RAJALAKSHMI ENGINEERING COLLEGE

RAJALAKSHMI NAGAR, THANDALAM – 602 105

RAJALAKSHMI
ENGINEERING COLLEGE

CS19443

DATABASE MANAGEMENT SYSTEMS LABORATORY

Laboratory Manual Note Book

Name : Amritha.A

Year/Branch/Section : 3rd year - Computer Science and Design

Register No. : 221701007

Semester : 5

Academic Year : 2024-2025

Vision

To promote highly Ethical and Innovative Computer Professionals through excellence in teaching, training and research.

Mission

• To produce globally competent professionals, motivated to learn the emerging technologies and to be innovative in solving real world problems.

• To promote research activities amongst the students and the members of faculty that could benefit the society.

• To impart moral and ethical values in their profession.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1:To equip students with essential background in computer science, basic electronics and applied mathematics.

PEO 2:To prepare students with fundamental knowledge in programming languages, and tools and enable them to develop applications.

PEO 3:To develop professionally ethical individuals enhanced with analytical skills, communication skills and organizing ability to meet industry requirements.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Computer Science and Design Program will have an

PSO 1: Ability to understand, analyze and develop efficient software solutions using suitable algorithms, data structures, and other computing techniques.

PSO 2: Ability to independently investigate a problem which can be solved by a Human Computer Interaction (HCI) design process and then design an end-to-end solution to it (i.e., from user need identification to UI design to technical coding and evaluation). Ability to effectively use suitable tools and platforms, as well as enhance them, to develop applications/products using for new media design in areas like animation, gaming, virtual reality, etc.

PSO 3: Ability to apply knowledge in various domains to identify research gaps and to provide solution to new ideas, inculcate passion towards higher studies, creating innovative career paths to be an entrepreneur and evolve as an ethically social responsible computer science and design professional.

<u>CO – PO and PSO matrices of course</u>

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19443.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS19443.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS19443.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS19443.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS19443.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	2.0	2.0	2.2	2.8	2.3	-	-	-	1.6	1.0	2.0	1.3	1.4	1.8	1.7

List of Experiments	
1	Introduction to SQL : DDL,DML,DCL,TCL. SQL clause :SELECT FROM WHERE GROUPBY,HAVING,ORDERBY Using SQLite/MySQL/Oracle
2	Creation of Views, Synonyms, Sequence, Indexes, Save point.
3	Creating an Employee database to set various constraints and subqueries.
4	Optimize a SQL query construct considering time complexity.
5	Write a PL/SQL block to specify constraints by accepting input from the user.
6	Implementation of PL/SQL Procedure (IN, OUT, INOUT) with Exception Handling.
7	Implementation of PL/SQL Function.
8	Implementation of PL/SQL Cursor.
9	Implementation of PL/SQL Trigger, Packages.
10	Implementation of NoSQL basic commands using Cassandra/Mongo DB.
11	Implementation of Data Model in NoSQL.
12	Implementation of Aggregation , Indexes in NoSQL.
13	**MINI PROJECT** Database Connectivity with Front End Tools(Python/C/C++/JAVA)and Back End Tools(MySQL/SQLite/CASSANDRA/MONGO DB) For any problem selected, write the ER Diagram, apply ER mapping rules, normalize the relations, and follow the application development process. Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. Indicative areas include a) Inventory Control System. b) Material Requirement Processing. c) Hospital Management System. d) Railway Reservation System.

	e) Personal Information System. f) Web Based User Identification System. g) Timetable Management System. h) Hotel Management System i)Library Management System.			
		Contact Hours		**: 60**
		Total Contact Hours		**: 90**

Safety Precautions

- Regular Backups: Ensure regular backups of all databases to prevent data loss.
- Secure Passwords: Use complex and unique passwords for database access and change them regularly.
- Antivirus Protection: Install and maintain updated antivirus software on all laboratory computers.
- Data Encryption: Encrypt sensitive data both in transit and at rest to protect against data breaches.
- Software Updates: Keep all database management software and operating systems up to date with the latest security patches.
- Environment Control: Ensure proper environmental controls, such as temperature and humidity, to protect hardware.
- Power Protection: Use Uninterruptible Power Supplies (UPS) to prevent data loss due to power outages.

Dos:

- Regular Maintenance: Perform regular maintenance and updates on the database systems to ensure optimal performance.
- Documentation: Maintain comprehensive documentation of database structures, procedures, and security policies.
- Monitoring: Continuously monitor database performance and security to detect and respond to issues promptly.
- Training: Provide regular training to staff and students on database management best practices and security measures.
- Data Integrity: Implement and enforce data integrity constraints to maintain accurate and reliable data.

Don'ts

- Sharing Passwords: Do not share passwords or leave them written down in accessible places.
- Ignoring Errors: Do not ignore system errors or warnings; investigate and resolve them promptly.
- Unauthorized Software: Do not install unauthorized software on lab computers as it may pose security risks.
- Neglecting Backups: Do not neglect regular backups; always have a backup strategy in place.
- Weak Passwords: Do not use weak or easily guessable passwords.
- Bypassing Security: Do not bypass or disable security features for convenience.
- Unverified Sources: Do not download or install software from unverified sources as they may contain malware.
- Public Wi-Fi: Avoid accessing the database from public Wi-Fi networks to prevent unauthorized interception of data.

INDEX

Reg. No. : 221701007 **Name : Amritha.A**

Year : 3rd year **Branch : Computer Science and Design** **Section :**

8		Displaying data from multiple tables		
9		Aggregating Data Using Group Functions		
10		Sub queries		
11		Using The Set Operators		
12		NULL Functions		
13		CREATING VIEWS		
14		Intro to Constraints; NOT NULL and UNIQUE Constraints		
15		Creating Views		
16		OTHER DATABASE OBJECTS		
17		Controlling User Access		
18		PROCEDURES AND FUNCTIONS PROCEDURES		
19		TRIGGER		
20		NoSQL-1		
		NoSQL-2		

Ex. No. : 0 **Date: 23/07/2024**

Register No.: 221701007 **Name: Amritha.A**

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.RREVOKE	Gives or removes access rights to both the oracle database and the structures within it.

DATA TYPES

1. **Character Data types:**
    - Char – fixed length character string that can varies between 1-2000 bytes
    - Varchar / Varchar2 – variable length character string, size ranges from 1-4000 bytes.it saves the disk space(only length of the entered value will be assigned as the size of column)
    - Long - variable length character string, maximum size is 2 GB
2. **Number Data types :** Can store +ve,-ve,zero,fixed point, floating point with 38 precission.
    - Number – {p=38,s=0}
    - Number(p) - fixed point
    - Number(p,s) –floating point (p=1 to 38,s= -84 to 127)
3. **Date Time Data type:** used to store date and time in the table.
    - DB uses its own format of storing in fixed length of 7 bytes for century, date, month, year, hour, minutes, and seconds.
    - Default data type is “dd-mon-yy”
    - New Date time data types have been introduced. They are TIMESTAMP-Date with fractional seconds
    - INTERVAL YEAR TO MONTH-stored as an interval of years and months
    - INTERVAL DAY TO SECOND-stored as o interval of days to hour’s minutes and seconds
4. **Raw Data type:** used to store byte oriented data like binary data and byte string.
5. **Other :**
    - CLOB – stores character object with single byte character.
    - BLOB – stores large binary objects such as graphics, video, sounds.
    - BFILE – stores file pointers to the LOB’s.

Ex. No. : 1 **Date: 23/07/2024**

Register No.: 221701007 **Name: Amritha.A**

Creating of Base Table and Managing Tables

1. Create MY_EMPLOYEE table with the following structure

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

create table MY_EMPLOYEE(ID number(4) primary key not null, Last_name varchar2(25), First_name varchar2(25), Userid varchar2(25), Salary number(9,2));

desc MY_EMPLOYEE;

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

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

insert into MY_EMPLOYEE values(1,'Patel','Ralph','rpatel',895);

insert into MY_EMPLOYEE values(2, 'Dancs', 'Betty','bdancs',860);

3. Display the table with values.

select * from MY_EMPLOYEE;

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

insert into MY_EMPLOYEE values(3,'Biri','Ben',substr('Biri',1,1) + substr('Ben',1,2),1100);

insert into MY_EMPLOYEE values(4,'Newman','Chad',substr('Newman',1,1) + substr('Chad',1,3),750);

insert into MY_EMPLOYEE values(5,'Ropebur','Audrey',substr('Ropebur',1,1) + substr('Audrey',1,5),1550);

select * from MY_EMPLOYEE;

5. Delete Betty dancs from MY _EMPLOYEE table.

   delete from MY_EMPLOYEE where First_name = 'Betty' and Last_name = 'Dancs';

   select * from MY_EMPLOYEE;

