 0.01 seconds [Download](#)

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

```

select last_name,job_title
from my_emp
where manager_is is null;

```

LAST_NAME	JOB_TITLE
prabhoo	data analyst

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

```

```
from emp
where commission is not null
order by salary asc ,commission asc;
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME	SALARY	COMMISSION		
vishal	11000	1000		
nizam	14000	1000		
farzad	24000	3000		
sakhil	32000	3000		
vishnu	40000	4000		

5 rows returned in 0.01 seconds [Download](#)

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

```
select last_name
from my_emp
where last_name like '__a%';
```

LAST_NAME
prabhuu

1 rows returned in 0.00 seconds [Download](#)

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 my_emp
where last_name like '%a%' 
and last_name like'%e%';
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME				
Patel				

1 rows returned in 0.01 seconds [Download](#)

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_title,salary
from my_emp
where job_title in( 'stock clerk','sales representative')
and salary not in(2500,3500,7000);
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME	JOB_TITLE	SALARY		
Drexler	stock clerk	20000		

1 rows returned in 0.00 seconds [Download](#)

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

```
select last_name,salary,commission  
from emp  
where commission ='%20';
```

LAST_NAME	SALARY	COMMISSION
vishnu	40000	%20
1 rows returned in 0.01 seconds		Download

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

Pracice Questions

Sorting Rows

1. In the example below, assign the employee_id column the alias of “Number.” Complete the SQL statement to order the result set by the column alias.

```
SELECT employee_id, first_name, last_name FROM employees;
```

2. Create a query that will return all the DJs on Demand CD titles ordered by year with titles in alphabetical order by year.

3. Order the DJs on Demand songs by descending title. Use the alias "Our Collection" for the song title.

4. Write a SQL statement using the ORDER BY clause that could retrieve the information needed.

EXERCISE-6

Single Row Functions

Objective

After the completion of will be able to do the

- Describe various in SQL.
- Use character, in SELECT statement.
- Describe the use of conversion functions.

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

this exercise, the students following:

types of functions available

number and date functions

Single row functions:

Manipulate data items.

Accept arguments and return one value.

Act on each row returned.

Return one result per row.

May modify the data type.

Can be nested.

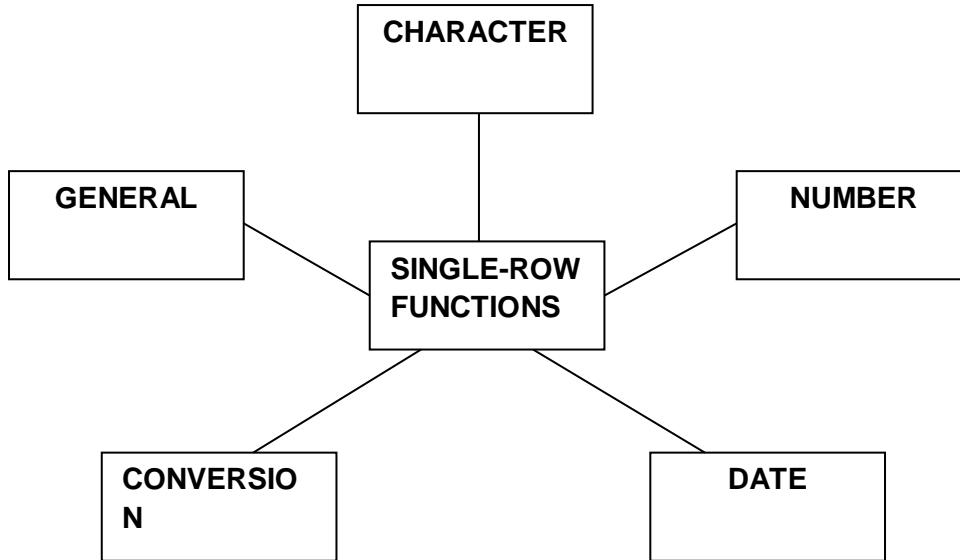
Accept arguments which can be a column or an expression

Syntax

Function_name(arg1,...argn)

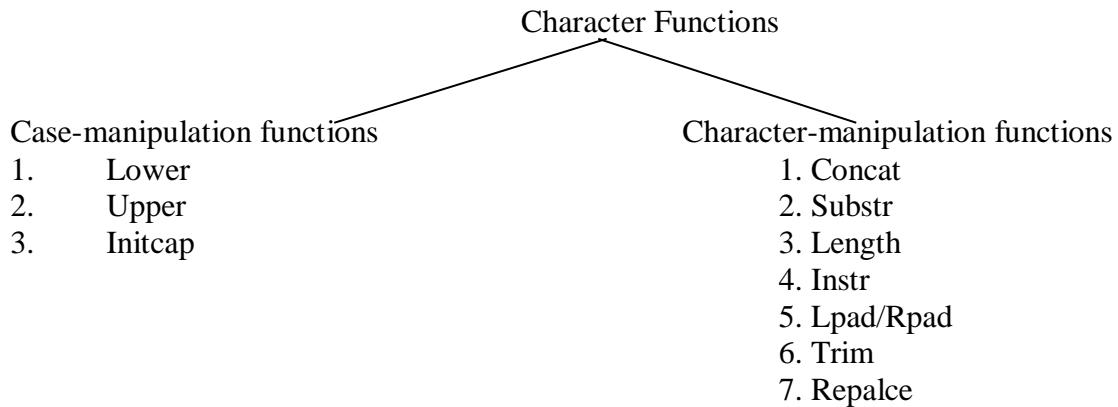
An argument can be one of the following

- ✓ User-supplied constant
- ✓ Variable value
- ✓ Column name
- ✓ Expression



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

Character Functions



Function	Purpose
lower(column/expr)	Converts alpha character values to lowercase
upper(column/expr)	Converts alpha character values to uppercase
initcap(column/expr)	Converts alpha character values the to uppercase for the first letter of each word, all other letters in lowercase
concat(column1/expr1, column2/expr2)	Concatenates the first character to the second character

substr(column/expr,m,n)	Returns specified characters from character value starting at character position m, n characters long
length(column/expr)	Returns the number of characters in the expression
instr(column/expr,’string’,m,n)	Returns the numeric position of a named string
lpad(column/expr, n,’string’)	Pads the character value right-justified to a total width of n character positions
rpad(column/expr,’string’,m,n)	Pads the character value left-justified to a total width of n character positions
trim(leading/trailing/both, trim_character FROM trim_source)	Enables you to trim heading or string. trailing or both from a character
replace(text, search_string, replacement_string)	

Example:

lower(‘SQL Course’) → sql course

upper(‘SQL Course’) → SQL COURSE

initcap(‘SQL Course’) → Sql Course

SELECT ‘The job id for’|| upper(last_name)||’is’||lower(job_id) AS “EMPLOYEE DETAILS”
FROM employees;

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

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

Command	Query	Output
initcap(char);	select initcap(“hello ”) from dual;	Hello
lower (char); upper (char);	select lower (‘HELLO’) from dual; select upper (‘hello ’) from dual;	Hello HELLO
ltrim (char,[set]);	select ltrim (‘cseit’, ‘cse’) from dual;	IT
rtrim (char,[set]);	select rtrim (‘cseit’, ‘it’) from dual;	CSE
replace (char,search string, replace string);	select replace (‘jack and jue’, ‘j’, ‘bl’) from dual;	black and blue
substr (char,m,n);	select substr (‘information’, 3, 4) from dual;	for

Example:

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

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

NUMBER FUNCTIONS

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

Example

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

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

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

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

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

Working with Dates

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

- The default date display format is DD-MON-RR.
- Enables you to store 21st-century dates in the 20th century by specifying only the last two digits of the year
- Enables you to store 20th-century dates in the 21st century in the same way

Example

```
SELECT last_name, hire_date FROM employees WHERE hire_date < ‘01-FEB-88’;
```

Working with Dates

SYSDATE is a function that returns:

- Date
- Time

Example

Display the current date using the DUAL table.

```
SELECT SYSDATE FROM DUAL;
```

Arithmetic with Dates

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

Arithmetic with Dates

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

You can perform the following operations:

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

Example

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

Date Functions

Function	Result
MONTHS_BETWEEN	Number of months between two dates
ADD_MONTHS	Add calendar months to date
NEXT_DAY	Next day of the date specified
LAST_DAY	Last day of the month
ROUND	Round date
TRUNC	Truncate date

Date Functions

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

- MONTHS_BETWEEN(date1, date2)::: Finds the number of months between date1 and date2. The result can be positive or negative. If date1 is later than date2, the result is positive; if date1 is earlier than date2, the result is negative. The noninteger part of the result represents a portion of the month.
- ADD_MONTHS(date, n)::: Adds n number of calendar months to date. The value of n must be an integer and can be negative.
- NEXT_DAY(date, 'char')::: Finds the date of the next specified day of the week ('char') following date. The value of char may be a number representing a day or a character string.
- LAST_DAY(date)::: Finds the date of the last day of the month that contains date
- ROUND(date[, 'fmt'])::: Returns date rounded to the unit that is specified by the format model fmt. If the format model fmt is omitted, date is rounded to the nearest day.
- TRUNC(date[, 'fmt'])::: Returns date with the time portion of the day truncated to the unit that is specified by the format model fmt. If the format model fmt is omitted, date is truncated to the nearest day.

Using Date Functions

Function	Result
MONTHS_BETWEEN ('01-SEP-95', '11-JAN-94')	19.6774194
ADD_MONTHS ('11-JAN-94', 6)	'11-JUL-94'
NEXT_DAY ('01-SEP-95', 'FRIDAY')	'08-SEP-95'
LAST_DAY ('01-FEB-95')	'28-FEB-95'

Example

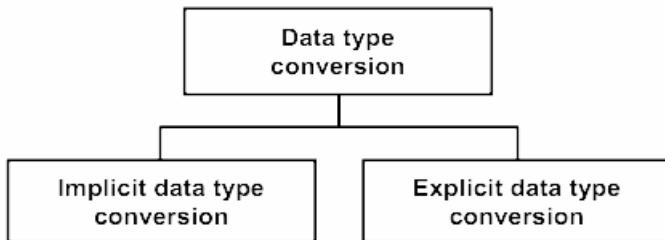
Display the employee number, hire date, number of months employed, sixmonth review date, first Friday after hire date, and last day of the hire month for all employees who have been employed for fewer than 70 months.

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

Conversion Functions

This covers the following topics:

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



Implicit Data Type Conversion

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

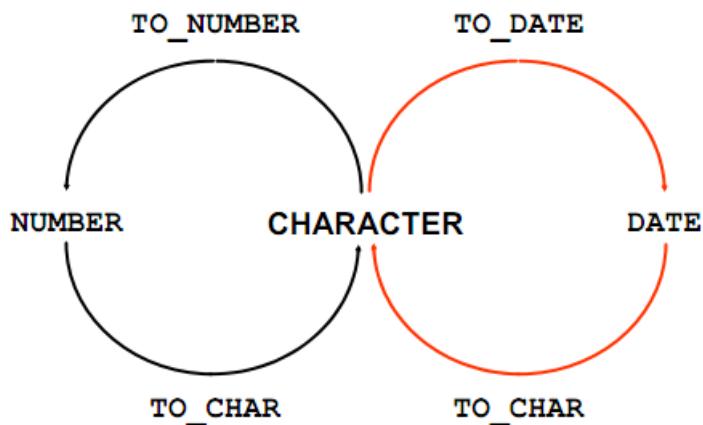
From	To
VARCHAR2 or CHAR	NUMBER
VARCHAR2 or CHAR	DATE
NUMBER	VARCHAR2
DATE	VARCHAR2

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

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

From	To
VARCHAR2 or CHAR	NUMBER
VARCHAR2 or CHAR	DATE

Explicit Data Type Conversion



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

Example:

Using the TO_CHAR Function with Dates

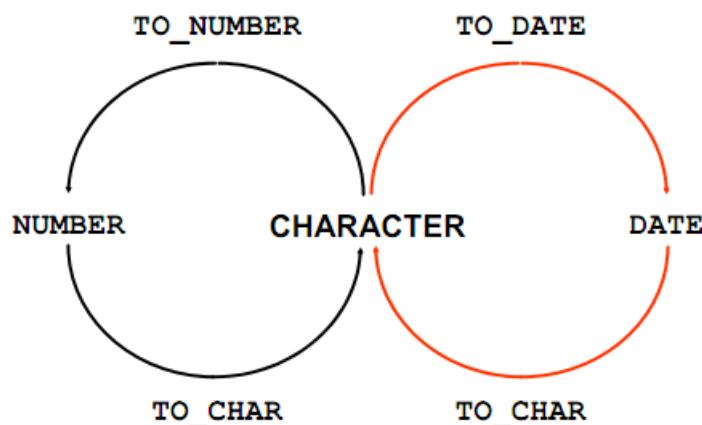
TO_CHAR(date, 'format_model')

The format model:

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

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

Elements of the Date Format Model



Sample Format Elements of Valid Date

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

Date Format Elements: Time Formats

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

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

Other Formats

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

Specifying Suffixes to Influence Number Display

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

Example

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

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

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

Using the TO_CHAR Function with Numbers

TO_CHAR(number, 'format_model')

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

Element	Result
9	Represents a number
0	Forces a zero to be displayed
\$	Places a floating dollar sign
L	Uses the floating local currency symbol
.	Prints a decimal point
,	Prints a comma as thousands indicator

Number Format Elements

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

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

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

Using the TO_NUMBER and TO_DATE Functions

- Convert a character string to a number format using the TO_NUMBER function:
TO_NUMBER(char[, 'format_model'])
- Convert a character string to a date format using the TO_DATE function:
TO_DATE(char[, 'format_model'])
- These functions have an fx modifier. This modifier specifies the exact matching for the character argument and date format model of a TO_DATE function.

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

- Punctuation and quoted text in the character argument must exactly match (except for case) the corresponding parts of the format model.
- The character argument cannot have extra blanks. Without fx, Oracle ignores extra blanks.
- Numeric data in the character argument must have the same number of digits as the corresponding element in the format model. Without fx, numbers in the character argument can omit leading zeros.

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

Find the Solution for the following:

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

```
SELECT HIREDATE AS "DATE"  
FROM MY_EMP;
```

Results	Explain	Describe	Saved SQL	History
DATE				
5/24/1994				
8/24/2006				
4/3/1998				

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

```
SELECT ID, LAST_NAME , (SALARY*1.05)+SALARY AS "NEW_SALARY"  
FROM MY_EMP;
```

Results	Explain	Describe	Saved SQL	History
ID LAST_NAME NEW_SALARY				
1	Patel			14350
4	prabhuu			18450
3	Drexler			41000
2	James			49200
80	Rollek			20500
85	Rockey			20500

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

```
Update my_emp
```

```
SET increased_salary = NEW_SALARY - SALARY  
where id is not null;
```

Table altered.

0.07 seconds

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

```
select upper(substr(last_name,1,1))||lower(substr(last_name,2)) as formattedcolumn  
from my_emp  
where lower (last_name) like 'j%'  
or lower (last_name) like 'a%'  
or lower (last_name) like'm%';
```

FORMATTEDCOLUMN
James

1 rows returned in 0.01 seconds [Download](#)

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

```
SELECT last_name  
FROM my_emp  
WHERE last_name LIKE :letter ||'%';
```

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

```
select last_name,round(MONTHS_BETWEEN(sysDate,HireDate)) as "month worked"  
from my_emp  
order by round (months_between(sysDate,HireDate));
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME				month worked
prabhuu				228
Rollek				293
Rockey				293
Drexler				329
Patel				375

Note: Your results will differ.

7. Create a report that produces the following for each employee:
<employee last name> earns <salary> monthly but wants <3 times salary>. Label the column Dream Salaries.