6. Empty the fourth row of the emp table.

   delete from MY_EMPLOYEE where ID=4;

   select * from MY_EMPLOYEE;

7. Make the data additions permanent.

   commit;

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

   update MY_EMPLOYEE set Last_name = 'Drexler' where ID = 3;

   select * from MY_EMPLOYEE;

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

   update MY_EMPLOYEE set Salary = 1000 where Salary < 900;

   select * from MY_EMPLOYEE;

Ex. No. : P-1 **Date: 25/07/2024**

Register No.: 221701007 **Name: Amritha.A**

DATA MANIPULATIONS

Create the following table 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)

Employee_ID	First_Name	Last_Name	Email	Phone_Number	Hire_Date	Job_ID	Salary	Commission_Pct	Manager_ID	Department_ID
1	John	Doe	johndoe@example.com	555-5555	1/1/2023	IT_PROG	5000	NULL	100	60
2	Jane	Austin	janeaustin@example.com	555-5556	2/1/2023	SA_REP	6000	0.1	101	70
3	Mike	Smith	mikesmith@example.com	555-5557	3/1/2023	AD_VP	7000	0.15	102	80
4	Anna	Austin	annaaustin@example.com	555-5558	4/1/2023	FI_MGR	4800	0.2	103	60
5	Bob	Brown	bobbrown@example.com	555-5559	5/1/2023	MK_MAN	4500	NULL	104	70
6	Alice	Johnson	alicejohnson@example.com	555-5560	6/1/2023	HR_REP	5500	0.05	100	60
7	Steve	Wilson	stevewilson@example.com	555-5561	7/1/2023	IT_PROG	5200	NULL	100	80
8	Laura	White	laurawhite@example.com	555-5562	8/1/2023	AD_ASST	4700	NULL	105	70
9	David	Harris	davidharris@example.com	555-5563	9/1/2023	MK_REP	5100	0.1	101	60
10	Emma	Martinez	emmarmartinez@example.com	555-5564	10/1/2023	SA_MAN	4900	NULL	104	80

create table employees(employee_id number(6) primary key,first_name varchar(20),last_name varchar(25),email varchar(25),phone_number varchar(20),hire_date date,job_id varchar(10),salary number(8,2),commission_pct number(2,2),manager_id number(6),department_id number(4));

alter table employees modify last_name varchar(25) not null;

alter table employees modify email varchar(25) not null;

```
alter table employees modify hire_date date not null;

alter table employees modify job_id varchar(10) not null;

insert into employees values (1, 'john', 'doe', 'johndoe@example.com', '555-5555', to_date('01-jan-2023', 'dd-mon-yyyy'), 'it_prog', 5000, null, 100, 60);

insert into employees values (2, 'jane', 'austin', 'janeaustine@example.com', '555-5556', to_date('02-jan-2023', 'dd-mon-yyyy'), 'sa_rep', 6000, 0.1, 101, 70);

insert into employees values (3, 'mike', 'smith', 'mikesmith@example.com', '555-5557', to_date('03-jan-2023', 'dd-mon-yyyy'), 'ad_vp', 7000, 0.15, 102, 80);

insert into employees values (4, 'anna', 'austin', 'annaaustin@example.com', '555-5558', to_date('04-jan-2023', 'dd-mon-yyyy'), 'fi_mgr', 4800, 0.2, 103, 60);

insert into employees values (5, 'bob', 'brown', 'bobbrown@example.com', '555-5559', to_date('05-jan-2023', 'dd-mon-yyyy'), 'mk_man', 4500, null, 104, 70);

insert into employees values (6, 'alice', 'johnson', 'alicejohnson@example.com', '555-5560', to_date('06-jan-2023', 'dd-mon-yyyy'), 'hr_rep', 5500, 0.05, 100, 60);

insert into employees values (7, 'steve', 'wilson', 'stevewilson@example.com', '555-5561', to_date('07-jan-2023', 'dd-mon-yyyy'), 'it_prog', 5200, null, 100, 80);

insert into employees values (8, 'laura', 'white', 'laurawhite@example.com', '555-5562', to_date('08-jan-2023', 'dd-mon-yyyy'), 'ad_asst', 4700, null, 105, 70);

insert into employees values (9, 'david', 'harris', 'davidharris@example.com', '555-5563', to_date('09-jan-2023', 'dd-mon-yyyy'), 'mk_rep', 5100, 0.1, 101, 60);

insert into employees values (10, 'emma', 'martinez', 'emmarmartinez@example.com', '555-5564', to_date('10-jan-2023', 'dd-mon-yyyy'), 'sa_man', 4900, null, 104, 80);
```

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

```
select employee_id,first_name,last_name,salary from employees order by employee_id asc;
```

b) List out the employees who works under manager 100

```
select employee_id,first_name,last_name,salary from employees where manager_id=100;
```

c) Find the names of the employees who have a salary greater than or equal to 4800

```
select employee_id from employees where salary>=4800;
```

d) List out the employees whose last name is _AUSTIN' select employee_id from employees where last_name='Austin';

e) Find the names of the employees who works in departments 60,70 and 80
SELECT first_name, last_name FROM employees WHERE department_id IN (60, 70, 80);

f) Display the unique Manager_Id.
SELECT DISTINCT manager_id FROM employees;

Ex. No. : 2 **Date: 01/08/2024**

Register No.: 221701007 **Name: Amritha.A**

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

Tables Used in this course

Creating a table by using a Sub query

SYNTAX

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

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

AS Subquery

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

Example

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

The ALTER TABLE Statement

The ALTER statement is used to

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

SYNTAX

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

ALTER TABLE table_name DROP COLUMN (Column_nname);

ALTER TABLE ADD CONSTRAINT Constraint_name PRIMARY KEY (Colum_Name);

Example:

Alter table dept80 add (jod_id varchar2(9));

Alter table dept80 modify (last_name varchar2(30));

Alter table dept80 drop column job_id;

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

DROPPING A TABLE

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

Syntax:

Drop table *tablename;*

Example:

Drop table dept80;

RENAMING A TABLE

To rename a table or view.

Syntax

RENAME old_name to new_name

Example:

Rename dept to detail_dept;

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)

Employees table:

create table employees(employee_id number(6) primary key,first_name varchar(20),last_name varchar(25),email varchar(25),phone_number varchar(20),hire_date date,job_id varchar(10),salary number(8,2),commission_pct number(2,2),manager_id number(6),department_id number(4));

alter table employees modify last_name varchar(25) not null;

alter table employees modify email varchar(25) not null;

alter table employees modify hire_date date not null;

alter table employees modify job_id varchar(10) not null;

department table:

create table department(dept_id number(6) primary key, dept_name varchar(20), manager_id number(6), location_id number(4));

alter table department modify dept_name varchar(20) not null;

job_grade table:

create table job_grade(grade_level varchar(2), lowest_sal number, highest_sal number);

location table:

create table location(location_id number(4) primary key, st_addr varchar(40), postal_code varchar(12), city varchar(30), state_province varchar(25), country_id char(2));

alter table location modify city char(2) not null;

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

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

create table d(id number(7) primary key, N varchar2(25));
alter table d modify N varchar2(25) not null;

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) primary key, last_name varchar2(25), first_name varchar2(25), dept_id number(7));

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

alter table emp modify last_name varchar2(50);

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

CREATE TABLE EMPLOYEES2 AS SELECT employee_id AS Id, first_name AS First_name, last_name AS Last_name, salary AS salary, department_id AS Dept_id FROM EMPLOYEES;

5. Drop the EMP table.
drop table emp;

6. Rename the EMPLOYEES2 table as EMP.
alter table employees rename to emp;

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

comment on table dept is 'this table contains department details.';
comment on table emp is 'this table contains employee details.';
select* from user_tab_comments where table_name in ('DEPT', 'EMP');

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

alter table emp drop column first_name;

desc emp;

Ex. No. : 2 **Date: 06/08/2024**

Register No.: 221701007 **Name: Amritha.A**

Manipulating Data

OBJECTIVE

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

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

A DML statement is executed when you:

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

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

To Add a New Row

INSERT Statement

Syntax

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

Example:

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

Inserting rows with null values

Implicit Method: (Omit the column)

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

Explicit Method: (Specify NULL keyword)

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

Inserting Special Values

Example:

Using SYSDATE

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

Inserting Specific Date Values

Example:

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

To Insert Multiple Rows

& is the placeholder for the variable value

Example:

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

Copying Rows from another table

- Using Subquery

Example:

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

CHANGING DATA IN A TABLE

UPDATE Statement

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

UPDATE table_name SET column=value WHERE condition;

Syntax 2: (To updae all rows)

UPDATE table_name SET column=value;

Updating columns with a subquery

UPDATE employees

SET job_id= (SELECT job_id

FROM employees

WHERE employee_id=205)