```
select last_name||' earns'||salary||' monthly but wants'||(salary*3) as "Dream Salaries"  
from my_emp;
```

Results	Explain	Describe	Saved SQL	History
Dream Salaries				
Patel earns 7000 monthly but wants 21000				
prabhuu earns 9000 monthly but wants 27000				
Drexler earns 20000 monthly but wants 60000				
James earns 24000 monthly but wants 72000				
Rollex earns 10000 monthly but wants 30000				
Rockey earns 10000 monthly but wants 30000				

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

```
select last_name,lpad(salary,15,'$') "SALARY"  
from my_emp;
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME				SALARY
Patel				\$\$\$\$\$\$\$\$\$\$7000
prabhuu				\$\$\$\$\$\$\$\$\$\$9000
Drexler				\$\$\$\$\$\$\$\$\$\$20000
James				\$\$\$\$\$\$\$\$\$\$24000
Rollex				\$\$\$\$\$\$\$\$\$\$10000
Rockey				\$\$\$\$\$\$\$\$\$\$10000

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

```
SELECT LAST_NAME,HIREDATE,  
TO_CHAR(NEXT_DAY (ADD_MONTHS(HIREDATE,6),'MONDAY'),'DAY,"THE "DDth  
"OF" MONTH,YYYY')AS "REVIEW"  
FROM MY_EMP;
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME				HIREDATE
Patel				5/24/1994
prabhuu				8/24/2006
Drexler				4/3/1998
James				-
Rollex				3/14/2001
Rockey				3/14/2001
				REVIEW
				MONDAY ,THE 28TH OF NOVEMBER,1994
				MONDAY ,THE 26TH OF FEBRUARY ,2007
				MONDAY ,THE 05TH OF OCTOBER,1998
				-
				MONDAY ,THE 17TH OF SEPTEMBER,2001
				MONDAY ,THE 17TH OF SEPTEMBER,2001

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

```
select last_name,hiredate,to_char(hiredate,'Day')as "Day"  
from my_emp  
order by to_char(hireDate,'D');
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME	HIREDATE	Day		
Patel	5/24/1994	Tuesday		
Rockey	3/14/2001	Wednesday		
Rollek	3/14/2001	Wednesday		
prabhuu	8/24/2006	Thursday		
Drexler	4/3/1998	Friday		
James	-	-		

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

Practice Questions

Introduction to Functions

1. For each task, choose whether a single-row or multiple row function would be most appropriate:
 - a. Showing all of the email addresses in upper case letters
 - b. Determining the average salary for the employees in the sales department
 - c. Showing hire dates with the month spelled out (*September 1, 2004*)
 - d. Finding out the employees in each department that had the most seniority (the earliest hire date)
 - e. Displaying the employees' salaries rounded to the hundreds place
 - f. Substituting zeros for null values when displaying employee commissions.

2. The most common multiple-row functions are: AVG, COUNT, MAX, MIN, and SUM. Give your own definition for each of these functions.

3. Test your definitions by substituting each of the multiple-row functions in this query.

```
SELECT FUNCTION(salary)
```

FROM employees

Write out each query and its results.

Case and Character Manipulation

1. Using the three separate words “Oracle,” “Internet,” and “Academy,” use one command to produce the following output:
The Best Class Oracle Internet Academy

2. Use the string “Oracle Internet Academy” to produce the following output:
The Net net

3. What is the length of the string “Oracle Internet Academy”?

4. What’s the position of “I” in “Oracle Internet Academy”?

5. Starting with the string “Oracle Internet Academy”, pad the string to create ****Oracle****Internet****Academy****

Number Functions

1. Display Oracle database employee last_name and salary for employee_ids between 100 and 102. Include a third column that divides each salary by 1.55 and rounds the result to two decimal places.

Display employee last_name and salary for those employees who work in department 80. Give each of them a raise of 5.333% and truncate the result to two decimal places.

Use a MOD number function to determine whether 38873 is an even number or an odd number.

Use the DUAL table to process the following numbers:

845.553 - round to one decimal place
30695.348 - round to two decimal places
30695.348 - round to -2 decimal Places
2.3454 - truncate the 454 from the decimal place

Divide each employee's salary by 3. Display only those employees' last names and salaries who earn a salary that is a multiple of 3.

Divide 34 by 8. Show only the remainder of the division. Name the output as EXAMPLE.

How would you like your paycheck – rounded or truncated? What if your paycheck was calculated to be \$565.784 for the week, but you noticed that it was issued for \$565.78. The loss of .004 cent would probably make very little difference to you. However, what if this was done to a thousand people, a 100,000 people, or a million people! Would it make a difference then? How much difference?

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE-7

Displaying data from multiple tables

Objective

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

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

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

Cartesian Products

- A Cartesian product is formed when:
 - A join condition is omitted
 - A join condition is invalid
 - All rows in the first table are joined to all rows in the second table
- To avoid a Cartesian product, always include a valid join condition in a WHERE clause.

A Cartesian product tends to generate a large number of rows, and the result is rarely useful. You should always include a valid join condition in a WHERE clause, unless you have a specific need to combine all rows from all tables.

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

Example:

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

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

Types of Joins

- Equijoin

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

Joining Tables Using Oracle Syntax

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

Write the join condition in the WHERE clause.

- Prefix the column name with the table name when the same column name appears in more than one table.

Guidelines

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

What is an Equijoin?

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

The relationship between the EMPLOYEES and DEPARTMENTS tables is an equijoin—that is, values

in the DEPARTMENT_ID column on both tables must be equal. Frequently, this type of join involves

primary and foreign key complements.

Note: Equijoins are also called simple joins or inner joins

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

Additional Search Conditions

Using the AND Operator

Example:

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

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

Qualifying Ambiguous Column Names

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

Using Table Aliases

- Simplify queries by using table aliases.
- Improve performance by using table prefixes

Example:

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

Joining More than Two Tables

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

Example:

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

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

Non-Equijoins

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

Example:

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

Outer Joins

Syntax

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

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

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

Example:

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

Outer Join Restrictions

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

Self Join

Sometimes you need to join a table to itself.

Example:

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

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

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

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

In the syntax:

table1.column Denotes the table and column from which data is retrieved

CROSS JOIN Returns a Cartesian product from the two tables

NATURAL JOIN Joins two tables based on the same column name

JOIN table USING column_name Performs an equijoin based on the column name

JOIN table ON table1.column_name = table2.column_name Performs an equijoin based on the condition in the ON clause

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 also 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 last_name,department_num,department_name  
from my_emp;
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME	DEPARTMENT_NUM	DEPARTMENT_NAME		
Patel	20	BioTech		
prabhuu	50	CSBS		
Drexler	80	CSE		
James	-	AI		
Rollek	38	bio		
Rockey	38	bio		

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_code, d.dept_location  
from my_emp e,dept d  
where e.id=d.id and d.id=80;
```

Results	Explain	Describe	Saved SQL	History
JOB_CODE	DEPT_LOCATION			
444csbs	65			
1 rows returned in 0.01 seconds				
Download				

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,e.department_name,d.dept_location,d.city
from my_emp e,dept d,emp v,
where e.id=d.id and d.dept_location = d.dept_location and v.commission is not null;
```

LAST_NAME	DEPARTMENT_NAME	DEPART_LOCATION	CITY
raj	sales	65	japan
Drexler	sales	68	Toronto

2 rows returned in 0.02 seconds [Download](#)

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

```
select e.last_name,e.department_name
from my_emp e,dept d
where e.id=d.id and e.last_name like '%P%';
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME				DEPARTMENT_NAME
Patel				BioTech

1 rows returned in 0.00 seconds [Download](#)

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_title,e.department_num,e.department_name
from my_emp e,dept d
where e.id=d.id and d.dept_location=d.dept_location
and d.city='Toronto';
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME				JOB_TITLE
Drexler				CSE

1 rows returned in 0.01 seconds [Download](#)

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.id as EMP#,e.manager_is as MANAGER,m.manager_num as
MGR#
from my_emp e,dept m
where m.manager_num=e.manager_num;
```

EMPLOYEE	EMP#	MANAGER	MGR#
Rockey	85	vishal	160
Patel	1	vishnu	40
prabhuu	4	Roshan	100
Drexler	3	Bala	80

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

```
select e.first_name  
from my_emp e  
left outer join dept d  
on (e.manager_num=d.manager_num)  
order by e.id
```

Results	Explain	Describe	Saved SQL	History
FIRST_NAME				
Davies				
Franker				
Ben				
Ralph				

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 last_name as EMPLOYEE ,department_num as department_number  
from my_emp  
WHERE department_name IN (  
    SELECT department_name  
    FROM my_emp  
    GROUP BY department_name  
    HAVING COUNT(*) > 1  
)
```

Results	Explain	Describe	Saved SQL	History
EMPLOYEE				
DEPARTMENT_NUMBER				
Rollek				
38				
Rockey				
38				

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

```
select last_name, job_title,department_name,Salary,job_grade  
from my_emp;
```

Results	Explain	Describe	Saved SQL	History
LAST_NAME				
JOB_TITLE				
DEPARTMENT_NAME				
SALARY				
JOB_GRADE				
Patel	data scientist	BioTech	7000	C
prabhuu	data analyst	CSBS	9000	A
Drexler	stock clerk	CSE	20000	B
James	-	AI	24000	D
Rollek	data engineer	bio	10000	C

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

```
select first_name,hiredate  
from my_emp  
where hiredate>(select hiredate from my_emp where first_name='Davies');
```

FIRST_NAME	HIREDATE
Ralph	8/24/2006
Ben	4/3/1998
king	3/14/2001
Bhai	3/14/2001

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.first_name as employee ,e.hiredate as emp_hired,e.manager_is as
Manager,e.manager_hire_date as mgr_hired
from my_emp e,dept d
where d.manager_num=e.manager_num
and e.hiredate<e.manager_hire_date;
```

EMPLOYEE	EMP_HIRED	MANAGER	MGR_HIRED
Bhai	3/14/2001	vishal	3/18/2012
Davies	5/24/1994	vishnu	2/9/2007
Ben	4/3/1998	Bala	3/8/2007
king	3/14/2001	vishal	9/18/2010

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

EXERCISE-8

Aggregating Data Using Group Functions

Objectives

After the completion of this exercise, the students 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_id HAVING 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 max(salary) as Maximum,min(salary) as Minimum,sum(salary) as Sum,round(avg(salary))  
as Average  
from my_emp;
```

MAXIMUM	MINIMUM	SUM	AVERAGE
24000	7000	80000	13333
1 rows returned in 0.01 seconds Download			

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

```
select max(salary) as Maximum,min(salary) as Minimum,sum(salary) as Sum,round(avg(salary)) as Average
from my_emp
group by job_title;
```

MAXIMUM	MINIMUM	SUM	AVERAGE
20000	20000	20000	20000
7000	7000	7000	7000
9000	9000	9000	9000
24000	24000	24000	24000
10000	10000	20000	10000

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 count(*) as "Number_of_people" from my_emp
where job_title like:letter || '%';
```

Number_of_people
3

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_num) as "Number_of_Managers" from my_emp
where manager_num is not null;
```

Number_of_Managers	
6	
1 rows returned in 0.00 seconds Download	

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

```
select max(salary) - min(salary) as Difference
from my_emp;
```

DIFFERENCE	
17000	
1 rows returned in 0.00 seconds Download	

9. Create a report to display the manager number and the salary of the lowest-paid employee for that manager. Exclude anyone whose manager is not known. Exclude any

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

```
select manager_num,min(salary)
from my_emp
where manager_is is not null
group by manager_num having min(salary)>6000
order by min(salary) desc;
```

Results		Explain	Describe	Saved SQL	History
MANAGER_NUM					MIN(SALARY)
60					24000
80					20000
140					10000
160					10000
100					9000

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 TO_CHAR(hiredate, 'YYYY') = '1995' THEN 1 ELSE 0 END) AS
Hired_in_1995,
      SUM(CASE WHEN TO_CHAR(hiredate, 'YYYY') = '1996' THEN 1 ELSE 0 END) AS
Hired_in_1996,
      SUM(CASE WHEN TO_CHAR(hiredate, 'YYYY') = '1997' THEN 1 ELSE 0 END) AS
Hired_in_1997,
      SUM(CASE WHEN TO_CHAR(hiredate, 'YYYY') = '1998' THEN 1 ELSE 0 END) AS
Hired_in_1998
FROM my_emp;
```

Results		Explain	Describe	Saved SQL	History
TOTAL_EMPLOYEES		HIRED_IN_1995	HIRED_IN_1996	HIRED_IN_1997	HIRED_IN_1998
6		0	0	0	1
1 rows returned in 0.01 seconds Download					

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_title as JOB,salary,SUM(SALARY) as total_salary
from my_emp
where department_num in(20,50,80)
group BY job_title,salary;
```

Results		Explain	Describe	Saved SQL	History
JOB		SALARY		TOTAL_SALARY	
data scientist		7000		7000	
stock clerk		20000		20000	
data analyst		9000		9000	
3 rows returned in 0.00 seconds Download					

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 e.department_name,d.dept_location,count(*) as number_of_people,avg(e.salary) as
average_salary
from my_emp e
JOIN dept d ON e.id = d.id
group by e.department_name , d.dept_location;

```

Results			
DEPARTMENT_NAME	DEPT_LOCATION	NUMBER_OF_PEOPLE	AVERAGE_SALARY
AI	75	1	24000
bio	90	1	10000
CSBS	69	1	9000
bio	65	1	10000
BioTech	65	1	7000
CSE	18	1	20000

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

Practice Questions

Date Functions

1. For DJs on Demand, display the number of months between the event_date of the Vigil wedding and today's date. Round to the nearest month.
 2. Display the days between the start of last summer's school vacation break and the day school started this year. Assume 30.5 days per month. Name the output "Days."
 3. Display the days between January 1 and December 31.
 4. Using one statement, round today's date to the nearest month and nearest year and truncate it to the nearest month and nearest year. Use an alias for each column.
 5. What is the last day of the month for June 2005? Use an alias for the output.
 6. Display the number of years between the Global Fast Foods employee Bob Miller's birthday and today. Round to the nearest year.

7.Your next appointment with the dentist is six months from today. On what day will you go to the dentist? Name the output, "Appointment."

8.The teacher said you have until the last day of this month to turn in your research paper. What day will this be? Name the output, "Deadline."

9.How many months between your birthday this year and January 1 next year?

10.What's the date of the next Friday after your birthday this year? Name the output, "First Friday."

11. Name a date function that will return a number.

12.Name a date function that will return a date.

13.Give one example of why it is important for businesses to be able to manipulate date data?

Conversion Functions

In each of the following exercises, feel free to use labels for the converted column to make the output more readable.

1. List the last names and birthdays of Global Fast Food Employees. Convert the birth dates to character data in the Month DD, YYYY format. Suppress any leading zeros.
2. Convert January 3, 04, to the default date format 03-Jan-2004.
3. Format a query from the Global Fast Foods f_promotional_menus table to print out the start_date of promotional code 110 as: The promotion began on the tenth of February 2004.
4. Convert today's date to a format such as: "Today is the Twentieth of March, Two Thousand Four"
5. List the ID, name and salary for all Global Fast Foods employees. Display salary with a \$ sign and two decimal places.

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE-9

Sub queries

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 employees WHERE 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,hiredate  
from my_emp  
where department_num in (select department_num  
from my_emp  
where last_name='Zlotkey'  
)  
and last_name!='Zlotkey';
```

Results Explain Describe Saved SQL History

LAST_NAME	HIREDATE
Raju	3/14/2001

1 rows returned in 0.02 seconds [Download](#)

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 id,last_name,salary  
from my_emp  
where salary>(select avg(salary)from my_emp)  
order by salary;
```

Results Explain Describe Saved SQL History

ID	LAST_NAME	SALARY
3	Drexler	20000
2	King	24000

2 rows returned in 0.02 seconds [Download](#)

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 id,last_name  
from my_emp  
where department_num in(select department_num from my_emp where last_name like '%u%')  
and last_name not like '%u%';
```

Results Explain Describe Saved SQL History

ID	LAST_NAME
85	Zlotkey

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,id,job_code from my_emp where department_num like 1700;
```

Results Explain Describe Saved SQL History

LAST_NAME	ID	JOB_CODE
King	2	342bio

1 rows returned in 0.01 seconds [Download](#)

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 my_emp  
where last_name like 'King';
```

Results		Explain	Describe	Saved SQL	History
LAST_NAME				SALARY	
King				24000	
1 rows returned in 0.00 seconds Download					

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

```
SELECT id, last_name, job_code  
FROM my_emp  
WHERE department_name = 'Executive';
```

Results		Explain	Describe	Saved SQL	History
ID		LAST_NAME		JOB_CODE	
80		Raju		444csbs	
1 rows returned in 0.00 seconds Download					

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 id,last_name,salary  
from my_emp  
where salary > (select avg(salary) from my_emp)  
and department_num in (select department_num from my_emp where last_name like '%u%');
```

Results		Explain	Describe	Saved SQL	History
no data found					

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

1. Ellen Abel is an employee who has received a \$2,000 raise. Display her first name and last name, her current salary, and her new salary. Display both salaries with a \$ and two decimal places. Label her new salary column AS New Salary.
 2. On what day of the week and date did Global Fast Foods' promotional code 110 Valentine's Special begin?
 3. Create one query that will convert 25-Dec-2004 into each of the following (you will have to convert 25-Dec-2004 to a date and then to character data):

December 25th, 2004
DECEMBER 25TH, 2004
25th december, 2004
 4. Create a query that will format the DJs on Demand d_packages columns, low-range and high- range package costs, in the format \$2500.00.
 5. Convert JUNE192004 to a date using the fx format model.
 6. What is the distinction between implicit and explicit datatype conversion? Give an example of each.
 7. Why is it important from a business perspective to have datatype conversions?

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE-10

USING THE SET OPERATORS

Objectives

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

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

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

Queries containing set operators are called *compound queries*.

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

The tables used in this lesson are:

- EMPLOYEES: Provides details regarding all current employees
- JOB_HISTORY: Records the details of the start date and end date of the former job, and the job identification number and department when an employee switches jobs

UNION Operator

Guidelines

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

- NULL values are not ignored during duplicate checking.
- The IN operator has a higher precedence than the UNION operator.
- By default, the output is sorted in ascending order of the first column of the SELECT clause.

Example:

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

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

Example:

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

UNION ALL Operator

Guidelines

The guidelines for UNION and UNION ALL are the same, with the following two exceptions that pertain to UNION ALL:

- Unlike UNION, duplicate rows are not eliminated and the output is not sorted by default.
- The DISTINCT keyword cannot be used.

Example:

Display the current and previous departments of all employees.

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

INTERSECT Operator

Guidelines

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

Example:

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

doing their original job).

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

Example

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

MINUS Operator

Guidelines

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

Example:

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

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

Find the Solution for the following:

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_num  
from my_emp  
where department_num is not null  
minus  
select distinct department_num  
from my_emp  
where job_code = 'ST_CLERK';
```

Results	Explain	Describe	Saved SQL	History
DEPARTMENT_NUM				
1700				
20				
38				

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 country  
minus  
select country_ID,country_name  
from country  
where departments is not null;
```

Results	Explain	Describe	Saved SQL	History
COUNTRY_ID		COUNTRY_NAME		
224		china		

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_code,department_num
from my_emp
where department_num=10 union select job_code,department_num
from my_emp where department_num=20 union select job_code,department_num
from my_emp where department_num=50;
```

Results	Explain	Describe	Saved SQL	History
JOB_CODE		DEPARTMENT_NUM		
234csd		20		
461vsd		50		
2 rows returned in 0.01 seconds		Download		

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 id,job_code
from my_emp
intersect
select id,job_code
from job_history
```

Results	Explain	Describe	Saved SQL	History
ID		JOB_CODE		
1		234csd		
80		444csbs		
2 rows returned in 0.02 seconds		Download		

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 as name,id,NULL as departments from my_emp
union
select null as name,id,departments from dept;
```

Results	Explain	Describe	Saved SQL	History
NAME		ID	DEPARTMENTS	
Drexler		3		-
King		2		-
Patel		1		-

Practice Exercise

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

NULL Functions

1. Create a report that shows the Global Fast Foods promotional name, start date, and end date from the f_promotional_menus table. If there is an end date, temporarily replace it with “end in two weeks”. If there is no end date, replace it with today’s date.

2. Not all Global Fast Foods staff members receive overtime pay. Instead of displaying a null value for these employees, replace null with zero. Include the employee’s last name and overtime rate in the output. Label the overtime rate as “Overtime Status”.

3. The manager of Global Fast Foods has decided to give all staff who currently do not earn overtime an overtime rate of \$5.00. Construct a query that displays the last names and the overtime rate for each staff member, substituting \$5.00 for each null overtime value.

4. Not all Global Fast Foods staff members have a manager. Create a query that displays the employee last name and 9999 in the manager ID column for these employees.

5. Which statement(s) below will return null if the value of v_sal is 50?
 - a. SELECT nvl(v_sal, 50) FROM emp;
 - b. SELECT nvl2(v_sal, 50) FROM emp;
 - c. SELECT nullif(v_sal, 50) FROM emp;
 - d. SELECT coalesce (v_sal, Null, 50) FROM emp;

6. What does this query on the Global Fast Foods table return?

```
SELECT COALESCE(last_name, to_char(manager_id)) as NAME  
FROM f_staffs;
```

7a. Create a report listing the first and last names and month of hire for all employees in the EMPLOYEES table (use TO_CHAR to convert hire_date to display the month).

b. Modify the report to display null if the month of hire is September. Use the NULLIF function.

8. For all null values in the specialty column in the DJs on Demand d_partners table, substitute “No Specialty.” Show the first name and specialty columns only.

Conditional Expressions

1. From the DJs on Demand d_songs table, create a query that replaces the 2-minute songs with “shortest” and the 10-minute songs with “longest”. Label the output column “Play Times”.

2. Use the Oracle database employees table and CASE expression to decode the department id. Display the department id, last name, salary and a column called “New Salary” whose value is based on the following conditions:

If the department id is 10 then 1.25 * salary
If the department id is 90 then 1.5 * salary
If the department id is 130 then 1.75 * salary
Otherwise, display the old salary.

3. Display the first name, last name, manager ID, and commission percentage of all employees in departments 80 and 90. In a 5th column called “Review”, again display the manager ID. If they

don't have a manager, display the commission percentage. If they don't have a commission, display 99999.

Cross Joins and Natural Joins

Use the Oracle database for problems 1-4.

1. Create a cross-join that displays the last name and department name from the employees and departments tables.

2. Create a query that uses a natural join to join the departments table and the locations table. Display the department id, department name, location id, and city.

3. Create a query that uses a natural join to join the departments table and the locations table. Restrict the output to only department IDs of 20 and 50. Display the department id, department name, location id, and city.

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE-11

CREATING VIEWS

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

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

View

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

Advantages of Views

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

Classification of views

1. Simple view
2. Complex view

Feature	Simple	Complex
No. of tables	One	One or more
Contains functions	No	Yes
Contains groups of data	No	Yes
DML operations thr' view	Yes	Not always

Creating a view

Syntax

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

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

NOFORCE - Creates the view only if the base 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 (Without 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.department_id=d.department_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 id,last_name as Employee,department_num from my_emp;
```

Results	Explain	Describe	Saved SQL	History
View created.				
0.04 seconds				

2. Display the contents of the EMPLOYEES_VU view.

```
select *from employee_vu;
```

Results	Explain	Describe	Saved SQL	History
ID		EMPLOYEE		DEPARTMENT_NUM
1		Patel		20
4		prabhuu		50
3		Drexler		80
2		King		1700

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

```
SELECT VIEW_NAME, TEXT
FROM USER_VIEWS;
```

Results	Explain	Describe	Saved SQL	History
VIEW_NAME		TEXT		
DEPT50		select id,last_name,department_num from my_emp where department_num=50		
EMPLOYEE_UV		select id,last_name as employee_name,department_num,department_name from my_emp		
EMPLOYEE_VU		select id,last_name as Employee,department_num from my_emp		
SALARY_VU		select m.last_name,d.departments,m.salary,j.grade_level from my_emp m,dept d,job_grade j		

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

```
select employee,department_num
from employee_vu;
```

Results	Explain	Describe	Saved SQL	History
EMPLOYEE		DEPARTMENT_NUM		
Patel		20		
prabhuu		50		
Drexler		80		
King		1700		

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.

```
select id as EMPNO, last_name as EMPLOYEE,department_num as DEPTNO
from DEPT50;
```

Results	Explain	Describe	Saved SQL	History		
EMPNO		EMPLOYEE		DEPTNO		
4		prabhuu		50		
1 rows returned in 0.02 seconds						
Download						

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

```
select *from DEPT50;
```

Results	Explain	Describe	Saved SQL	History		
ID		LAST_NAME		DEPARTMENT_NUM		
4		prabhuu		50		
1 rows returned in 0.02 seconds						
Download						

7. Attempt to reassign Matos to department 80.

```

UPDATE employees
SET department_id = 80
WHERE employee_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.

```

select last_name as Employee,departments as Department,salary ,grade_level as grade
from salary_vu;

```

Results	Explain	Describe	Saved SQL	History
EMPLOYEE	DEPARTMENT	SALARY	GRADE	
Patel	60	7000	B	
prabhuu	60	9000	B	
Drexler	60	20000	B	
King	60	24000	B	

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

Practice Problems -I

Join Clauses

Use the Oracle database for problems 1-6.

1. Join the Oracle database locations and departments table using the location_id column. Limit the results to location 1400 only.

2. Join DJs on Demand d_play_list_items, d_track_listings, and d_cds tables with the JOIN USING syntax. Include the song ID, CD number, title, and comments in the output.

3. Display the city, department name, location ID, and department ID for departments 10, 20, and 30 for the city of Seattle.

4. Display country name, region ID, and region name for Americas.

5. Write a statement joining the employees and jobs tables. Display the first and last names, hire date, job id, job title, and maximum salary. Limit the query to those employees who are in jobs that can earn more than \$12,000.

Inner versus Outer Joins

Use the Oracle database for problems 1-7.

1. Return the first name, last name, and department name for all employees including those employees not assigned to a department.

2. Return the first name, last name, and department name for all employees including those departments that do not have an employee assigned to them.

3. Return the first name, last name, and department name for all employees including those departments that do not have an employee assigned to them and those employees not assigned to a department.

4. Create a query of the DJs on Demand database to return the first name, last name, event date, and description of the event the client held. Include all the clients even if they have not had an event scheduled.

5. Using the Global Fast Foods database, show the shift description and shift assignment date even if there is no date assigned for each shift description.

Self Joins and Hierarchical Queries

For each problem, use the Oracle database.

1. Display the employee's last name and employee number along with the manager's last name and manager number. Label the columns: Employee, Emp#, Manager, and Mgr#, respectively.
2. Modify question 1 to display all employees and their managers, even if the employee does not have a manager. Order the list alphabetically by the last name of the employee.
3. Display the names and hire dates for all employees who were hired before their managers, along with their managers' names and hire dates. Label the columns Employee, Emp Hired, Manager, and Mgr Hired, respectively.
4. Write a report that shows the hierarchy for Lex De Haans department. Include last name, salary, and department id in the report.
5. What is wrong in the following statement:

```
SELECT last_name, department_id, salary  
FROM employees  
START WITH last_name = 'King'  
CONNECT BY PRIOR manager_id = employee_id;
```

6. Create a report that shows the organization chart for the entire employee table. Write the report so that each level will indent each employee 2 spaces. Since Oracle Application Express cannot display the spaces in front of the column, use - (minus) instead.

7. Re-write the report from 6 to exclude De Haan and all the people working for him.

Oracle Equijoin and Cartesian Product

1. Create a Cartesian product that displays the columns in the d_play_list_items and the d_track_listings in the DJs on Demand database.
2. Correct the Cartesian product produced in question 1 by creating an equijoin using a common column.
3. Write a query to display the title, type, description, and artist from the DJs on Demand database.
4. Rewrite the query in question 3 to select only those titles with an ID of 47 or 48.
5. Write a query that extracts information from three tables in the DJs on Demand database, the d_clients table, the d_events table, and the d_job_assignments table.

Group Functions

1. Define and give an example of the seven group functions: AVG, COUNT, MAX, MIN, STDDEV, SUM, and VARIANCE.

2. Create a query that will show the average cost of the DJs on Demand events. Round to two decimal places.

3. Find the average salary for Global Fast Foods staff members whose manager ID is 19.

4. Find the sum of the salaries for Global Fast Foods staff members whose IDs are 12 and 9.

Using the Oracle database, select the lowest salary, the most recent hire date, the last name of the person who is at the top of an alphabetical list of employees, and the last name of the person who is at the bottom of an alphabetical list of employees. Select only employees who are in departments 50 or 60

5. Your new Internet business has had a good year financially. You have had 1,289 orders this year. Your customer order table has a column named total_sales. If you submit the following query, how many rows will be returned?

```
SELECT sum(total_sales) fFROM orders;
```

6. You were asked to create a report of the average salaries for all employees in each division of the company. Some employees in your company are paid hourly instead of by salary. When you ran the report, it seemed as though the averages were not what you expected—they were much higher than you thought! What could have been the cause?

7. Employees of Global Fast Foods have birth dates of July 1, 1980, March 19, 1979, and March 30, 1969. If you select MIN(birthdate), which date will be returned?

8. Create a query that will return the average order total for all Global Fast Foods orders from January 1, 2002, to December 21, 2002.

9. What was the hire date of the last Oracle employee hired?

10. Your new Internet business has had a good year financially. You have had 1,289 orders this year. Your customer order table has a column named total_sales. If you submit the following query, how many rows will be returned?