WHERE employee_id=114;

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_EMPLOYEE(ID number(4) primary key not null, Last_name varchar2(25), First_name varchar2(25), Userid varchar2(25), Salary number(9,2));

desc MY_EMPLOYEE;

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

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

insert into MY_EMPLOYEE values(1,'Patel','Ralph','rpatel',895);

insert into MY_EMPLOYEE values(2,'Dancs','Betty','bdancs',860);

select * from MY_EMPLOYEE;

3. Display the table with values.

select * from MY_EMPLOYEE order by ID asc;

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

insert into MY_EMPLOYEE values(3, 'Biri', 'Ben', substr('Biri',1,1) || substr('Ben',1,2), 1100);

insert into MY_EMPLOYEE values(4, 'Newman', 'Chad', substr('Newman',1,1) || substr('Chad',1,3), 750);

insert into MY_EMPLOYEE values(5, 'Ropebur', 'Audrey', substr('Ropebur',1,1) || substr('Audrey',1,5), 1550);

5. Make the data additions permanent.

commit;

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

update MY_EMPLOYEE set Last_name = 'Drexler' where ID = 3;

select * from MY_EMPLOYEE;

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

update MY_EMPLOYEE set Salary = 1000 where Salary < 900;

select * from MY_EMPLOYEE;

8. Delete Betty dancs from MY _EMPLOYEE table.

delete from MY_EMPLOYEE where First_name = 'Betty' and Last_name = 'Dancs';

select * from MY_EMPLOYEE;

9. Empty the fourth row of the emp table.

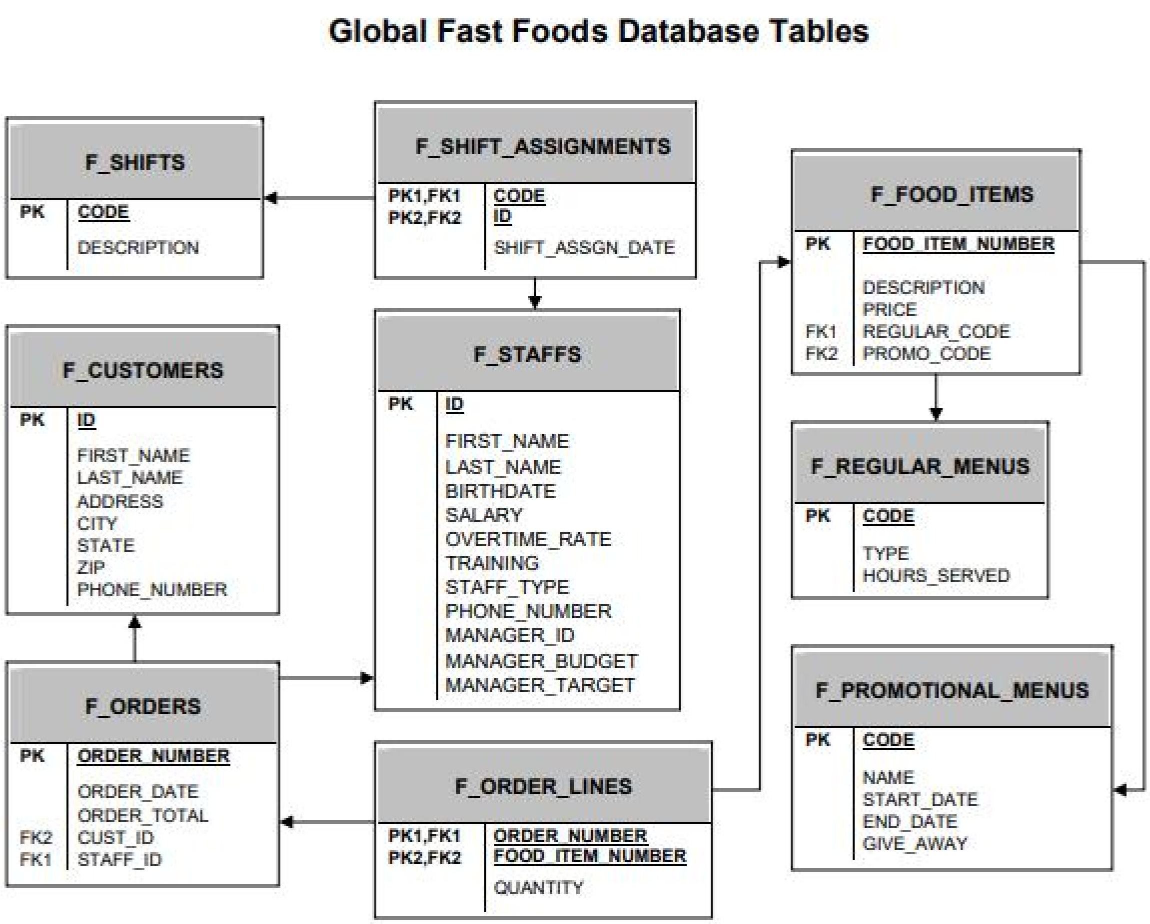
delete from MY_EMPLOYEE where ID=4;

select * from MY_EMPLOYEE;

Ex. No. : 3 Date: 08/08/2024

Register No.: 221701007 Name: Amritha.A

Working With Column, Characters and rows



create table f_shifts (code varchar2(10) primary key, description varchar2(100));

create table f_customers (id number primary key, first_name varchar2(50), last_name varchar2(50), address varchar2(100), city varchar2(50), state varchar2(50), zip varchar2(10), phone_number varchar2(15));

create table f_orders (order_number number primary key, order_date date, order_total number(10, 2), cust_id number, staff_id number, foreign key (cust_id) references f_customers(id), foreign key (staff_id) references f_staffs(id));

create table f_order_lines (order_number number, food_item_number number, quantity number, primary key (order_number, food_item_number), foreign key (order_number) references f_orders(order_number), foreign key (food_item_number) references f_food_items(food_item_number));

create table f_staffs (id number primary key, first_name varchar2(50), last_name varchar2(50), birthdate date, salary number(10, 2), overtime_rate number(5, 2), training varchar2(100), staff_type varchar2(50), phone_number varchar2(15), manager_id number, manager_budget number(10, 2), manager_target number(10, 2));

create table f_shift_assignments (code varchar2(10), id number, shift_assign_date date, primary key (code, id), foreign key (code) references f_shifts(code), foreign key (id) references f_staffs(id));

create table f_food_items (food_item_number number primary key, description varchar2(100), price number(10, 2), regular_code varchar2(10), promo_code varchar2(10), foreign key (regular_code) references f_regular_menus(code), foreign key (promo_code) references f_promotional_menus(code));

create table f_regular_menus (code varchar2(10) primary key, type varchar2(50), hours_served varchar2(50));

create table f_promotional_menus (code varchar2(10) primary key, name varchar2(100), start_date date, end_date date, giveaway varchar2(100));

insert into f_shifts (code, description) values ('S1', 'Morning Shift');

insert into f_shifts (code, description) values ('S2', 'Afternoon Shift');

insert into f_shifts (code, description) values ('S3', 'Night Shift');

insert into f_customers (id, first_name, last_name, address, city, state, zip, phone_number) values (1, 'John', 'Doe', '123 Elm St', 'Springfield', 'IL', '62701', '217-555-0199');

insert into f_customers (id, first_name, last_name, address, city, state, zip, phone_number) values (2, 'Jane', 'Smith', '456 Oak St', 'Springfield', 'IL', '62701', '217-555-0100');

insert into f_customers (id, first_name, last_name, address, city, state, zip, phone_number) values (3, 'Alice', 'Johnson', '789 Maple St', 'Springfield', 'IL', '62701', '217-555-0101');

insert into f_staffs (id, first_name, last_name, birthdate, salary, overtime_rate, training, staff_type, phone_number, manager_id, manager_budget, manager_target) values (1, 'Sue', 'Williams', to_date('1985-05-15', 'YYYY-MM-DD'), 35000, 20, 'Customer Service', 'Full-time', '217-555-0200', null, null, null);

insert into f_staffs (id, first_name, last_name, birthdate, salary, overtime_rate, training, staff_type, phone_number, manager_id, manager_budget, manager_target) values (2, 'Bob', 'Brown', to_date('1990-06-20', 'YYYY-MM-DD'), 30000, 18, 'Kitchen Training', 'Full-time', '217-555-0201', null, null, null);

insert into f_staffs (id, first_name, last_name, birthdate, salary, overtime_rate, training, staff_type, phone_number, manager_id, manager_budget, manager_target) values (3, 'Monique', 'Garcia', to_date('1992-03-30', 'YYYY-MM-DD'), 32000, 19, 'Management', 'Part-time', '217-555-0202', null, null, null);

insert into f_food_items (food_item_number, description, price, regular_code, promo_code) values (1, 'Cheeseburger', 5.99, 'RM1', null);

insert into f_food_items (food_item_number, description, price, regular_code, promo_code) values (2, 'French Fries', 2.49, 'RM1', null);

insert into f_food_items (food_item_number, description, price, regular_code, promo_code) values (3, 'Soda', 1.99, 'RM1', null);

insert into f_regular_menus (code, type, hours_served) values ('RM1', 'Standard Menu', '10:00-22:00');

insert into f_promotional_menus (code, name, start_date, end_date, giveaway) values ('PM1', 'Weekend Special', to_date('2024-11-01', 'YYYY-MM-DD'), to_date('2024-11-03', 'YYYY-MM-DD'), 'Free Soda with any meal');

insert into f_orders (order_number, order_date, order_total, cust_id, staff_id) values (1, to_date('2024-11-01', 'YYYY-MM-DD'), 9.48, 1, 1);

insert into f_orders (order_number, order_date, order_total, cust_id, staff_id) values (2, to_date('2024-11-02', 'YYYY-MM-DD'), 8.47, 2, 2);

insert into f_order_lines (order_number, food_item_number, quantity) values (1, 1, 1);

insert into f_order_lines (order_number, food_item_number, quantity) values (1, 2, 1);

insert into f_order_lines (order_number, food_item_number, quantity) values (2, 3, 2);

insert into f_shift_assignments (code, id, shift_assign_date) values ('S1', 1, to_date('2024-11-01', 'YYYY-MM-DD'));

insert into f_shift_assignments (code, id, shift_assign_date) values ('S2', 2, to_date('2024-11-02', 'YYYY-MM-DD'));

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.

select last_name, address || ', ' || city || ', ' || state || ' ' || zip as mailing_address from f_customers;

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

a.

SELECT first name FROM

f_staffs;

select first_name from f_staffs;

b.

SELECT first_name |" " | last_name AS "DJs on Demand Clients" FROM

d_clients;

select first_name || ' ' || last_name as "djs on demand clients" from d_clients;

c.

SELECT DISCTINCT f_order_lines FROM

quantity;

select distinct quantity from f_order_lines;

d.

SELECT order number FROM

f_orders;

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 ***

select '*** ' || first_name || ' *** ' || first_name || ' ***' as "super star" from f_staffs where first_name in ('Sue', 'Bob', 'Monique') order by instr('Sue,Bob,Monique', first_name);

super star
*** Sue *** Sue ***
*** Bob *** Bob ***
*** Monique *** Monique ***

3 rows returned in 0.01 seconds Download

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. - true

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

select last_name, salary as "current salary", salary * 1.05 as "salary with 5% raise" from f_staffs;

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

select column_name, data_type, data_length, nullable from user_tab_columns where table_name = 'EMPLOYEES';

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.

create table d_cds (inventory_item number primary key, cd_title varchar2(100), music_producer varchar2(100), year_purchased number(4));

insert into d_cds (inventory_item, cd_title, music_producer, year_purchased) values (1, 'greatest hits', 'various artists', 2020);

insert into d_cds (inventory_item, cd_title, music_producer, year_purchased) values (2, 'classical essentials', 'various artists', 2019);

insert into d_cds (inventory_item, cd_title, music_producer, year_purchased) values (3, 'rock legends', 'the band', 2021);

select inventory_item, cd_title, music_producer, year_purchased from d_cds;

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

True

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

True

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;

SELECT employee_id, last_name, salary * 12 AS ANNUAL_SALARY FROM employees;

11.In the arithmetic expression salary*12 - 400, which operation will be evaluated first?
The multiplication (salary * 12) will be evaluated first due to the order of operations (PEMDAS/BODMAS).

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

Ans:- *

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

a. selection

b. projection

c. partitioning

d. join

Ans:- projection

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

a. EMPLOYEE

b. employee

c. Employee

d. "Employee:

Ans:- 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

Ans:- 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

Ans:- 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.

Ans:- Keywords cannot be abbreviated or split across lines.

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;

Ans:- 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;

Ans:- SELCT * 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_superplus.sql.

Ex. No. : 4 **Date: 13/08/2024**

Register No.: 221701007 **Name: Amritha.A**

INCLUDING CONSTRAINTS

OBJECTIVE

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

- Describe the constraints
- Create and maintain the constraints

What are Integrity constraints?

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

The following types of integrity constraints are valid

a) **Domain Integrity**

✔ NOT NULL

✔ CHECK

b) **Entity Integrity**

✔ UNIQUE

✔ PRIMARY KEY

c) **Referential Integrity**

✔ FOREIGN KEY

Constraints can be created in either of two ways

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

Defining Constraints

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

Example:

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

Domain Integrity

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

NOT NULL Constraint

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

Principle of null values:

- Setting null value is appropriate when the actual value is unknown, or when a value would not be meaningful.
- A null value is not equivalent to a value of zero.
- A null value will always evaluate to null in any expression.
- When a column name is defined as not null, that column becomes a mandatory i.e., the user has to enter data into it.
- Not null Integrity constraint cannot be defined using the alter table command when the table contain rows.

Example

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

CHECK

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

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

Entity Integrity

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

a) Unique key constraint

It is used to ensure that information in the column for each record is unique, as with telephone or driver's license numbers. It prevents the duplication of value with rows of a specified column in a set of column. A column defined with the constraint can allow null value.

If unique key constraint is defined in more than one column i.e., combination of column cannot be specified. Maximum combination of columns that a composite unique key can contain is 16.

Example:

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

PRIMARY KEY CONSTRAINT

A primary key avoids duplication of rows and does not allow null values. Can be defined on one or more columns in a table and is used to uniquely identify each row in a table. These values should never be changed and should never be null.

A table should have only one primary key. If a primary key constraint is assigned to more than one column or combination of column is said to be composite primary key, which can contain 16 columns.

Example:

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

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

c) Referential Integrity

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

Foreign key

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

Referenced key

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

Keywords:

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

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

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

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

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

ADDING A CONSTRAINT

Use the ALTER to

- Add or Drop a constraint, but not modify the structure
- Enable or Disable the constraints
- Add a not null constraint by using the Modify clause

Syntax

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

Example:

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

DROPPING A CONSTRAINT

Example:

ALTER TABLE employees DROP CONSTRAINT emp_manager_fk;

CASCADE IN DROP

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

Syntax

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

DISABLING CONSTRAINTS

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

Example

ALTER TABLE employees DISABLE CONSTRAINT emp_emp_id_pk CASCADE;

ENABLING CONSTRAINTS

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

Example

ALTER TABLE employees ENABLE CONSTRAINT emp_emp_id_pk CASCADE;

CASCADING CONSTRAINTS

The CASCADE CONSTRAINTS clause is used along with the DROP column clause.

It drops all referential integrity constraints that refer to the primary and unique keys defined on the dropped Columns.

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

Example:

Assume table TEST1 with the following structure

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

An error is returned for the following statements

ALTER TABLE test1 DROP (pk);

ALTER TABLE test1 DROP (col1);

The above statement can be written with CASCADE CONSTRAINT

ALTER TABLE test 1 DROP(pk) CASCADE CONSTRAINTS;

(OR)

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

VIEWING CONSTRAINTS

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

Example:

SELECT constraint_name, constraint_type, search_condition FROM user_constraints

WHERE table_name='employees';

Viewing the columns associated with constraints

SELECT constraint_name, constraint_type, FROM user_cons_columns

WHERE table_name='employees';

Find the Solution for the following:

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

create table emp (id number constraint my_emp_id_pk primary key, dept_id number);

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

create table dept (id number constraint my_dept_id_pk primary key);

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

alter table emp add constraint my_emp_dept_id_fk foreign key (dept_id) references dept(id);

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

alter table emp add commission number(8,2) constraint check_commission check (commission > 0);

Ex. No. : 5 **Date: 15/08/2024**

Register No.: 221701007 **Name: Amritha.A**

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—Suppr

ess the duplicates.

Alias—gives selected columns different headings.

Example: 1

SELECT * FROM departments;

Example: 2

SELECT location_id, department_id FROM departments;

Writing SQL Statements

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

<u>Using Arithmetic Expressions</u>

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

<u>Example:1</u>

SELECT last_name, salary, salary+300 FROM employees;

<u>Example:2</u>

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

The statement is not same as

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

<u>Example:3</u>

SELECT last_name, job_id, salary, commission_pct FROM employees;

<u>Example:4</u>

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

<u>Using Column Alias</u>

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

Example:1

SELECT last_name AS Name

FROM employees;

Example: 2

SELECT last_name “Name” salary*12 “Annual Salary “

FROM employees;

Concatenation Operator

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

Example:

SELECT last_name||job_id AS "EMPLOYEES JOB" FROM employees;

Using Literal Character String

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

Example:

SELECT last_name||'is a'||job_id AS "EMPLOYEES JOB" FROM employees;

Eliminating Duplicate Rows

- Using DISTINCT keyword.