```
SELECT sum(total_sales)  
FROM orders;
```

Problems -II

COUNT,

1. How many songs are in D_SONGS table?

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

2. In how many different location types has DJs on Demand had venues?

3. The d_track_listings table in the DJs on Demand database has a song_id column and a cd_number column. How many song IDs are in the table and how many different CD numbers are in the table?

4. How many of the DJs on Demand customers have email addresses?

5. Some of the partners in DJs on Demand do not have authorized expense amounts (auth_expense_amt). How many partners do have this privilege?

6. What values will be returned when the statement below is issued?

ID	type	shoe_color
456	oxford	brown
463	sandal	tan
262	heel	black
433	slipper	tan

```
SELECT COUNT(shoe_color),
COUNT(DISTINCT shoe_color)
FROM shoes;
```

Practice

DISTINCT, NVL

listed in the DJs on Demand

7. Create a query that will convert any null values in the auth_expense_amt column on the DJs on Demand D_PARTNERS table to 100000 and find the average of the values in this column. Round the result to two decimal places.

8. Which of the following statements is/are TRUE about the following query?

SELECT AVG(NVL(selling_bonus, 0.10))

FROM bonuses;

- a. The datatypes of the values in the NVL clause can be any datatype except date data.
- b. If the selling_bonus column has a null value, 0.10 will be substituted.
- c. There will be no null values in the selling_bonus column when the average is calculated.
- d. This statement will cause an error. There cannot be two functions in the SELECT statement.

9. Which of the following statements is/are TRUE about the following query?

SELECT DISTINCT colors, sizes

FROM items;

- a. Each color will appear only once in the results set.
- b. Each size will appear only once in the results set.
- c. Unique combinations of color and size will appear only once in the results set.
- d. Each color and size combination will appear more than once in the results set.

Using GROUP BY and HAVING Clauses

1. In the SQL query shown below, which of the following are true about this query?
 - a. Kimberly Grant would not appear in the results set.
 - b. The GROUP BY clause has an error because the manager_id is not listed in the SELECT clause.
 - c. Only salaries greater than 16001 will be in the result set.
 - d. Names beginning with Ki will appear after names beginning with Ko.
 - e. Last names such as King and Kochhar will be returned even if they don't have salaries > 16000.

```
SELECT last_name, MAX(salary)
FROM employees
WHERE last_name LIKE 'K%' GROUP
BY manager_id, last_name HAVING
MAX(salary) >16000
ORDER BY last_name DESC ;
```

2. Each of the following SQL queries has an error. Find the error and correct it. Use Oracle Application Express to verify that your corrections produce the desired results.

a. `SELECT manager_id`

`FROM employees`

`WHERE AVG(salary) <16000`

`GROUP BY manager_id;`

b. `SELECT cd_number, COUNT(title)`

`FROM d_cds`

`WHERE cd_number < 93;`

c. `SELECT ID, MAX(ID), artist AS Artist FROM d_songs`

`WHERE duration IN('3 min', '6 min', '10 min')`

`HAVING ID < 50`

`GROUP by ID;`

d. `SELECT loc_type, rental_fee AS Fee`

`FROM d_venues`

`WHERE id <100`

`GROUP BY "Fee"`

`ORDER BY 2;`

3. Rewrite the following query to accomplish the same result:

```
SELECT DISTINCT MAX(song_id)
FROM d_track_listings WHERE
track IN ( 1, 2, 3);
```

4. Indicate True or False

- a. If you include a group function and any other individual columns in a SELECT clause, then each individual column must also appear in the GROUP BY clause.
- b. You can use a column alias in the GROUP BY clause.
- c. The GROUP BY clause always includes a group function.

5. Write a query that will return both the maximum and minimum average salary grouped by department from the employees table.

6. Write a query that will return the average of the maximum salaries in each department for the employees table.

Using Set Operators

1. Name the different Set operators?
 2. Write one query to return the employee_id, job_id, hire_date, and department_id of all employees and a second query listing employee_id, job_id, start_date, and department_id from the job_history table and combine the results as one single output. Make sure you suppress duplicates in the output.
 3. Amend the previous statement to not suppress duplicates and examine the output. How many extra rows did you get returned and which were they? Sort the output by employee_id to make it easier to spot.

There is one extra row on employee 176 with a job_id of SA_REP.

4. List all employees who have not changed jobs even once. (Such employees are not found in the job_history table)

 5. List the employees that HAVE changed their jobs at least once.

6. Using the UNION operator, write a query that displays the employee_id, job_id, and salary of ALL present and past employees. If a salary is not found, then display a 0 (zero) in its place.

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

Practice Problems -III

Fundamentals of Subqueries

1. What is the purpose of using a subquery?

2. What is a subquery?

3. What DJs on Demand d_play_list_items song_id's have the same event_id as song_id 45?

4. Which events in the DJs on Demand database cost more than event_id = 100?

5. Find the track number of the song that has the same CD number as “Party Music for All Occasions.”

6. List the DJs on Demand events whose theme code is the same as the code for “Tropical.”

7. What are the names of the Global Fast Foods staff members whose salaries are greater than the staff member whose ID is 12?

8. What are the names of the Global Fast Foods staff members whose staff types are not the same as Bob Miller’s?

9. Which Oracle employees have the same department ID as the IT department?

10. What are the department names of the Oracle departments that have the same location ID as Seattle?

11. Which statement(s) regarding subqueries is/are true?
- It is good programming practice to place a subquery on the right side of the comparison operator.
 - A subquery can reference a table that is not included in the outer query's FROM clause.
 - Single-row subqueries can return multiple values to the outer query.

Single-Row Subqueries

- Write a query to return all those employees who have a salary greater than that of Lorentz and are in the same department as Abel.
- Write a query to return all those employees who have the same job id as Rajs and were hired after Davies.
- What DJs on Demand events have the same theme code as event ID = 100?

4. What is the staff type for those Global Fast Foods jobs that have a salary less than those of any Cook staff-type jobs?

5. Write a query to return a list of department id's and average salaries where the department's average salary is greater than Ernst's salary.

6. Return the department ID and minimum salary of all employees, grouped by department ID, having a minimum salary greater than the minimum salary of those employees whose department ID is not equal to 50.

Multiple-Row Subqueries

1. What will be returned by a query if it has a subquery that returns a null?

2. Write a query that returns jazz and pop songs. Write a multi-row subquery and use the d_songs and d_types tables. Include the id, title, duration, and the artist name.

3. Find the last names of all employees whose salaries are the same as the minimum salary for any department.

4. Which Global Fast Foods employee earns the lowest salary? Hint: You can use either a single- row or a multiple-row subquery.

5. Place the correct multiple-row comparison operators in the outer query WHERE clause of each of the following:

- a. Which CDs in our d_cds collection were produced before “Carpe Diem” was produced?

WHERE year _____(SELECT year ...

- b. Which employees have salaries lower than any one of the programmers in the IT department?

WHERE salary _____(SELECT salary ...

- c. What CD titles were produced in the same year as “Party Music for All Occasions” or “Carpe Diem”?

WHERE year _____(SELECT year ...

- d. What song title has a duration longer than every type code 77 title?

WHERE duration _____(SELECT duration ...

6. If each WHERE clause is from the outer query, which of the following are true?

- a. WHERE size > ANY -- If the inner query returns sizes ranging from 8 to 12, the value 9 could be returned in the outer query.
- b. WHERE book_number IN -- If the inner query returns books numbered 102, 105, 437, and 225 then 325 could be returned in the outer query.
- c. WHERE score <= ALL -- If the inner query returns the scores 89, 98, 65, and 72, then 82 could be returned in the outer query.
- d. WHERE color NOT IN -- If the inner query returns red, green, blue, black, and then the outer query could return white.
- e. WHERE game_date = ANY -- If the inner query returns 05-Jun-1997, 10-Dec-2002, and 2-Jan- 2004, then the outer query could return 10-Sep-2002.

7. The goal of the following query is to display the minimum salary for each department whose minimum salary is less than the lowest salary of the employees in department 50. However, the subquery does not execute because it has five errors. Find them, correct them, and run the query.

```
SELECT department_id  
FROM employees WHERE  
MIN(salary) HAVING  
MIN(salary) > GROUP BY  
department_id SELECT
```

```
MIN(salary)
WHERE department_id < 50;
```

No data was returned from this query.

8. Which statements are true about the subquery below?

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

- a. The inner query could be eliminated simply by changing the WHERE clause to WHERE MIN(salary).
- b. The query wants the names of employees who make the same salary as the smallest salary in any department.
- c. The query first selects the employee ID and last name, and then compares that to the salaries in every department.
- d. This query will not execute.

9. Write a pair-wise subquery listing the last_name, first_name, department_id, and manager_id for all employees that have the same department_id and manager_id as employee 141. Exclude employee 141 from the result set.

10. Write a non-pair-wise subquery listing the last_name, first_name, department_id, and manager_id for all employees that have the same department_id and manager_id as employee 141.

Correlated Subqueries

1. Explain the main difference between correlated and non-correlated subqueries?

2. Write a query that lists the highest earners for each department. Include the last_name, department_id, and the salary for each employee.

3. Examine the following select statement and finish it so that it will return the last_name, department_id, and salary of employees who have at least one person reporting to them. So we are effectively looking for managers only. In the partially written SELECT statement, the WHERE clause will work as it is. It is simply testing for the existence of a row in the subquery.

```
SELECT (enter columns here)
FROM (enter table name here) outer
WHERE 'x' IN (SELECT 'x'
               FROM (enter table name here) inner
               WHERE inner(enter column name here) = inner(enter column name here))
Finish off the statement by sorting the rows on the department_id column.
```

4. Using a WITH clause, write a SELECT statement to list the job_title of those jobs whose maximum salary is more than half the maximum salary of the entire company. Name your subquery MAX_CALC_SAL. Name the columns in the result JOB_TITLE and JOB_TOTAL, and sort the result on JOB_TOTAL in descending order.

Hint: Examine the jobs table. You will need to join JOBS and EMPLOYEES to display the job_title.

Summarizing Queries for practice

INSERT Statements

**Students should execute DESC tablename before doing INSERT to view the data types for each column.
VARCHAR2 data-type entries need single quotation marks in the VALUES statement.**

1. Give two examples of why it is important to be able to alter the data in a database.

2. DJs on Demand just purchased four new CDs. Use an explicit INSERT statement to add each CD to the copy_d_cds table. After completing the entries, execute a SELECT * statement to verify your work.

CD_NUMBER	TITLE	PRODUCER	YEAR
97	Celebrate the Day	R&B Inc.	2003
98	Holiday Tunes for All Ages	Tunes are Us	2004
99	Party Music	Old Town Records	2004
100	Best of Rock and Roll	Old Town Records	2004

3. DJs on Demand has two new events coming up. One event is a fall football party and the other event is a sixties theme party. The DJs on Demand clients requested the songs shown in the table for their events. Add these songs to the copy_d_songs table using an implicit INSERT statement.

ID	TITLE	DURATION	TYPE_CODE
52	Surfing Summer	Not known	12
53	Victory Victory	5 min	12

4. Add the two new clients to the copy_d_clients table. Use either an implicit or an explicit INSERT.

CLIENT_NUMBER	FIRST_NAME	LAST_NAME	PHONE	EMAIL
6655	Ayako	Dahish	3608859030	dahisha@harbor.net
6689	Nick	Neuville	9048953049	nnicky@charter.net

5. Add the new client's events to the copy_d_events table. The cost of each event has not been

determined at this date.

ID	NAME	EVENT_DATE	DESCRIPTION	COST	VENUE_ID	PACKAGE_CODE	THEME_CODE	CLIENT_NUMBER
110	Ayako Anniversary	07-Jul-2004	Party for 50, sixties dress, decorations	245	79	240	6655	
115	Neuville Sports Banquet	09-Sep-2004	Barbecue at residence, college alumni, 100 people	315	87	340	6689	

6. Create a table called rep_email using the following statement:

```
CREATE TABLE rep_email ( id NUMBER(3) CONSTRAINT rel_id_pk PRIMARY KEY, first_name  
VARCHAR2(10), last_name VARCHAR2(10), email_address VARCHAR2(10))
```

Populate this table by running a query on the employees table that includes only those employees who are REP's.

Updating Column Values and Deleting Rows

NOTE: Copy tables in this section do not yet exist; students must create them.

If any change is not possible, give an explanation as to why it is not possible.

1. Monique Tuttle, the manager of Global Fast Foods, sent a memo requesting an immediate change in prices. The price for a strawberry shake will be raised from \$3.59 to \$3.75, and the price for fries will increase to \$1.20. Make these changes to the `copy_f_food_items` table.

2. Bob Miller and Sue Doe have been outstanding employees at Global Fast Foods. Management has decided to reward them by increasing their overtime pay. Bob Miller will receive an additional \$0.75 per hour and Sue Doe will receive an additional \$0.85 per hour. Update the `copy_f_staffs` table to show these new values. (Note: Bob Miller currently doesn't get overtime pay. What function do you need to use to convert a null value to 0?)

3. Add the orders shown to the Global Fast Foods copy_f_orders table:

ORDER_NUMBER	ORDER_DATE	ORDER_TOTAL	CUST_ID	STAFF_ID
5680	June 12, 2004	159.78	145	9
5691	09-23-2004	145.98	225	12
5701	July 4, 2004	229.31	230	12

4. Add the new customers shown below to the copy_f_customers table. You may already have added Katie Hernandez. Will you be able to add all these records successfully?

ID	FIRST_NAME	LAST_NAME	ADDRESS	CITY	STATE	ZIP	PHONE_NUMBER
145	Katie	Hernandez	92 Chico Way	Los Angeles	CA	98008	8586667641
225	Daniel	Spode	1923 Silverado	Denver	CO	80219	7193343523
230	Adam	Zurn	5 Admiral Way	Seattle	WA		4258879009

5. Sue Doe has been an outstanding Global Foods staff member and has been given a salary raise. She will now be paid the same as Bob Miller. Update her record in copy_f_staffs.

6. Global Fast Foods is expanding their staff. The manager, Monique Tuttle, has hired Kai Kim. Not all information is available at this time, but add the information shown at right.

ID	FIRST_NAME	LAST_NAME	BIRTHDATE	SALARY	STAFF TYPE
25	Kai	Kim	3-Nov-1988	6.75	Order Taker

7. Now that all the information is available for Kai Kim, update his Global Fast Foods record to include the following: Kai will have the same manager as Sue Doe. He does not qualify for overtime. Leave the values for training, manager budget, and manager target as null.

8. Execute the following SQL statement. Record your results.

```
DELETE from departments  
WHERE department_id = 60;
```

9. Kim Kai has decided to go back to college and does not have the time to work and go to school. Delete him from the Global Fast Foods staff. Verify that the change was made.

10. Create a copy of the employees table and call it lesson7_emp;

Once this table exists, write a correlated delete statement that will delete any employees from the lesson7_employees table that also exist in the job_history table.

DEFAULT Values, MERGE, and Multi-Table Inserts

1. When would you want a DEFAULT value?
 2. Currently, the Global Foods F_PROMOTIONAL_MENU table START_DATE column does not have SYSDATE set as DEFAULT. Your manager has decided she would like to be able to set the starting date of promotions to the current day for some entries. This will require three steps:
 - a. In your schema, Make a copy of the Global Foods F_PROMOTIONAL_MENU table using the following SQL statement:
 - b. Alter the current START_DATE column attributes using:
 - c. INSERT the new information and check to verify the results.
 3. INSERT a new row into the copy_f_promotional_menus table for the manager's new promotion. The promotion code is 120. The name of the promotion is 'New Customer.' Enter DEFAULT for the start date and '01-Jun-2005' for the ending date. The giveaway is a 10% discount coupon. What was the correct syntax used?
 3. Allison Plumb, the event planning manager for DJs on Demand, has just given you the following list of CDs she acquired from a company going out of business. She wants a new updated list of CDs in inventory in an hour, but she doesn't want the original D_CDS table changed. Prepare an updated inventory list just for her.
 - a. Assign new cd_numbers to each new CD acquired.
 - b. Create a copy of the D_CDS table called manager_copy_d_cds. What was the correct syntax used?

one example or use this data:

20, 'Hello World Here I Am', 'Middle Earth Records', '1998' What was the correct syntax used?

d. Use a merge statement to add to the manager_copy_d_cds table, the CDs from the original table. If there is a match, update the title and year. If not, insert the data from the original table. What was the correct syntax used?

4. Run the following 3 statements to create 3 new tables for use in a Multi-table insert statement. All 3 tables should be empty on creation, hence the WHERE 1=2 condition in the WHERE clause.