Example:

SELECT DISTINCT deparment_id FROM employees;

Displaying Table Structure

- Using DESC keyword.

Syntax

DESC table_name;

Example:

DESC employees;

Find the Solution for the following:

True OR False

1. The following statement executes successfully.

Identify the Errors

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

Queries

False

select employee_id, last_name, sal * 12 as annual_salary from employees;

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

desc departments;

select * from departments;

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

select employee_id, last_name, job_code, hire_date from employees;

4. Provide an alias STARTDATE for the hire date.

select employee_id, last_name, job_code, hire_date as startdate from employees;

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

select distinct job_code from employees;

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

select last_name || ', ' || job_code as "EMPLOYEE and TITLE" from employees;

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

select employee_id || ', ' || last_name || ', ' || job_code || ', ' || hire_date as the_output from employees;

Ex. No. : P-2 Date: 15/08/2024

Register No.: 221701007 Name: Amritha.A

COMPARISON OPERATORS

create table partners (partner_id number primary key, partner_name varchar2(100), authorized_expense number);
create table employees (employee_id number primary key, first_name varchar2(50), last_name varchar2(50), email_address varchar2(100), date_of_hire date, monthly_salary number(8, 2), job_id varchar2(10), commission_percentage number(5, 2));
create table inventory (song_id number primary key, song_title varchar2(100), genre_code number);
create table themes (theme_code number primary key, theme_description varchar2(100));
create table events (event_id number primary key, event_venue varchar2(100));
create table departments (department_id number primary key, department_name varchar2(100));

insert into partners values (1, 'Partner A', 1000);

insert into partners values (2, 'Partner B', NULL);

insert into partners values (3, 'Partner C', 1500);

insert into employees values (1, 'John', 'Doe', 'john.doe@example.com', to_date('1999-01-15', 'YYYY-MM-DD'), 7500, 5, 'E01');

insert into employees values (2, 'Jane', 'Smith', 'jane.smith@example.com', to_date('2000-06-20', 'YYYY-MM-DD'), 6500, 2, 'E02');

insert into employees values (3, 'Alice', 'Jones', 'alice.jones@example.com', to_date('1997-09-30', 'YYYY-MM-DD'), 8000, NULL, 'E03');

insert into inventory values (1, 'Song A', 77);

insert into inventory values (2, 'Song B', 12);

```sql
insert into inventory values (3, 'Song C', 1);

insert into themes values (1, 'Tropical');

insert into themes values (2, 'Football');

insert into themes values (3, 'Carnival');

insert into events values (1, 'Club A');

insert into events values (2, 'Private Home');

insert into events values (3, 'Hall B');

insert into departments values (1, 'Sales');

insert into departments values (2, 'Engineering');

insert into departments  values (3, 'Human Resources');

alter table employees add job_position varchar2(50);

update employees set job_position = 'Manager' where employee_id = 1;

update employees set job_position = 'Sales Associate' where employee_id = 2;

update employees set job_position = 'Senior Developer' where employee_id = 3;

insert into employees values (4, 'Bob', 'Klein', 'bob.klein@example.com', TO_DATE('2001-01-10', 'YYYY-MM-DD'), 7000, NULL, 'E04', 'Developer');

insert into employees values (5, 'Alice', 'Tremblay', 'alice.tremblay@example.com', TO_DATE('2002-02-15', 'YYYY-MM-DD'), 7200, NULL, 'E05', 'Designer');
```

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

```sql
SELECT partner_name FROM partners WHERE authorized_expense IS NULL;
```

2. Select all the Oracle database employees whose last names end with “s”. Change the heading of the

column to read Possible Candidates.

select last_name as "Possible Candidates" from employees where last_name like '%s';

3. Which statement(s) are valid?

a. WHERE quantity <> NULL;

b. WHERE quantity = NULL;

c. WHERE quantity IS NULL; --valid

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.

SELECT * FROM inventory WHERE genre_code IN (77, 12, 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');
```

The first query uses AND, meaning both conditions must be true for a record to be returned. The second query uses OR, meaning if either condition is true, the record will be returned. This leads to different results based on the logic applied.

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

select last_name from employees where last_name like '%e%' and last_name like
'%i%';

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.”

select * from employees where (monthly_salary / 160) > 6.50 and job_position <> '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.

select * from employees where last_name like 'd%' and last_name like '%a%' and last_name like '%e%';

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

select event_venue from events where event_venue <> 'private home';

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

select 'not, and, or' from dual;

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.

select * from employees where date_of_hire > to_date('1998-05-31', 'yyyy-mm-dd') and date_of_hire < to_date('1999-06-01', 'yyyy-mm-dd') and monthly_salary < 8000 and last_name like '%en%';

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

select * from employees where date_of_hire < to_date('1996-01-01', 'yyyy-mm-dd') and monthly_salary > 9000 and commission_percentage is null;

Ex. No. : 6 **Date: 20/08/2024**

Register No.: 221701007 **Name: Amritha.A**

Restricting and Sorting data

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

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

Limiting the Rows selected

- Using WHERE clause
- Alias cannot used in WHERE clause

Syntax

SELECT----------
FROM----------
WHERE condition;

Example:

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

Character strings and Dates

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

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

Example:

SELECT employee_id,last_name, job_id, deparment_id FROM employees

WHERE last_name='WHALEN";

Comparison Conditions

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

Example:

SELECT last_name, salary

FROM employees

WHERE salary<=3000;

Other comparison conditions

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

Example:1

SELECT last_name, salary

FROM employees

WHERE salary BETWEEN 2500 AND 3500;

Example:2

SELECT employee_id, last_name, salary , manager_id

FROM employees

WHERE manager_id IN (101, 100,201);

Example:3

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

SELECT first_name, salary

FROM employees

WHERE first_name LIKE '%s';

Example:4

SELECT last_name, salary

FROM employees

WHERE last_name LIKE '_o%';

Example:5

ESCAPE option-To have an exact match for the actual % and_ characters

To search for the string that contain 'SA_'

SELECT employee_id, first_name, salary,job_id

FROM employees

WHERE job_id LIKE '%sa_%'ESCAPE'\';

Test for NULL

- Using IS NULL operator

Example:

SELECT employee_id, last_name, salary , manager_id

FROM employees

WHERE manager_id IS NULL;

Logical Conditions

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

Example:1

SELECT employee_id, last_name, salary , job_id

FROM employees

WHERE salary>=10000

AND job_id LIKE '%MAN%';

Example:2

SELECT employee_id, last_name, salary , job_id

FROM employees

WHERE salary>=10000

OR job_id LIKE '%MAN%';

Example:3

SELECT employee_id, last_name, salary , job_id

FROM employees

WHERE job_id NOT IN (‘it_prog’, st_clerk’, sa_rep’);

Rules of Precedence

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

Example:1

SELECT employee_id, last_name, salary , job_id

FROM employees

WHERE job_id =’sa_rep’

OR job_id=’ad_pres’

AND salary>15000;

Example:2

SELECT employee_id, last_name, salary , job_id

FROM employees

WHERE (job_id ='sa_rep'

OR job_id='ad_pres')

AND salary>15000;

<u>Sorting the rows</u>

Using ORDER BY Clause

ASC-Ascending Order,Default

DESC-Descending order

<u>Example:1</u>

SELECT last_name, salary , job_id,department_id,hire_date

FROM employees

ORDER BY hire_date;

<u>Example:2</u>

SELECT last_name, salary , job_id,department_id,hire_date

FROM employees

ORDER BY hire_date DESC;

<u>Example:3</u>

<u>Sorting by column alias</u>

SELECT last_name, salary*12 annsal , job_id,department_id,hire_date

FROM employees

ORDER BY annsal;

<u>Example:4</u>

<u>Sorting by Multiple columns</u>

SELECT last_name, salary , job_id,department_id,hire_date

FROM employees

ORDER BY department_id, salary DESC;

Find the Solution for the following:

create table employees(employee_id number(6) primary key,first_name varchar(20),last_name varchar(25),email varchar(25),phone_number varchar(20),hire_date date,job_id varchar(10),salary number(8,2),commission_pct number(2,2),manager_id number(6),department_id number(4));

alter table employees modify last_name varchar(25) not null;

alter table employees modify email varchar(25) not null;

alter table employees modify hire_date date not null;

alter table employees modify job_id varchar(10) not null;

insert into employees values (1, 'john', 'doe', 'johndoe@example.com', '555-5555', to_date('01-jan-2023', 'dd-mon-yyyy'), 'it_prog', 5000, null, 100, 60);

insert into employees values (2, 'jane', 'austin', 'janeaustine@example.com', '555-5556', to_date('02-jan-2023', 'dd-mon-yyyy'), 'sa_rep', 6000, 0.1, 101, 70);

insert into employees values (3, 'mike', 'smith', 'mikesmith@example.com', '555-5557', to_date('03-jan-2023', 'dd-mon-yyyy'), 'ad_vp', 7000, 0.15, 102, 80);

insert into employees values (4, 'anna', 'austin', 'annaaustin@example.com', '555-5558', to_date('04-jan-2023', 'dd-mon-yyyy'), 'fi_mgr', 48000, 0.2, 103, 60);

insert into employees values (5, 'bob', 'brown', 'bobbrown@example.com', '555-5559', to_date('05-jan-2023', 'dd-mon-yyyy'), 'mk_man', 4500, null, 104, 70);

insert into employees values (6, 'alice', 'johnson', 'alicejohnson@example.com', '555-5560', to_date('06-jan-2023', 'dd-mon-yyyy'), 'hr_rep', 12500, 0.05, 100, 60);

insert into employees values (7, 'steve', 'wilson', 'stevewilson@example.com', '555-5561', to_date('07-jan-2023', 'dd-mon-yyyy'), 'it_prog', 5200, null, 100, 80);

insert into employees values (8, 'laura', 'white', 'laurawhite@example.com', '555-5562', to_date('08-jan-2023', 'dd-mon-yyyy'), 'ad_asst', 4700, null, 105, 70);

insert into employees values (9, 'david', 'harris', 'davidharris@example.com', '555-5563', to_date('09-jan-2023', 'dd-mon-yyyy'), 'mk_rep', 5100, 0.1, 101, 60);

insert into employees values (10, 'emma', 'martinez', 'emmarmartinez@example.com', '555-5564', to_date('10-jan-2023', 'dd-mon-yyyy'), 'sa_man', 4900, null, 104, 80);

1. Create a query to display the last name and salary of employees earning more than 12000.
select last_name, salary from employees where salary > 12000;

2. Create a query to display the employee last name and department number for employee number 176.
select last_name, department_id from employees where employee_id='176';

3. Create a query to display the last name and salary of employees whose salary is not in the range of 5000 and 12000. (hints: not between)
select last_name, salary from employees where salary not between 5000 and 12000;

4. Display the employee last name, job ID, and start date of employees hired between February 20,1998 and May 1,1998.order the query in ascending order by start date.(hints: between)
select last_name, job_id, hire_date from employees where hire_date between to_date('02-may-1998', 'dd-mon-yyyy') and to_date('07-may-1998', 'dd-mon-yyyy') order by hire_date asc;

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

update departments set department_id = 20 where department_id = 1;
update departments set department_id = 50 where department_id = 2;
select e.last_name, d.department_id from employees e join departments d on e.employee_id = d.department_id where d.department_id in (20, 50) order by e.last_name asc;

6. Display the last name and salary of all employees who earn between 5000 and 12000 and are in departments 20 and 50 in alphabetical order by name. Label the columns EMPLOYEE, MONTHLY SALARY respectively.(hints: between, in)

select e.last_name as "EMPLOYEE", e.salary as "MONTHLY SALARY" from employees e join departments d on e.employee_id = d.department_id where e.salary between 5000 and 12000 and d.department_id in (20, 50) order by e.last_name asc;

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

update employees set hire_date = to_date('15-jun-1994', 'dd-mm-yyyy') where employee_id = 1;

select last_name, hire_date from employees where hire_date like '%94';

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

update employees set manager_id = null where manager_id =101;

select last_name, job_id from employees where manager_id is null;

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

select last_name, salary, commission_pct from employees where commission_pct is not null order by salary, commission_pct desc;

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

update employees set last_name = 'Bhat' where employee_id = 2;

select last_name from employees where last_name like '__a%';

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

select last_name from employees where last_name like '%a%' and last_name like '%e%';

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

alter table employees add job varchar2(50);

update employees set job = 'sales representative' where employee_id = 1;

```
update employees set job = 'sales representative' where employee_id = 2;
update employees set job = 'sales representative' where employee_id = 3;
update employees set job = 'stock clerk' where employee_id = 4;
update employees set job = 'stock clerk' where employee_id = 5;
update employees set job = 'stock clerk' where employee_id = 6;
select last_name, job, salary from employees where job in( 'sales representative','stock clerk') and salary not in(2500,3500,7000);
```

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

```
select last_name, salary, commission_pct from employees where commission_pct = 0.20;
```

Ex. No. : P-3 **Date: 23/08/2024**

Register No.: 221701007 **Name: Amritha.A**

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 as "number", first_name, last_name from employees order by "number";

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

select cd_title, year_purchased from D_CDS order by year_purchased, cd_title;

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

create table songs (song_id number primary key,song_title varchar2(100),artist varchar2(100),album varchar2(100), release_year number);
insert into songs values (1, 'Song A', 'Artist 1', 'Album 1', 2020);
insert into songs values (2, 'Song B', 'Artist 2', 'Album 1', 2019);
insert into songs values (3, 'Song C', 'Artist 1', 'Album 2', 2021);
insert into songs values (4, 'Song D', 'Artist 3', 'Album 3', 2018);
insert into songs values (5, 'Song E', 'Artist 2', 'Album 2', 2020);
select song_title as "Our Collection" from songs order by song_title desc;

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

select song_title, artist, album, release_year from songs order by release_year asc, song_title asc;

Ex. No. : 7 **Date: 23/08/2024**

Register No.: 221701007 **Name: Amritha.A**

Single Row Functions

Objective

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

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

Single row functions:

Manipulate data items.

Accept arguments and return one value.

Act on each row returned.

Return one result per row.

May modify the data type.

Can be nested.

Accept arguments which can be a column or an expression

Syntax

Function_name(arg1,…argn)

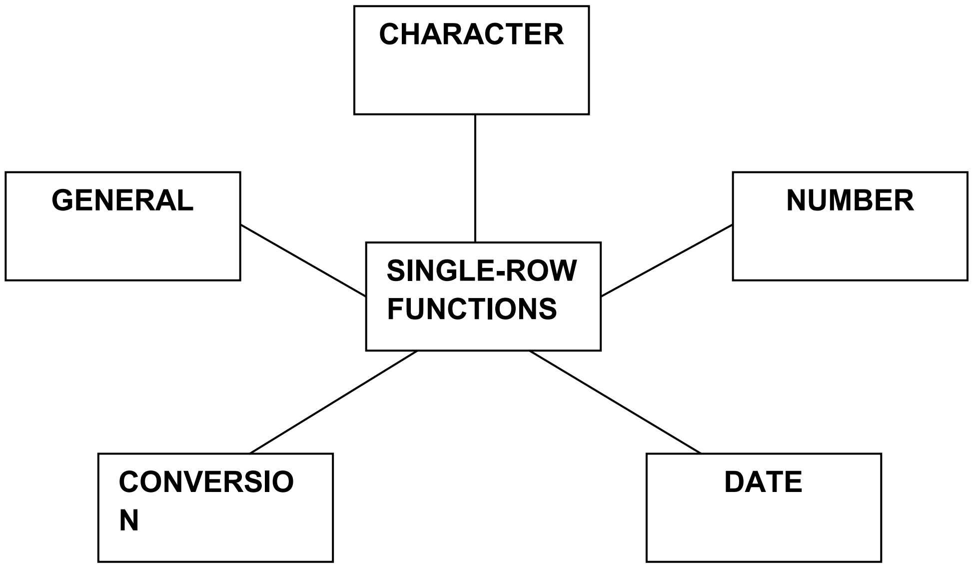
An argument can be one of the following

✔ User-supplied constant

✔ Variable value

✔ Column name

✔ Expression



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

Character Functions

Character Functions

Case-manipulation functions

1. Lower
2. Upper

Character-manipulation functions

1. Concat
2. Substr

3.	Initcap	3. Length 4. Instr 5. Lpad/Rpad 6. Trim 7. Repalce

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

replace(text, search_string, replacement_string)	

Example:

lower('SQL Course') sql course

upper('SQL Course') SQL COURSE

initcap('SQL Course') Sql Course

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

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

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

Command	Query	Output

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

Example:

SELECT employee_id, CONCAT (first_name,last_name) NAME , job_id,LENGTH(last_name), INSTR(last_name,'a') "contains'a'?"
FROM employees WHERE SUBSTR(job_id,4)='ERP';

NUMBER FUNCTIONS

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

Example

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

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

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

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

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

Working with Dates

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

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

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

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

Example

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

Working with Dates

SYSDATE is a function that returns:

• Date

• Time

Example

Display the current date using the DUAL table.