```
CREATE TABLE sal_history (employee_id, hire_date, salary) AS  
SELECT employee_id, hire_date, salary  
FROM employees  
WHERE 1=2;  
CREATE TABLE mgr_history (employee_id, manager_id, salary)  
AS SELECT employee_id, manager_id, salary  
FROM employees  
WHERE 1=2;  
CREATE TABLE special_sal (employee_id, salary) AS  
SELECT employee_id, salary  
FROM employees  
WHERE 1=2;
```

Once the tables exist in your account, write a Multi-Table insert statement to first select the employee_id, hire_date, salary, and manager_id of all employees. If the salary is more than 20000 insert the employee_id and salary into the special_sal table. Insert the details of employee_id, hire_date, and salary into the sal_history table. Insert the employee_id, manager_id, and salary into the mgr_history table.

You should get a message back saying 39 rows were inserted. Verify you get this message and verify you have the following number of rows in each table:

Sal_history: 19 rows
Mgr_history: 19 rows
Special_sal: 1

Creating Tables

1. Complete the GRADUATE CANDIDATE table instance chart. Credits is a foreign-key column referencing the requirements table.

2. Write the syntax to create the grad_candidates table.

3. Confirm creation of the table using DESCRIBE.

4. Create a new table using a subquery. Name the new table your last name – e.g., smith_table. Using a subquery, copy grad_candidates into smith_table.

5. Insert your personal data into the table created in question 4.

6. Query the data dictionary for each of the following:
 - USER_TABLES
 - USER_OBJECTS
 - USER_CATALOG or USER_CAT

In separate sentences, summarize what each query will return.

Modifying a Table

Before beginning the practice exercises, execute a DESCRIBE for each of the following tables: o_employees and o_jobs. These tables will be used in the exercises. You will need to know which columns do not allow null values.

NOTE: If students have not already created the o_employees, o_departments, and o_jobs tables they should create them using the four steps outlined in the practice.

1. Create the three o_tables – jobs, employees, and departments – using the syntax:
 2. Add the Human Resources job to the jobs table:
 3. Add the three new employees to the employees table:
 4. Add Human Resources to the departments table:
 5. Why is it important to be able to modify a table?
-
1. CREATE a table called Artists.
 - a. Add the following to the table:
 - artist ID
 - first name
 - last name
 - band name
 - email
 - hourly rate
 - song ID from d_songs table
 - b. INSERT one artist from the d_songs table.
 - c. INSERT one artist of your own choosing; leave song_id blank.
 - d. Give an example how each of the following may be used on the table that you have created:
 - 1) ALTER TABLE
 - 2) DROP TABLE
 - 3) RENAME TABLE
 - 4) TRUNCATE
 - 5) COMMENT ON TABLE
 - a. Explain to students how you want the DJs on Demand artist's table assignment to be completed. Students should be able to list the term followed by the SQL statement they used. For example:
 2. In your o_employees table, enter a new column called "Termination." The datatype for the new column should be VARCHAR2. Set the DEFAULT for this column as SYSDATE to appear as character data in the format: February 20th, 2003.
 3. Create a new column in the o_employees table called start_date. Use the TIMESTAMP WITH LOCAL TIME ZONE as the datatype.

4. Truncate the o_jobs table. Then do a SELECT * statement. Are the columns still there? Is the data still there?

5. What is the distinction between TRUNCATE, DELETE, and DROP for tables?

6. List the changes that can and cannot be made to a column.

7. Add the following comment to the o_jobs table:

"New job description added"

View the data dictionary to view your comments.

8. Rename the o_jobs table to o_job_description.

9.F_staffs table exercises:

A. Create a copy of the f_staffs table called copy_f_staffs and use this copy table for the remaining labs in this lesson.

B.Describe the new table to make sure it exists.

C.Drop the table.

D.Try to select from the table.

E.Investigate your recyclebin to see where the table went.

a. Try to select from the dropped table by using the value stored in the OBJECT_NAME column. You will need to copy and paste the name as it is exactly, and enclose the new name in " " (double quotes). So if the dropped name returned to you is BIN\$Q+x1nJdcUnngQESYELVIdQ==\$0, you need to write a query that refers to "BIN\$Q+x1nJdcUnngQESYELVIdQ==\$0".

b. Undrop the table.

c. Describe the table.

11. Still working with the copy_f_staffs table, perform an update on the table.

a. Issue a select statement to see all rows and all columns from the copy_f_staffs table;

b. Change the salary for Sue Doe to 12 and commit the change.

c. Issue a select statement to see all rows and all columns from the copy_f_staffs table;

- d. For Sue Doe, update the salary to 2 and commit the change.
- e. Issue a select statement to see all rows and all columns from the copy_f_staffs table;
- f. Now, issue a FLASHBACK QUERY statement against the copy_f_staffs table, so you can see all the changes made.
- g. Investigate the result of f), and find the original salary and update the copy_f_staffs table salary column for Sue Doe back to her original salary.

Evaluation Procedure	Marks awarded
Practice Evaluation (5)	
Viva(5)	
Total (10)	
Faculty Signature	

EXERCISE 12

Intro to Constraints; NOT NULL and UNIQUE Constraints

Global Fast Foods has been very successful this past year and has opened several new stores. They need to add a table to their database to store information about each of their store's locations. The owners want to make sure that all entries have an identification number, date opened, address, and city and that no other entry in the table can have the same email address. Based on this information, answer the following questions about the global_locations table. Use the table for your answers.

Global Fast Foods global_locations Table						
NAME	TYPE	LENGTH	PRECISION	SCALE	NULLABLE	DEFAULT
Id						
name						
date_opened						
address						
city						
zip/postal code						
phone						
email						
manager_id						
Emergency contact						

1. What is a “constraint” as it relates to data integrity?

A “constraint” in data integrity refers to a rule enforced by a database to ensure the accuracy, consistency, and reliability of the data stored within it.

2. What are the limitations of constraints that may be applied at the column level and at the table level?

Column-level constraints apply to a single column, while table-level constraints can span multiple columns. The main limitation is that column-level constraints cannot enforce rules involving multiple columns.

3. Why is it important to give meaningful names to constraints?

Giving meaningful names to constraints improves clarity, maintainability, and debugging in database systems. It helps developers and DBAs quickly understand the purpose of each constraint and resolve issues efficiently.

4. Based on the information provided by the owners, choose a datatype for each column. Indicate the length, precision, and scale for each NUMBER datatype.

Customer_ID NUMBER(6)

Purchase_Amount NUMBER(10,2)

5. Use “(nullable)” to indicate those columns that can have null values.

Emp_ID NUMBER(6) NOT NULL,
First_Name VARCHAR2(30) NOT NULL,
Last_Name VARCHAR2(30) NOT NULL,
Email VARCHAR2(50),

6. Write the CREATE TABLE statement for the Global Fast Foods locations table to define the constraints at the column level.

```
create table GLOBAL_LOCATIONS (id number(6) not null , name varchar2(50) not null,date_opened DATE NOT NULL,address varchar2(100) not null,city varchar2(30) not null,zip_postal_code varchar2(10),phone varchar2(15) ,email varchar2(100) unique ,manager_id number(6),emergency_contact varchar2(50));
```

Table created.

0.02 seconds

7. Execute the CREATE TABLE statement in Oracle Application Express.

Table created.

0.02 seconds

8. Execute a DESCRIBE command to view the Table Summary information.

```
desc global_locations
```

Results	Explain	Describe	Saved SQL	History						
Object Type		TABLE	Object	GLOBAL_LOCATIONS						
Table		Column	Data Type	Length	Precision	Scale	Primary Key	Nullable	Default	Comment
GLOBAL_LOCATIONS	ID		NUMBER	-	6	0	-	-	-	-
	NAME		VARCHAR2	50	-	-	-	-	-	-
	DATE_OPENED		DATE	7	-	-	-	-	-	-
	ADDRESS		VARCHAR2	100	-	-	-	-	-	-
	CITY		VARCHAR2	30	-	-	-	-	-	-

9. Rewrite the CREATE TABLE statement for the Global Fast Foods locations table to define the UNIQUE constraints at the table level. Do not execute this statement.

NAME	TYPE	LENGTH	PRECISION	SCALE	NULLABLE	DEFAULT
id	number	4				
loc_name	varchar2	20			X	
	date					
address	varchar2	30				
city	varchar2	20				
zip_postal	varchar2	20			X	
phone	varchar2	15			X	
email	varchar2	80			X	
manager_id	number	4			X	
contact	varchar2	40			X	

PRIMARY KEY, FOREIGN KEY, and CHECK Constraints

1. What is the purpose of a
 - PRIMARY KEY
 - FOREIGN KEY
 - CHECK CONSTRAINT
2. Using the column information for the animals table below, name constraints where applicable at the table level, otherwise name them at the column level. Define the primary key (animal_id). The license_tag_number must be unique. The admit_date and vaccination_date columns cannot contain null values.

```
animal_id NUMBER(6)
name VARCHAR2(25)
license_tag_number NUMBER(10)
admit_date DATE
adoption_id NUMBER(5),
vaccination_date DATE
```

3. Create the animals table. Write the syntax you will use to create the table.
4. Enter one row into the table. Execute a SELECT * statement to verify your input. Refer to the graphic below for input.

ANIMAL_ID	NAM E	LICENSE_TAG_NUMBE R	ADMIT_DATE	ADOPTION_I D	VACCINATION_DATE
101	Spot	35540	10-Oct-2004	205	12-Oct-2004

5. Write the syntax to create a foreign key (adoption_id) in the animals table that has a corresponding primary-key reference in the adoptions table. Show both the column-level and table-level syntax. Note that because you have not actually created an adoptions table, no adoption_id primary key exists, so the foreign key cannot be added to the animals table.

6. What is the effect of setting the foreign key in the ANIMAL table as:

- a. ON DELETE CASCADE
- b. ON DELETE SET NULL

7. What are the restrictions on defining a CHECK constraint?

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

PRACTICE PROBLEM

Managing Constraints

Using Oracle Application Express, click the SQL Workshop tab in the menu bar. Click the Object Browser and verify that you have a table named copy_d_clients and a table named copy_d_events. If you don't have these tables in your schema, create them before completing the exercises below. Here is how the original tables are related. The d_clients table has a primary key client_number. This has a primary-key constraint and it is referenced in the foreign-key constraint on the d_events table.

NOTE: The practice exercises use the d_clients and d_events tables in the DJs on Demand database. Students will work with copies of these two tables named copy_d_clients and copy_d_events. Make sure they have new copies of the tables (without changes made from previous exercises). Remember, tables copied using a subquery do not have the integrity constraints as established in the original tables. When using the SELECT statement to view the constraint name, the tablename must be all capital letters.

1. What are four functions that an ALTER statement can perform on constraints?

2. Since the tables are copies of the original tables, the integrity rules are not passed onto the new tables; only the column datatype definitions remain. You will need to add a PRIMARY KEY constraint to the copy_d_clients table. Name the primary key copy_d_clients_pk . What is the syntax you used to create the PRIMARY KEY constraint to the copy_d_clients.table?

3. Create a FOREIGN KEY constraint in the copy_d_events table. Name the foreign key copy_d_events_fk. This key references the copy_d_clients table client_number column. What is the syntax you used to create the FOREIGN KEY constraint in the copy_d_events table?

4. Use a SELECT statement to verify the constraint names for each of the tables. Note that the tablename must be capitalized.
 - a. The constraint name for the primary key in the copy_d_clients table is_____.

5. Drop the PRIMARY KEY constraint on the copy_d_clients table. Explain your results.

6. Add the following event to the copy_d_events table. Explain your results.

ID	NAME	EVENT_DATE	DESCRIPTION	COST	VENUE_ID	PACKAGE_CODE	THEME_CODE	CLIENT_NUMBER
140	Cline Bas Mitzvah	15-Jul-2004	Church and Private Home formal	4500	105	87	77	7125

7. Create an ALTER TABLE query to disable the primary key in the copy_d_clients table. Then add the values from #6 to the copy_d_events table. Explain your results.

8. Repeat question 6: Insert the new values in the copy_d_events table. Explain your results.

9. Enable the primary-key constraint in the copy_d_clients table. Explain your results.

10. If you wanted to enable the foreign-key column and reestablish the referential integrity between these two tables, what must be done?

11. Why might you want to disable and then re-enable a constraint?

12. Query the data dictionary for some of the constraints that you have created. How does the data dictionary identify each constraint type?

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

EXERCISE 13

Creating Views

1. What are three uses for a view from a DBA's perspective?

- ❖ Security and Access Control
- ❖ Simplifying Complex Queries.
- ❖ Data Abstraction and Schema Evolution

2. Create a simple view called view_d_songs that contains the ID, title and artist from the DJs on Demand table for each "New Age" type code. In the subquery, use the alias "Song Title" for the title column.

```
create view view_d_songs as select id ,title as "Song Title" , artist  
from djs  
where type_code='New Age';
```

The screenshot shows a dark-themed database interface with a navigation bar at the top featuring tabs for 'Results', 'Explain', 'Describe', 'Saved SQL', and 'History'. The 'Results' tab is selected. Below the navigation bar, the text 'View created.' is displayed, followed by '0.04 seconds' indicating the execution time. The main area of the window is currently empty, suggesting no data has been retrieved from the newly created view.

3. SELECT * FROM view_d_songs. What was returned?

The screenshot shows a dark-themed database interface with a navigation bar at the top featuring tabs for 'Results', 'Explain', 'Describe', 'Saved SQL', and 'History'. The 'Results' tab is selected. Below the navigation bar, a table is displayed with four columns: 'Song ID', 'Song Title', 'Artist name', and 'type code'. Two rows of data are shown: one row where Song ID is 1, Song Title is 'The Depth', Artist name is 'Vishal', and type code is 'New Age'; and another row where Song ID is 4, Song Title is 'End Chase', Artist name is 'Jai', and type code is 'Old Age'. At the bottom of the table, it says '2 rows returned in 0.02 seconds' and there is a 'Download' link.

Song ID	Song Title	Artist name	type code
1	The Depth	Vishal	New Age
4	End Chase	Jai	Old Age

4. REPLACE view_d_songs. Add type_code to the column list. Use aliases for all columns.

```
create or REPLACE VIEW view_d_songs AS  
SELECT  
    id AS "Song ID",  
    title AS "Song Title",  
    artist AS "Artist name",  
    type_code AS "type code"  
FROM djs;
```

Results Explain Describe Saved SQL History

View created.

0.04 seconds

5. Jason Tsang, the disk jockey for DJs on Demand, needs a list of the past events and those planned for the coming months so he can make arrangements for each event's equipment setup. As the company manager, you do not want him to have access to the price that clients paid for their events. Create a view for Jason to use that displays the name of the event, the event date, and the theme description. Use aliases for each column name.

```
CREATE VIEW dj_event_schedule AS
SELECT
    event_name AS "Event Name",
    event_date AS "Event Date",
    theme_description AS "Theme"
FROM
    events;
```

Results	Explain	Describe	Saved SQL
Event Name	Event Date	Theme	
Minacle Theatre	2018-06-24	A formal corporate gathering	
Saz Twin Wedding	2020-02-29	Traditional wedding	
Mordella Rock Fest	2027-10-31	A classic rock concert	

6. It is company policy that only upper-level management be allowed access to individual employee salaries. The department managers, however, need to know the minimum, maximum, and average salaries, grouped by department. Use the Oracle database to prepare a view that displays the needed information for department managers.

```
SELECT
    DEPARTMENT_NUM AS "Department ID",
    MIN(salary) AS "Minimum Salary",
    MAX(salary) AS "Maximum Salary"
FROM my_emp
GROUP BY DEPARTMENT_NUM;
```

Results Explain Describe Saved SQL History

Department ID	Minimum Salary	Maximum Salary
20	7000	7000
50	9000	9000
38	10000	10000
80	20000	20000

DML Operations and Views

Use the DESCRIBE statement to verify that you have tables named copy_d_songs, copy_d_events, copy_d_cds, and copy_d_clients in your schema. If you don't, write a query to create a copy of each.

1. Query the data dictionary USER_UPDATABLE_COLUMNS to make sure the columns in the base tables will allow UPDATE, INSERT, or DELETE. All table names in the data dictionary are stored in uppercase.

Use the same syntax but change table_name of the other tables.

2. Use the CREATE or REPLACE option to create a view of *all* the columns in the copy_d_songs table called view_copy_d_songs.

3. Use view_copy_d_songs to INSERT the following data into the underlying copy_d_songs table. Execute a SELECT * from copy_d_songs to verify your DML command. See the graphic.

ID	TITLE	DURATION	ARTIST	TYPE_CODE
88	Mello Jello	2	The What	4

4. Create a view based on the DJs on Demand COPY_D_CDS table. Name the view read_copy_d_cds. Select all columns to be included in the view. Add a WHERE clause to restrict the year to 2000. Add the WITH READ ONLY option.

5. Using the read_copy_d_cds view, execute a DELETE FROM read_copy_d_cds WHERE cd_number = 90;

6. Use REPLACE to modify read_copy_d_cds. Replace the READ ONLY option with WITH CHECK OPTION CONSTRAINT ck_read_copy_d_cds. Execute a SELECT * statement to verify that the view exists.

7. Use the read_copy_d_cds view to delete any CD of year 2000 from the underlying copy_d_cds.

8. Use the read_copy_d_cds view to delete cd_number 90 from the underlying copy_d_cds table.

9. Use the read_copy_d_cds view to delete year 2001 records.

10. Execute a SELECT * statement for the base table copy_d_cds. What rows were deleted?

11.What are the restrictions on modifying data through a view?

12. What is Moore's Law? Do you consider that it will continue to apply indefinitely? Support your opinion with research from the internet.

13. What is the “singularity” in terms of computing?

Managing Views

1. Create a view from the copy_d_songs table called view_copy_d_songs that includes only the title and artist. Execute a SELECT * statement to verify that the view exists.
 2. Issue a DROP view_copy_d_songs. Execute a SELECT * statement to verify that the view has been deleted.
 3. Create a query that selects the last name and salary from the Oracle database. Rank the salaries from highest to lowest for the top three employees.
 4. Construct an inline view from the Oracle database that lists the last name, salary, department ID, and maximum salary for each department. Hint: One query will need to calculate maximum salary by department ID.
 5. Create a query that will return the staff members of Global Fast Foods ranked by salary from lowest to highest.

Indexes and Synonyms

1. What is an index and what is it used for?

2. What is a ROWID, and how is it used?

3. When will an index be created automatically?

4. Create a nonunique index (foreign key) for the DJs on Demand column (cd_number) in the D_TRACK_LISTINGS table. Use the Oracle Application Express SQL Workshop Data Browser to confirm that the index was created.

5. Use the join statement to display the indexes and uniqueness that exist in the data dictionary for the DJs on Demand D_SONGS table.

6. Use a SELECT statement to display the index_name, table_name, and uniqueness from the data dictionary USER_INDEXES for the DJs on Demand D_EVENTS table.

7. Write a query to create a synonym called dj_tracks for the DJs on Demand d_track_listings table.

8. Create a function-based index for the last_name column in DJs on Demand D_PARTNERS table that makes it possible not to have to capitalize the table name for searches. Write a SELECT statement that would use this index.

9. Create a synonym for the D_TRACK_LISTINGS table. Confirm that it has been created by querying the data dictionary.

10. Drop the synonym that you created in question

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

EXERCISE-14

OTHER DATABASE OBJECTS

Objectives

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

- Create, maintain, and use sequences
- Create and maintain indexes

Database Objects

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

What Is a Sequence?

A sequence:

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

The CREATE SEQUENCE Statement Syntax

Define a sequence to generate sequential numbers automatically:

```
CREATE SEQUENCE sequence
[INCREMENT BY n]
[START WITH n]
[{:MAXVALUE n | NOMAXVALUE}]
[{:MINVALUE n | NOMINVALUE}]
[{:CYCLE | NOCYCLE}]
[{:CACHE n | NOCACHE}];
```

In the syntax:

sequence is the name of the sequence generator

INCREMENT BY *n* specifies the interval between sequence numbers where *n* is an integer (If this clause is omitted, the sequence increments by 1.)

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

MAXVALUE *n* specifies the maximum value the sequence can generate

NOMAXVALUE specifies a maximum value of 10^{27} for an ascending sequence and -1 for a descending sequence (This is the default option.)

MINVALUE *n* specifies the minimum sequence value

NOMINVALUE specifies a minimum value of 1 for an ascending sequence and $-(10^{26})$ for a descending sequence (This is the default option.)

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

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

Creating a Sequence

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

EXAMPLE:

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

Confirming Sequences

- Verify your sequence values in the USER_SEQUENCES data dictionary table.
- The LAST_NUMBER column displays the next available sequence number if NOCACHE is specified.

EXAMPLE:

```
SELECT sequence_name, min_value, max_value, increment_by, last_number
```

NEXTVAL and CURRVAL Pseudocolumns

- NEXTVAL returns the next available sequence value. It returns a unique value every time it is referenced, even for different users.
- CURRVAL obtains the current sequence value.
- NEXTVAL must be issued for that sequence before CURRVAL contains a value.

Rules for Using NEXTVAL and CURRVAL

You can use NEXTVAL and CURRVAL in the following contexts:

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

You cannot use NEXTVAL and CURRVAL in the following contexts:

- The SELECT list of a view
- A SELECT statement with the DISTINCT keyword

- A SELECT statement with GROUP BY, HAVING, or ORDER BY clauses
- A subquery in a SELECT, DELETE, or UPDATE statement
- The DEFAULT expression in a CREATE TABLE or ALTER TABLE statement

Using a Sequence

- Insert a new department named “Support” in location ID 2500.
- View the current value for the DEPT_DEPTID_SEQ sequence.

EXAMPLE:

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

```
SELECT dept_deptid_seq.CURRVAL FROM dual;
```

The example inserts a new department in the DEPARTMENTS table. It uses the DEPT_DEPTID_SEQ sequence for generating a new department number as follows:

You can view the current value of the sequence:

```
SELECT dept_deptid_seq.CURRVAL FROM dual;
```

Removing a Sequence

- Remove a sequence from the data dictionary by using the DROP SEQUENCE statement.
- Once removed, the sequence can no longer be referenced.

EXAMPLE:

```
DROP SEQUENCE dept_deptid_seq;
```

What is an Index?

An index:

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

How Are Indexes Created?

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

Types of Indexes

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

The other type of index is a nonunique index, which a user can create. For example, you can create a FOREIGN KEY column index for a join in a query to improve retrieval speed.

Creating an Index

- Create an index on one or more columns.
- Improve the speed of query access to the LAST_NAME column in the EMPLOYEES table.

```
CREATE INDEX index
ON table (column[, column]...);
```

EXAMPLE:

```
CREATE INDEX emp_last_name_idx
ON employees(last_name);
```

In the syntax:

index is the name of the index

table is the name of the table

column is the name of the column in the table to be indexed

When to Create an Index

You should create an index if:

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

When Not to Create an Index

It is usually not worth creating an index if:

- The table is small
- The columns are not often used as a condition in the query
- Most queries are expected to retrieve more than 2 to 4 percent of the rows in the table
- The table is updated frequently
- The indexed columns are referenced as part of an Expression

Confirming Indexes

- The USER_INDEXES data dictionary view contains the name of the index and its uniqueness.
- The USER_IND_COLUMNS view contains the index name, the table name, and the column name.

EXAMPLE:

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

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
    START WITH 200
    INCREMENT BY 10
    MAXVALUE 1000
    NOCACHE
    NOCYCLE;
```

Results	Explain	Saved SQL
Sequence created.		
0.03 seconds		

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

```
SELECT
    sequence_name,
    max_value,
    increment_by AS increment_size,
    last_number
FROM
    user_sequences;
```

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

```
INSERT INTO dept (id, dept_name)
VALUES (dept_seq.NEXTVAL, 'Education');
```

```
INSERT INTO dept (id, dept_name)
VALUES (dept_seq.NEXTVAL, 'Administration');
```

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
    index_name,
    uniqueness
FROM
    user_indexes
WHERE
    table_name = 'EMP';
```

Results	Explain	Saved
INDEX_NAME	UNIQUENESS	
PK_EMP	UNIQUE	
EMP_DEPT_IDX	NONUNIQUE	
EMP_JOB_IDX	NONUNIQUE	

EXERCISE-15

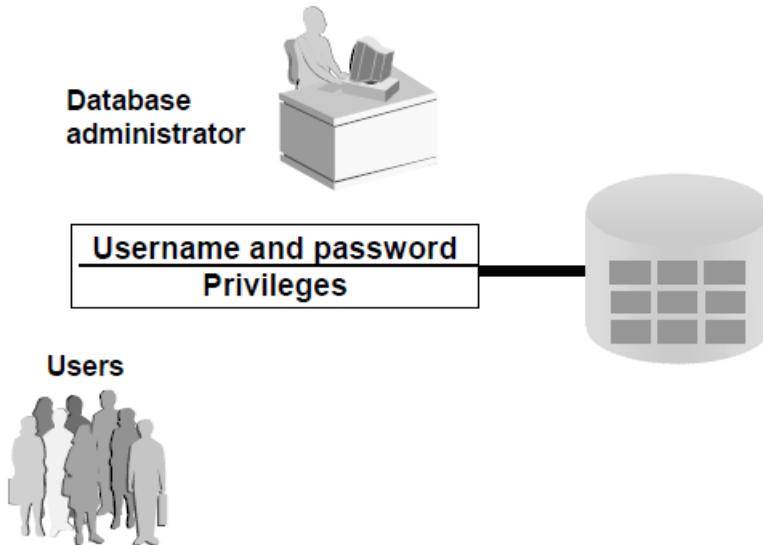
Controlling User Access

Objectives

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

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

Controlling User Access



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 change your password by using the

ALTER USER statement.

```
ALTER USER scott
IDENTIFIED BY lion;
User altered.
```

Object Privileges

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

Object Privileges

- Object privileges vary from object to object.
- An owner has all the privileges on the object.

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

GRANT *object_priv* [(*columns*)]

ON *object*

TO {*user|role|PUBLIC*}

[WITH GRANT OPTION];

In the syntax:

object_priv is an object privilege to be granted

ALL specifies all object privileges

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

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

TO identifies to whom the privilege is granted

PUBLIC grants object privileges to all users

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

Granting Object Privileges

- Grant query privileges on the EMPLOYEES table.
- Grant privileges to update specific columns to users and roles.

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

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

Using the WITH GRANT OPTION and PUBLIC Keywords

- Give a user authority to pass along privileges.
- Allow all users on the system to query data from Alice's DEPARTMENTS table.

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

```
GRANT select  
ON alice.departments  
TO PUBLIC;
```

How to Revoke Object Privileges

- You use the REVOKE statement to revoke privileges granted to other users.
- Privileges granted to others through the WITH GRANT OPTION clause are also revoked.

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

In the syntax:

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

Revoking Object Privileges

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

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

Find the Solution for the following:

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

GRANT CREATE SESSION TO username;

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

GRANT CREATE TABLE TO username;

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

GRANT SELECT ON employees TO user_b WITH GRANT OPTION;

One who owns

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?

A **role** is a named group of privileges that can be granted to users — it simplifies user management.

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 user_b;

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 (510, 'Human Resources');**

COMMIT;

GRANT SELECT ON departments TO team1;

SELECT * FROM team1.departments;

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

```
SELECT table_name, tablespace_name, num_rows, status  
FROM user_tables;
```

10. Revoke the SELECT privilege on your table from the other team.
REVOKE SELECT ON departments FROM team2;

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;

<u>Evaluation Procedure</u>	<u>Marks awarded</u>
<u>Practice Evaluation (5)</u>	
<u>Viva(5)</u>	
<u>Total (10)</u>	
<u>Faculty Signature</u>	

PL/SQL

PL/SQL

Control Structures

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

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

BRANCHING in PL/SQL:

Sequence of statements can be executed on satisfying certain condition .

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

1.Simple IF

2.ELSIF

3.ELSE IF

SIMPLE IF:

Syntax:

IF condition THEN

 statement1;

 statement2;

END IF;

IF-THEN-ELSE STATEMENT:

Syntax:

IF condition THEN

 statement1;

ELSE

 statement2;

END IF;

ELSIF STATEMENTS:

Syntax:

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

NESTED IF :

Syntax:

```
IF condition THEN  
    statement1;  
  
ELSE  
    IF condition THEN  
        statement2;  
  
    ELSE  
        statement3;  
  
    END IF;  
  
END IF;  
  
ELSE  
    statement3;  
  
END IF;
```

SELECTION IN PL/SQL(Sequential Controls)

SIMPLE CASE

Syntax:

CASE SELECTOR

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

SEARCHED CASE:

```
CASE  
    WHEN searchcondition1 THEN statement1;  
    WHEN searchcondition2 THEN statement2;  
    :  
    :  
ELSE  
    statementn;  
END CASE;
```

ITERATIONS IN PL/SQL

Sequence of statements can be executed any number of times using loop construct.

It is broadly classified into:

- Simple Loop
- For Loop
- While Loop

SIMPLE LOOP

Syntax:

```
LOOP  
    statement1;  
    EXIT [ WHEN Condition];  
END LOOP;
```

WHILE LOOP

Syntax:

WHILE condition LOOP

statement1;

statement2;

END LOOP;

FOR LOOP

Syntax:

FOR counter IN [REVERSE]

 LowerBound..UpperBound

LOOP

statement1;

statement2;

END LOOP;

PROGRAM 1

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    v_emp_id      employees.employee_id%TYPE := 110;
    v_salary      employees.salary%TYPE;
    v_incentive   NUMBER(10,2);
```

```
BEGIN
```

```
    SELECT salary
        INTO v_salary
       FROM employees
      WHERE employee_id = v_emp_id;
```

```
    v_incentive := v_salary * 0.10;
```

```
    DBMS_OUTPUT.PUT_LINE('Employee ID: ' || v_emp_id);
    DBMS_OUTPUT.PUT_LINE('Salary: ' || v_salary);
    DBMS_OUTPUT.PUT_LINE('Incentive: ' || v_incentive);
```

```
EXCEPTION
```

```
    WHEN NO_DATA_FOUND THEN
```

```
        DBMS_OUTPUT.PUT_LINE('Employee with ID ' || v_emp_id || ' not found.');
```

```
END;
```

```
/
```