```
SELECT SYSDATE FROM   DUAL;
```

Arithmetic with Dates

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

Arithmetic with Dates

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

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

Example

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

Date Functions

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;
```

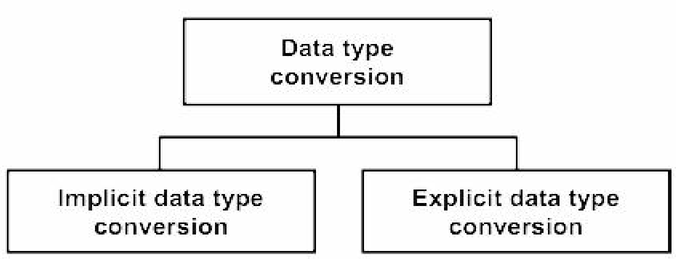
Conversion Functions

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:

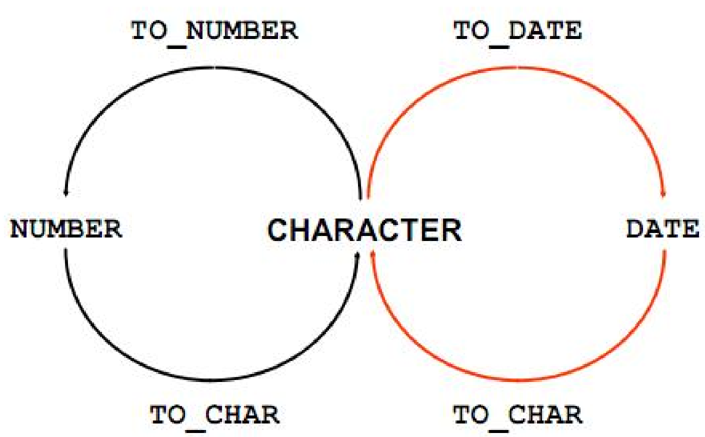
From	To
VARCHAR2 or CHAR	NUMBER
VARCHAR2 or CHAR	DATE
NUMBER	VARCHAR2
DATE	VARCHAR2

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

<u>Explicit Data Type Conversion</u>



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

<u>Example:</u>

Using the TO_CHAR Function with Dates

TO_CHAR(date, 'format_model')

The format model:

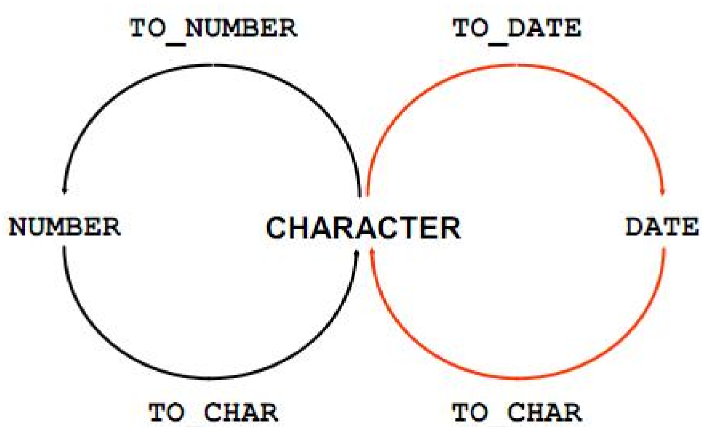
- Must be enclosed by single quotation marks
- Is case-sensitive
- Can include any valid date format element

• Has an fm element to remove padded blanks or suppress leading zeros

• Is separated from the date value by a comma

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

Elements of the Date Format Model



Sample Format Elements of Valid Date

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

Date Format Elements: Time Formats

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

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

Other Formats

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

Specifying Suffixes to Influence Number Display

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

Example

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

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

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

Using the TO_CHAR Function with Numbers

TO_CHAR(number, 'format_model')

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

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';

<u>Using the TO_NUMBER and TO_DATE Functions</u>

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

TO_NUMBER(char[, 'format_model']

• Convert a character string to a date format using the TO_DATE function:

TO_DATE(char[, 'format_model']

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

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

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

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

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

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

Find the Solution for the following:

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

```
select sysdate as "Date" from dual;
```

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

```
select employee_id, last_name, salary, round(salary * 1.155) as "New Salary" from employees;
```

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

```
select employee_id, last_name, salary, round(salary * 1.155) as "New Salary", round((salary * 1.155) - salary) as "Increase" from employees;
```

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

```
update employees set last_name='Austin' where employee_id=2;
update employees set last_name='Johnson' where employee_id=4;
```

update employees set last_name='Miller' where employee_id=10;
select initcap(last_name) as "Last Name", length(last_name) as "Length" from employees where last_name like 'J%' or last_name like 'A%' or last_name like 'M%' order by last_name;

5. Rewrite the query so that the user is prompted to enter a letter that starts the last name. For example, if the user enters H when prompted for a letter, then the output should show all employees whose last name starts with the letter H.
select initcap(last_name) as "Last Name", length(last_name) as "Length" from employees where last_name like '&Enter_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.

Note: Your results will differ.

select last_name, months_between(sysdate, hire_date) as "MONTHS_WORKED" from employees order by round(months_between(sysdate, hire_date));

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 employees;

8. Create a query to display the last name and salary for all employees. Format the salary to be 15 characters long, left-padded with the $ symbol. Label the column SALARY.
select last_name, lpad(salary, 15, '$') as "SALARY" from employees;

9. Display each employee's last name, hire date, and salary review date, which is the first Monday after six months of service. Label the column REVIEW. Format the dates to appear in the format similar to "Monday, the Thirty-First of July, 2000."
select last_name, hire_date, next_day(add_months(hire_date, 6), 'MONDAY') as "REVIEW" from employees;

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

select last_name, hire_date, to_char(hire_date, 'Day') as "DAY" from employees order by to_char(hire_date, 'D');

Ex. No. : P-4 Date: 27/08/2024

Register No.: 221701007 Name: Amritha.A

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

select upper(email) from employees;

b. Determining the average salary for the employees in the sales department

select avg(salary) as "Average Salary" from employees where department_id = (select department_id from departments where department_name = 'Sales');

c. Showing hire dates with the month spelled out *(September 1, 2004)*

select to_char(hire_date, 'Month DD, YYYY') from employees;

d. Finding out the employees in each department that had the most seniority (the earliest hire date)

select last_name, hire_date from employees where hire_date = (select min(hire_date) from employees);

e. Displaying the employees' salaries rounded to the hundreds place

select round(salary, -2) as "Rounded Salary" from employees;

f. Substituting zeros for null values when displaying employee commissions.

select nvl(commission_pct, 0) as "Commission" from employees;

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

Definitions of Multiple-Row Functions:

AVG: Returns the average value of a numeric column.

COUNT: Returns the number of rows that match the query criteria.

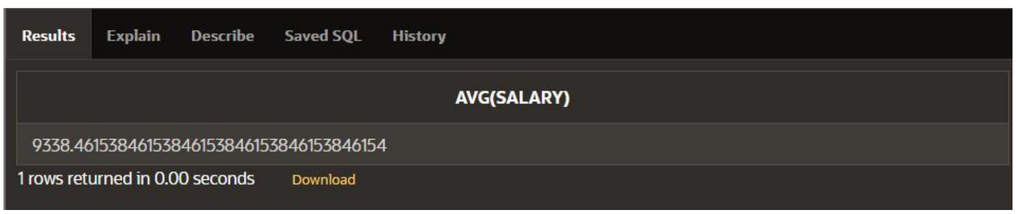
MAX: Returns the largest value from the selected column.

MIN: Returns the smallest value from the selected column.

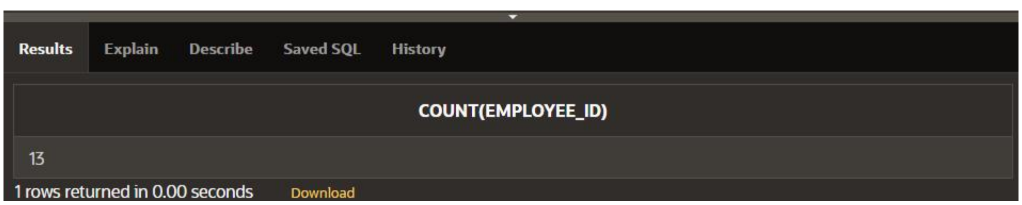
SUM: Returns the total sum of a numeric column.

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.