PROGRAM 2

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    "MyVar" NUMBER := 100;
```

```
BEGIN
```

```
    DBMS_OUTPUT.PUT_LINE(MyVar);
```

```
    DBMS_OUTPUT.PUT_LINE("MyVar");
```

```
END;
```

```
/
```

PROGRAM 3

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

Sample table: employees

DECLARE

v_emp_id employees.employee_id%TYPE := 122;

v_salary employees.salary%TYPE;

BEGIN

SELECT salary

INTO v_salary

FROM employees

WHERE employee_id = v_emp_id;

UPDATE employees

SET salary = v_salary * 1.10

WHERE employee_id = v_emp_id;

DBMS_OUTPUT.PUT_LINE('Salary updated for employee ID ' || v_emp_id);

DBMS_OUTPUT.PUT_LINE('Old Salary: ' || v_salary);

DBMS_OUTPUT.PUT_LINE('New Salary: ' || v_salary * 1.10);

COMMIT;

EXCEPTION

WHEN NO_DATA_FOUND THEN

DBMS_OUTPUT.PUT_LINE('Employee with ID ' || v_emp_id || ' not found.');

```
END;
```

```
/
```

PROGRAM 4

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

```
SET SERVEROUTPUT ON;
```

```
CREATE OR REPLACE PROCEDURE check_conditions IS
```

```
    v_name  VARCHAR2(20) := 'John';
```

```
    v_bonus NUMBER := 1000;
```

```
BEGIN
```

```
    IF v_name IS NOT NULL AND v_bonus IS NOT NULL THEN
```

```
        DBMS_OUTPUT.PUT_LINE('Both conditions are TRUE — AND returns TRUE.');
```

```
    ELSE
```

```
        DBMS_OUTPUT.PUT_LINE('At least one condition is FALSE — AND returns FALSE.');
```

```
    END IF;
```

```
END;
```

```
/
```

```
BEGIN
```

```
    check_conditions;
```

```
END;
```

```
/
```

PROGRAM 5

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    v_name VARCHAR2(30);
```

```
BEGIN
```

```
    v_name := 'ALICE_01';
```

```
    IF v_name LIKE 'AL%' THEN
```

```
        DBMS_OUTPUT.PUT_LINE('Matched with % wildcard (starts with AL).');
```

```
    END IF;
```

```
    IF v_name LIKE 'ALICE_0_' THEN
```

```
        DBMS_OUTPUT.PUT_LINE('Matched with _ wildcard (exact character positions).');
```

```
    END IF;
```

```
    IF v_name LIKE 'ALICE\_%' ESCAPE '\' THEN
```

```
        DBMS_OUTPUT.PUT_LINE('Matched with ESCAPE (underscore treated as a normal character).');
```

```
    END IF;
```

```
END;
```

```
/
```

PROGRAM 6

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    num1 NUMBER := 45;
```

```
    num2 NUMBER := 20;
```

```
    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('Smaller Number: ' || num_small);
```

```
    DBMS_OUTPUT.PUT_LINE('Larger 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.

```
SET SERVEROUTPUT ON;
```

```
CREATE OR REPLACE PROCEDURE calc_incentive(p_emp_id NUMBER,  
p_target NUMBER) IS
```

```
    v_incentive NUMBER;  
  
    v_count    NUMBER;  
  
BEGIN  
  
    IF p_target >= 100000 THEN  
        v_incentive := 10000;  
  
    ELSIF p_target >= 50000 THEN  
        v_incentive := 5000;  
  
    ELSE  
        v_incentive := 1000;  
  
    END IF;
```

```
UPDATE employees  
SET commission_pct = v_incentive  
WHERE employee_id = p_emp_id;
```

```
v_count := SQL%ROWCOUNT;
```

```
IF v_count > 0 THEN
    DBMS_OUTPUT.PUT_LINE('Record updated successfully. Incentive = ' || v_incentive);
ELSE
    DBMS_OUTPUT.PUT_LINE('No record found for Employee ID ' || p_emp_id);
END IF;
```

```
COMMIT;
END;
/
```

```
BEGIN
calc_incentive(110, 75000);
END;
/
```

PROGRAM 8

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

SET SERVEROUTPUT ON;

```
CREATE OR REPLACE PROCEDURE calc_sale_incentive(p_emp_id NUMBER,  
p_sales NUMBER) IS
```

```
    v_incentive NUMBER;  
  
    v_count    NUMBER;  
  
BEGIN  
  
    IF p_sales >= 100000 THEN  
        v_incentive := 15000;  
  
    ELSIF p_sales >= 75000 THEN  
        v_incentive := 10000;  
  
    ELSIF p_sales >= 50000 THEN  
        v_incentive := 5000;  
  
    ELSE  
        v_incentive := 0;  
  
    END IF;
```

```
UPDATE employees  
SET commission_pct = v_incentive  
WHERE employee_id = p_emp_id;
```

```
v_count := SQL%ROWCOUNT;

IF v_count > 0 THEN
    DBMS_OUTPUT.PUT_LINE('Incentive calculated and record updated.
Incentive = ' || v_incentive);
ELSE
    DBMS_OUTPUT.PUT_LINE('No record found for Employee ID ' || p_emp_id);
END IF;

COMMIT;
END;
/

BEGIN
calc_sale_incentive(122, 85000);
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.

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    v_dept_id    NUMBER := 50;  
    v_emp_count  NUMBER;  
    v_vacancies  NUMBER := 45;
```

```
BEGIN
```

```
    SELECT COUNT(*)  
    INTO v_emp_count  
    FROM employees  
    WHERE department_id = v_dept_id;
```

```
    DBMS_OUTPUT.PUT_LINE('Number of employees in Department ' || v_dept_id  
    || ':' || v_emp_count);
```

```
    IF v_emp_count < v_vacancies THEN
```

```
        DBMS_OUTPUT.PUT_LINE('Department ' || v_dept_id || ' has vacancies.');
```

```
    ELSE
```

```
        DBMS_OUTPUT.PUT_LINE('Department ' || v_dept_id || ' has 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.

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    v_dept_id    NUMBER := &dept_id;
```

```
    v_emp_count  NUMBER;
```

```
    v_vacancies  NUMBER := 45;
```

```
    v_remaining   NUMBER;
```

```
BEGIN
```

```
    SELECT COUNT(*)
```

```
        INTO v_emp_count
```

```
        FROM employees
```

```
        WHERE department_id = v_dept_id;
```

```
    DBMS_OUTPUT.PUT_LINE('Number of employees in Department ' || v_dept_id  
    || ':' || v_emp_count);
```

```
    IF v_emp_count < v_vacancies THEN
```

```
        v_remaining := v_vacancies - v_emp_count;
```

```
        DBMS_OUTPUT.PUT_LINE('Department ' || v_dept_id || ' has ' || v_remaining  
        || ' vacancies.');
```

```
    ELSE
```

```
        DBMS_OUTPUT.PUT_LINE('Department ' || v_dept_id || ' has 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.

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    CURSOR emp_cur IS
        SELECT employee_id, first_name || ' ' || last_name AS full_name, job_id,
        hire_date, salary
        FROM employees;
        v_emp_rec emp_cur%ROWTYPE;
```

```
BEGIN
```

```
    OPEN emp_cur;
```

```
    LOOP
```

```
        FETCH emp_cur INTO v_emp_rec;
        EXIT WHEN emp_cur%NOTFOUND;
        DBMS_OUTPUT.PUT_LINE('ID: ' || v_emp_rec.employee_id ||
            ', Name: ' || v_emp_rec.full_name ||
            ', Job: ' || v_emp_rec.job_id ||
            ', Hire Date: ' || TO_CHAR(v_emp_rec.hire_date, 'DD-MON-
YYYY') ||
            ', Salary: ' || v_emp_rec.salary);
```

```
    END LOOP;
```

```
    CLOSE emp_cur;
```

```
END;
```

/

PROGRAM 12

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    CURSOR emp_cur IS
```

```
        SELECT e.employee_id,  
              e.first_name || ' ' || e.last_name AS full_name,  
              d.department_name
```

```
        FROM employees e
```

```
        JOIN departments d
```

```
        ON e.department_id = d.department_id;
```

```
    v_emp_rec emp_cur%ROWTYPE;
```

```
BEGIN
```

```
    OPEN emp_cur;
```

```
LOOP
```

```
    FETCH emp_cur INTO v_emp_rec;
```

```
    EXIT WHEN emp_cur%NOTFOUND;
```

```
    DBMS_OUTPUT.PUT_LINE('Employee ID: ' || v_emp_rec.employee_id ||  
                         ', Name: ' || v_emp_rec.full_name ||  
                         ', Department: ' || v_emp_rec.department_name);
```

```
END LOOP;
```

```
CLOSE emp_cur;
```

```
END;
```

/

PROGRAM 13

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    CURSOR job_cur IS
        SELECT job_id, job_title, min_salary
        FROM jobs;
        v_job_rec job_cur%ROWTYPE;
```

```
BEGIN
```

```
    OPEN job_cur;
```

```
    LOOP
```

```
        FETCH job_cur INTO v_job_rec;
        EXIT WHEN job_cur%NOTFOUND;
        DBMS_OUTPUT.PUT_LINE('Job ID: ' || v_job_rec.job_id ||
            ', Title: ' || v_job_rec.job_title ||
            ', Min Salary: ' || v_job_rec.min_salary);
```

```
    END LOOP;
```

```
    CLOSE job_cur;
```

```
END;
```

/

PROGRAM 14

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    CURSOR emp_hist_cur IS
```

```
        SELECT e.employee_id,  
              e.first_name || ' ' || e.last_name AS full_name,  
              jh.start_date
```

```
        FROM employees e
```

```
        JOIN job_history jh
```

```
        ON e.employee_id = jh.employee_id;
```

```
    v_emp_hist_rec emp_hist_cur%ROWTYPE;
```

```
BEGIN
```

```
    OPEN emp_hist_cur;
```

```
LOOP
```

```
    FETCH emp_hist_cur INTO v_emp_hist_rec;
```

```
    EXIT WHEN emp_hist_cur%NOTFOUND;
```

```
    DBMS_OUTPUT.PUT_LINE('Employee ID: ' || v_emp_hist_rec.employee_id ||
```

```
                      ', Name: ' || v_emp_hist_rec.full_name ||
```

```
                      ', Job History Start Date: ' ||
```

```
TO_CHAR(v_emp_hist_rec.start_date, 'DD-MON-YYYY'));
```

```
END LOOP;
```

```
CLOSE emp_hist_cur;
```

```
END;
```

```
/
```

PROGRAM 15

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

```
SET SERVEROUTPUT ON;
```

```
DECLARE
```

```
    CURSOR emp_hist_cur IS
        SELECT e.employee_id,
               e.first_name || ' ' || e.last_name AS full_name,
               jh.end_date
        FROM employees e
        JOIN job_history jh
          ON e.employee_id = jh.employee_id;
        v_emp_hist_rec emp_hist_cur%ROWTYPE;

    BEGIN
        OPEN emp_hist_cur;
        LOOP
            FETCH emp_hist_cur INTO v_emp_hist_rec;
            EXIT WHEN emp_hist_cur%NOTFOUND;
            DBMS_OUTPUT.PUT_LINE('Employee ID: ' || v_emp_hist_rec.employee_id ||
                ', Name: ' || v_emp_hist_rec.full_name ||
                ', Job History End Date: ' || TO_CHAR(v_emp_hist_rec.end_date, 'DD-MON-
YYYY'));
        END LOOP;
        CLOSE emp_hist_cur;
    END;
```

```
/
```

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

EXERCISE-16

PROCEDURES AND FUNCTIONS

PROCEDURES

DEFINITION

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

- Declarative part
- Executable part
- Optional exception handling part

These procedures and functions do not show the errors.

KEYWORDS AND THEIR PURPOSES

REPLACE: It recreates the procedure if it already exists.

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

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

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

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

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

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

PROCEDURES – SYNTAX

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

FUNCTIONS – SYNTAX

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

CREATING THE TABLE ‘ITITEMS’ AND DISPLAYING THE CONTENTS

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

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

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

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

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

103 4000 600 202

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

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

Procedure created.

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

```
SQL> select * from ititems;
ITEMID ACTUALPRICE     OR DID     PRO DID
-----     -----     -----     -----
 101        2500        500        201
 102        3000        1600        202
 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.

Program 1

FACTORIAL OF A NUMBER USING FUNCTION

```
SET SERVEROUTPUT ON;
```

```
CREATE OR REPLACE FUNCTION factorial(n NUMBER) RETURN NUMBER IS
    result NUMBER := 1;
BEGIN
    FOR i IN 1..n LOOP
        result := result * i;
    END LOOP;
    RETURN result;
END;
/
```

```
DECLARE
    v_num NUMBER := 5;
    v_fact NUMBER;
BEGIN
    v_fact := factorial(v_num);
    DBMS_OUTPUT.PUT_LINE('Factorial of ' || v_num || ' is ' || v_fact);
END;
/
```

Program 2

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

```
SET SERVEROUTPUT ON;
```

```
CREATE OR REPLACE PROCEDURE get_book_info(
    p_book_id IN NUMBER,
    p_title OUT VARCHAR2,
    p_author OUT VARCHAR2,
    p_price IN OUT NUMBER
) IS
BEGIN
    SELECT title, author, price
    INTO p_title, p_author, p_price
    FROM library
    WHERE book_id = p_book_id;

    p_price := p_price * 0.9;
END;
/
```

```
DECLARE
    v_book_id NUMBER := 101;
    v_title  VARCHAR2(100);
    v_author VARCHAR2(100);
    v_price  NUMBER := 0;
BEGIN
    get_book_info(v_book_id, v_title, v_author, v_price);
    DBMS_OUTPUT.PUT_LINE('Book ID: ' || v_book_id);
    DBMS_OUTPUT.PUT_LINE('Title: ' || v_title);
    DBMS_OUTPUT.PUT_LINE('Author: ' || v_author);
    DBMS_OUTPUT.PUT_LINE('Discounted Price: ' || v_price);
END;
/
```

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

EXERCISE-17

TRIGGER

DEFINITION

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

- **Trigger statement:** Specifies the DML statements and fires the trigger body. It also specifies the table to which the trigger is associated.
- **Trigger body or trigger action:** It is a PL/SQL block that is executed when the triggering statement is used.
- **Trigger restriction:** Restrictions on the trigger can be achieved

The different uses of triggers are as follows,

- *To generate data automatically*
- *To enforce complex integrity constraints*

- To customize complex securing authorizations
- To maintain the replicate table
- To audit data modifications

TYPES OF TRIGGERS

The various types of triggers are as follows,

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

VARIABLES USED IN TRIGGERS

- :new
- :old

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

SYNTAX

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

```
-----
-----
-----
```

```
exception
end;
```

USER DEFINED ERROR MESSAGE

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

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

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

The error message should be a character string.

TO CREATE THE TABLE ‘ITEMPLS’

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

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

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

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

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

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

```
SQL> create trigger ittrigg before insert or update or delete on itempls for each row
  2 begin
  3 raise_application_error(-20010,'You cannot do manipulation');
  4 end;
  5
  6 /
Trigger created.
```

```
SQL> insert into itempls values('aaa',14,34000);
insert into itempls values('aaa',14,34000)
*
ERROR at line 1:
```

```
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'
```

```
SQL> delete from itempls where ename='xxx';
delete from itempls where ename='xxx'
*
ERROR at line 1:
```

```
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'
```

```
SQL> update itempls set eid=15 where ename='yyy';
update itempls set eid=15 where ename='yyy'
*
ERROR at line 1:
```

```
ORA-20010: You cannot do manipulation
ORA-06512: at "STUDENT.ITTRIGG", line 2
ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'
```

TO DROP THE CREATED TRIGGER

SQL> drop trigger ittrigg;

Trigger dropped.

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

```
SQL> create trigger ittriggs before insert or update of salary on itempls for each row
  2 declare
  3 triggsal itempls.salary%type;
  4 begin
  5 select salary into triggsal from itempls where eid=12;
  6 if(:new.salary>triggsal or :new.salary<triggsal) then
  7 raise_application_error(-20100,'Salary has not been changed');
  8 end if;
  9 end;
10 /
```

Trigger created.

SQL> insert into itempls values ('bbb',16,45000);

insert into itempls values ('bbb',16,45000)

*

ERROR at line 1:

ORA-04098: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation

SQL> update itempls set eid=18 where ename='zzz';

update itempls set eid=18 where ename='zzz'

*

ERROR at line 1:

ORA-04298: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation

Cursor for loop

- Explicit cursor
- Implicit cursor

TO CREATE THE TABLE ‘SSEMPP’

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

Table created.

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

1 row created.

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

1 row created.

SQL> insert into ssempp values(5,'ajay','lecturer',30000,11);

1 row created.

SQL> insert into ssempp values(6,'vijay','lecturer',18000,11);

1 row created.

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

SQL> select * from ssempp;

EID	ENAME	JOB	SAL	DNO
1	nala	lecturer	34000	11
2	kala	seniorlecturer	20000	12
5	ajay	lecturer	30000	11
6	vijay	lecturer	18000	11
3	nila	professor	60000	12

EXTRA PROGRAMS

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

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

Employee id and employee name are 1 and nala
Employee id and employee name are 2 and kala
Employee id and employee name are 5 and ajay
Employee id and employee name are 6 and vijay
Employee id and employee name are 3 and nila

PL/SQL procedure successfully completed.

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

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

PL/SQL procedure successfully completed.

SQL> select * from ssempp;

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

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

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

SQL> /

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

PL/SQL procedure successfully completed.

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

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

```
15 end;
16 /
The number of rows are 3
```

Employee record modification successful

PL/SQL procedure successfully completed.

```
SQL> select * from ssempp;
```

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

PROGRAMS

TO DISPLAY HELLO MESSAGE

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

```
SQL> declare
```

```
2 a varchar2(20);
3 begin
4 a:='Hello';
5 dbms_output.put_line(a);
6 end;
7 /
```

```
Hello
```

PL/SQL procedure successfully completed.

TO INPUT A VALUE FROM THE USER AND DISPLAY IT

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

```
SQL> declare
```

```
2 a varchar2(20);
3 begin
4 a:=&a;
5 dbms_output.put_line(a);
6 end;
7 /
```

```
Enter value for a: 5
```

```
old 4: a:=&a;
new 4: a:=5;
5
```

PL/SQL procedure successfully completed.

GREATEST OF TWO NUMBERS

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

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

Enter value for a: 5

old 5: a:=&a;

new 5: a:=5;

Enter value for b: 9

old 6: b:=&b;

new 6: b:=9;

The grerater of the two is9

PL/SQL procedure successfully completed.

GREATEST OF THREE NUMBERS

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

```
SQL> declare
2 a number(7);
3 b number(7);
4 c number(7);
5 begin
6 a:=&a;
7 b:=&b;
8 c:=&c;
9 if(a>b and a>c) then
10 dbms_output.put_line (' The greatest of the three is '|| a);
11 else if (b>c) then
12 dbms_output.put_line (' The greatest of the three is '|| b);
13 else
14 dbms_output.put_line (' The greatest of the three is '|| c);
15 end if;
16 end if;
17 end;
18 /
```

Enter value for a: 5

old 6: a:=&a;

new 6: a:=5;

Enter value for b: 7

old 7: b:=&b;

new 7: b:=7;

Enter value for c: 1

old 8: c:=&c;

```
new 8: c:=1;
The greatest of the three is 7
```

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 USING SIMPLE LOOP

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

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

1
2
3
4
5

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 4 USING WHILE LOOP

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

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

1
2
3
4

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 USING FOR LOOP

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

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

```
4 for a in 1..5
5 loop
6 dbms_output.put_line (a);
7 end loop;
8 end;
9 /
1
2
3
4
5
```

PL/SQL procedure successfully completed.

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

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

```
SQL> declare
```

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

PL/SQL procedure successfully completed.

TO CALCULATE AREA OF CIRCLE

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

```
SQL> declare
```

```
2 pi constant number(4,2):=3.14;
3 a number(20);
4 r number(20);
5 begin
6 r:=&r;
7 a:= pi* power(r,2);
8 dbms_output.put_line ('The area of circle is ' || a);
9 end;
10 /
```

Enter value for r: 2

old 6: r:=&r;

new 6: r:=2;

The area of circle is 13

PL/SQL procedure successfully completed.

TO CREATE SACCOUNT TABLE

```
SQL> create table saccount ( accno number(5), name varchar2(20), bal number(10));
```

Table created.

```
SQL> insert into saccount values ( 1,'mala',20000);
```

1 row created.

```
SQL> insert into saccount values (2,'kala',30000);
```

1 row created.

```
SQL> select * from saccount;
```

ACCNO	NAME	BAL
1	mala	20000
2	kala	30000

SQL> set serveroutput on;

```

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

```

Enter value for a_no: 1
old 7: a_no:=&a_no;
new 7: a_no:=1;

PL/SQL procedure successfully completed.

SQL> select * from saccount;

ACCNO	NAME	BAL
1	mala	18000
2	kala	30000

TO CREATE TABLE SROUTES

SQL> create table sroutes (rno number(5), origin varchar2(20), destination varchar2(20), fare number(10), distance number(10));

Table created.

SQL> insert into sroutes values (2, 'chennai', 'dindugal', 400,230);
1 row created.

SQL> insert into sroutes values (3, 'chennai', 'madurai', 250,300);
1 row created.

SQL> insert into sroutes values (6, 'thanjavur', 'palani', 350,370);
1 row created.

SQL> select * from sroutes;

RNO	ORIGIN	DESTINATION	FARE	DISTANCE
2	chennai	dindugal	400	230
3	chennai	madurai	250	300
6	thanjavur	palani	350	370

SQL> set serveroutput on;

SQL> declare
2 route sroutes.rno % type;

```

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

```

Enter value for route: 3

old 6: route:=&route;
new 6: route:=3;

PL/SQL procedure successfully completed.

SQL> select * from sroutes;

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

TO CREATE SCALCULATE TABLE

SQL> create table scalculate (radius number(3), area number(5,2));

Table created.

SQL> desc scalculate;

Name	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 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 departments
```

```
FOR EACH ROW
```

```
DECLARE
```

```
    v_count NUMBER;
```

```
BEGIN
```

```
    SELECT COUNT(*)
```

```
        INTO v_count
```

```
        FROM employees
```

```
        WHERE department_id = :OLD.department_id;
```

```
    IF v_count > 0 THEN
```

```
        RAISE_APPLICATION_ERROR(-20001, 'Cannot delete department –  
employees exist in this department.');
```

```
    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_duplicate_email
BEFORE INSERT OR UPDATE ON employees
FOR EACH ROW
DECLARE
    v_count NUMBER;
BEGIN
    SELECT COUNT(*)
    INTO v_count
    FROM employees
    WHERE email = :NEW.email;

    IF v_count > 0 THEN
        RAISE_APPLICATION_ERROR(-20002, 'Duplicate email detected. Each
employee must have a unique email.');
    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_total_salary
```

```
BEFORE INSERT ON employees
```

```
FOR EACH ROW
```

```
DECLARE
```

```
    v_total_salary NUMBER;
```

```
    v_threshold    NUMBER := 1000000;
```

```
BEGIN
```

```
    SELECT NVL(SUM(salary), 0)
```

```
        INTO v_total_salary
```

```
    FROM employees;
```

```
    IF (v_total_salary + :NEW.salary) > v_threshold THEN
```

```
        RAISE_APPLICATION_ERROR(-20003, 'Cannot insert: total salary exceeds  
the allowed 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 TABLE employee_audit (
```

```
    audit_id      NUMBER GENERATED BY DEFAULT AS IDENTITY,  
    employee_id   NUMBER,  
    old_salary    NUMBER,  
    new_salary    NUMBER,  
    old_job_id    VARCHAR2(20),  
    new_job_id    VARCHAR2(20),  
    changed_by    VARCHAR2(30),  
    changed_on    DATE
```

```
);
```

```
/
```

```
CREATE OR REPLACE TRIGGER emp_audit_trigger
```

```
AFTER UPDATE OF salary, job_id ON employees
```

```
FOR EACH ROW
```

```
BEGIN
```

```
INSERT INTO employee_audit (
    employee_id,
    old_salary,
    new_salary,
    old_job_id,
    new_job_id,
    changed_by,
    changed_on
)
VALUES (
    :OLD.employee_id,
    :OLD.salary,
    :NEW.salary,
    :OLD.job_id,
    :NEW.job_id,
    USER,
    SYSDATE
);
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 TABLE activity_audit_log (
    log_id      NUMBER GENERATED BY DEFAULT AS IDENTITY,
    table_name   VARCHAR2(50),
    operation    VARCHAR2(10),
    user_name    VARCHAR2(30),
    record_id    NUMBER,
    action_date  DATE
);  
/
```

```
CREATE OR REPLACE TRIGGER audit_employee_activity
AFTER INSERT OR UPDATE OR DELETE ON employees
FOR EACH ROW
DECLARE
    v_operation VARCHAR2(10);
    v_record_id NUMBER;
BEGIN
    IF INSERTING THEN
```

```
v_operation := 'INSERT';

v_record_id := :NEW.employee_id;

ELSIF UPDATING THEN

    v_operation := 'UPDATE';

    v_record_id := :OLD.employee_id;

ELSIF DELETING THEN

    v_operation := 'DELETE';

    v_record_id := :OLD.employee_id;

END IF;
```

```
INSERT INTO activity_audit_log (
    table_name,
    operation,
    user_name,
    record_id,
    action_date
)
VALUES (
    'EMPLOYEES',
    v_operation,
    USER,
    v_record_id,
    SYSDATE
);
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 TABLE sales (
```

```
    sale_id      NUMBER GENERATED BY DEFAULT AS IDENTITY,  
    sale_amount   NUMBER,  
    running_total NUMBER  
);  
/
```

```
CREATE OR REPLACE TRIGGER update_running_total
```

```
BEFORE INSERT ON sales
```

```
FOR EACH ROW
```

```
DECLARE
```

```
    v_total NUMBER;
```

```
BEGIN
```

```
    SELECT NVL(SUM(running_total), 0)
```

```
    INTO v_total
```

```
    FROM sales;
```

```
:NEW.running_total := v_total + :NEW.sale_amount;
```

```
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 TABLE items (
    item_id    NUMBER PRIMARY KEY,
    item_name   VARCHAR2(50),
    stock_qty   NUMBER
);
```

```
/
```



```
CREATE TABLE orders (
    order_id    NUMBER GENERATED BY DEFAULT AS IDENTITY PRIMARY KEY,
    item_id    NUMBER,
    order_qty   NUMBER,
    order_date  DATE
);
```

```
/
```



```
CREATE OR REPLACE TRIGGER validate_item_stock
BEFORE INSERT ON orders
FOR EACH ROW
DECLARE
    v_available_qty NUMBER;
    v_pending_qty  NUMBER;
BEGIN
    SELECT NVL(stock_qty, 0)
    INTO v_available_qty
    FROM items
    WHERE item_id = :NEW.item_id;

    SELECT NVL(SUM(order_qty), 0)
    INTO v_pending_qty
    FROM orders
```

```

WHERE item_id = :NEW.item_id;

IF (:NEW.order_qty + v_pending_qty) > v_available_qty THEN
    RAISE_APPLICATION_ERROR(-20004, 'Order cannot be placed: insufficient stock
available.');
END IF;
END;
/

```

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

MONGO DB

MONGO DB

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-existent.

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.insertOne({
```

```
    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": "1007",  
    "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 MongoDB query to find the restaurant Id, name, borough and cuisine for those restaurants which prepared dish except 'American' and 'Chinees' or restaurant's name begins with letter 'Wil'.

db.restaurants.find(

```
{  
  $or: [  
    { name: { $regex: /^Wil/i } },  
    { cuisine: { $nin: ['American', 'Chinese'] } }  
  ]  
},  
{ restaurant_id: 1, name: 1, borough: 1, cuisine: 1 }  
);
```

3. Write a MongoDB query to find the restaurant Id, name, and grades 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 MongoDB query to find the restaurant Id, name and grades for those restaurants 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")  

```

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 query to arrange the name of the restaurants in ascending order along with all the columns.

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

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

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

7. Write a MongoDB query to arranged the name of the cuisine in ascending order and for that same cuisine borough should be in descending order.

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

8. Write a MongoDB query to know whether all the addresses contains the street or not.

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

9. Write a MongoDB query which will select all documents 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 and grades for 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: { $regex: /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: { $regex: /^Mad/i } },
```

```
{ name: 1, borough: 1, "address.coord": 1, cuisine: 1 }
```

```
);
```

13. Write a MongoDB query to find the restaurants that have at 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 have at 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 their cuisine 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 have a grade with a score of 2 and a grade with a score of 6.

```
db.restaurants.find({  
    "grades.score": { $all: [2, 6] }  
});
```

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

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

20. Write a MongoDB query to find the restaurants that have a grade with a 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.score": { $all: [2, 6] },  
    borough: { $in: ["Manhattan", "Brooklyn"] }  
});
```

```
borough: { $in: ["Manhattan", "Brooklyn"] }  
});
```

21. Write a MongoDB query to find the restaurants that have a 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.

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

22. Write a MongoDB query to find the restaurants that have a 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.score": { $all: [2, 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.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/MV5BMTU3NjE5NzYtYTYYNS00MDVmLWIwYjgtMmYwYWIxZDYyNzU2XkEyXkFqcGdeQXVyNzQzNzQxNzI@._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 with full information from the 'movies' collection that released in the year 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 all movies from the 'movies' collection that have complete information and are rated as "UNRATED".

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

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

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

8. Retrieve all movies from the 'movies' collection that have complete information and have an IMDb rating higher than 7.

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

9. Retrieve all movies from 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 movies from the 'movies' collection that have received an 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": { $gt: 0 } },
```

```
{
```

```
  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: ISODate("1893-05-09T00:00:00Z") }, { 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: { $regex: /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	