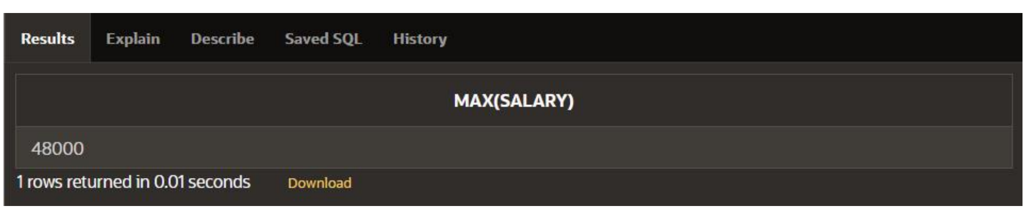
Avg - select avg(salary) from employees;



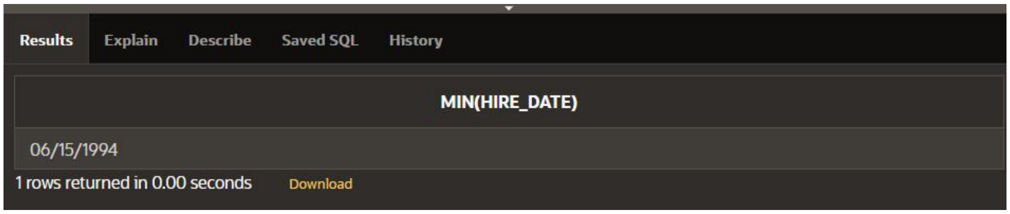
Count - select count(employee_id) from employees;



Max - select max(salary) from employees;



Min - select min(hire_date) from employees;



Sum - select sum(salary) from employees;

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

select 'The Best Class ' || 'Oracle ' || 'Internet ' || 'Academy' as "Combined Words" from dual;

2. Use the string “Oracle Internet Academy” to produce the following output:
The Net net
select substr('Oracle Internet Academy', 8, 3) || ' net' as "The Net net" from dual;

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

select length('Oracle Internet Academy') as "Length" from dual;

4. What’s the position of “I” in “Oracle Internet Academy”?
select instr('Oracle Internet Academy', 'I') as "Position" from dual;

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

select rpad(lpad('Oracle', 10, '*'), 16, '*') || rpad(lpad('Internet', 10, '*'), 16, '*') || rpad(lpad('Academy', 10, '*'), 16, '*') as "Padded String" from dual;

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.

select last_name, salary, round(salary / 1.55, 2) as "Divided Salary" from employees where employee_id between 100 and 102;

2. 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.

select last_name, salary, trunc(salary * 1.05333, 2) as "New Salary" from employees where department_id = 80;

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

select mod(38873, 2) as "Even or Odd" from dual;

4. 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

select round(845.553, 1) as "Rounded to 1 Decimal",
round(30695.348, 2) as "Rounded to 2 Decimals",
round(30695.348, -2) as "Rounded to -2",
trunc(2.3454, 2) as "Truncated to 2 Decimals" from
dual;

5. 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.

select last_name, salary from employees where mod(salary, 3) = 0;

6. Divide 34 by 8. Show only the remainder of the division. Name the output as EXAMPLE.
select mod(34, 8) as "EXAMPLE" from dual;

7. 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?

select 0.004 * 1000000 as "Difference" from dual;

Ex. No. : 8 **Date: 29/08/2024**

Register No.: 221701007 **Name: Amritha.A**

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

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

<u>Additional Search Conditions</u>

Using the AND Operator

<u>Example:</u>

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

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

Qualifying Ambiguous

Column Names

• Use table prefixes to qualify column names that are in multiple tables.

• Improve performance by using table prefixes.

• Distinguish columns that have identical names but reside in different tables by using column aliases.

Using Table Aliases

• Simplify queries by using table aliases.

• Improve performance by using table prefixes

Example:

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

Joining More than Two Tables

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

Example:

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

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

Non-Equijoins

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

Example:

```
SELECT e.last_name, e.salary, j.grade_level
```

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

Outer Joins

Syntax

• You use an outer join to also see rows that do not meet the join condition.

• The Outer join operator is the plus sign (+).

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

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

Example:

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

Outer Join Restrictions

• The outer join operator can appear on only one side of the expression—the side that has information missing. It returns those rows from one table that have no direct match in the other table.

• A condition involving an outer join cannot use the IN operator or be linked to another condition by the OR operator

Self Join

Sometimes you need to join a table to itself.

Example:

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

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

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

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

In the syntax:

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

CROSS JOIN Returns a Cartesian product from the two tables

NATURAL JOIN Joins two tables based on the same column name

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

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

= table2.column_name

LEFT/RIGHT/FULL OUTER

Creating Cross Joins

- The CROSS JOIN clause produces the crossproduct of two tables.
- This is the same as a Cartesian product between the two tables.

Example:

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

Creating Natural Joins

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

Example:

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

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

Example:

```
SELECT  department_id, department_name,
location_id, city
```

```
FROM    departments
NATURAL JOIN locations
WHERE   department_id IN (20, 50);
```

Creating Joins with the USING Clause

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

Example:

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

EXAMPLE:

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

Creating Joins with the ON Clause

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

Example:

```
SELECT e.employee_id, e.last_name, e.department_id,
```

d.department_id, d.location_id

FROM   employees e JOIN departments d

ON   (e.department_id = d.department_id);

EXAMPLE:

SELECT e.last_name emp, m.last_name mgr

FROM   employees e JOIN employees m

ON   (e.manager_id = m.employee_id);

INNER Versus OUTER Joins

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

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

LEFT OUTER JOIN

Example:

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

FROM   employees e

LEFT OUTER JOIN departments d

ON   (e.department_id = d.department_id) ;

Example of LEFT OUTER JOIN

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

This query was completed in earlier releases as follows:

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

RIGHT OUTER JOIN

Example:

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

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

This query was completed in earlier releases as follows:

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

FULL OUTER JOIN

Example:

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

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

Find the Solution for the following:

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

select last_name,department_id,job_id as "Dept_Name" from employees;

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

select distinct e.job_id, d.location_id from employees e join departments d on e.department_id = d.department_id where e.department_id = 80;

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

select e.last_name, d.department_name, d.location_id, l.city from employees e join departments d on e.department_id = d.department_id join locations l on d.location_id = l.location_id where e.commission_pct is not null;

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

select e.last_name, d.department_name from employees e join departments d on e.department_id = d.department_id where e.last_name like '%a%';

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

select e.last_name, e.job_id, e.department_id, d.department_name from employees e join departments d on e.department_id = d.department_id join locations l on d.location_id = l.location_id where l.city = 'Toronto';

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

select e.last_name as "Employee", e.employee_id as "Emp#", m.last_name as "Manager", m.employee_id as "Mgr#" from employees e left join employees m on e.manager_id = m.employee_id;

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

select e.last_name as "Employee", e.employee_id as "Emp#", m.last_name as "Manager", m.employee_id as "Mgr#" from employees e left join employees m on e.manager_id = m.employee_id order by e.employee_id;

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

select e.last_name as "Employee", e.department_id as "Department" from employees e where e.department_id = (select department_id from employees where employee_id = 100);

9. Show the structure of the JOB_GRADES table. Create a query that displays the name, job,
department name, salary, and grade for all employees.
desc job_grades;
select e.last_name, e.job_id, d.department_name, e.salary, j.grade_level from employees e join departments d on e.department_id = d.department_id join job_grades j on e.salary between j.min_salary and j.max_salary;

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

select last_name, hire_date from employees where hire_date > (select hire_date from employees where last_name = 'davies');

11. Display the names and hire dates for all employees who were hired before their managers,

along with their manager's names and hire dates. Label the columns Employee, Emp Hired, Manager, and Mgr Hired, respectively.

select e.last_name as "Employee", e.hire_date as "Emp Hired", m.last_name as "Manager", m.hire_date as "Mgr Hired" from employees e join employees m on e.manager_id = m.employee_id where e.hire_date < m.hire_date;

Ex. No. : 9 **Date: 29/08/2024**

Register No.: 221701007 **Name: Amritha.A**

Aggregating Data Using Group Functions

Objectives

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

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

What Are Group Functions?

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

Types of Group Functions

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

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

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

Group Functions: Syntax

SELECT [*column*,] *group_function(column), ...*

FROM *table*

[WHERE *condition*]

[GROUP BY *column*]

[ORDER BY *column*];

Guidelines for Using Group Functions

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

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

• All group functions ignore null values.

Using the AVG and SUM Functions

You can use AVG and SUM for numeric data.

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

Using the MIN and MAX Functions

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

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

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

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

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

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

Using the COUNT Function

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

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

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

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

Using the DISTINCT Keyword

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

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

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

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

Group Functions and Null Values

Group functions ignore null values in the column:

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

The NVL function forces group functions to include null values:

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

Creating Groups of Data

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

GROUP BY Clause Syntax

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

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

Guidelines

• If you include a group function in a SELECT clause, you cannot select individual results as well, *unless* the individual column appears in the GROUP BY clause. You receive an error message if you fail to include the column list in the GROUP BY clause.

• Using a WHERE clause, you can exclude rows before dividing them into groups.

• You must include the *columns* in the GROUP BY clause.

• You cannot use a column alias in the GROUP BY clause.

Using the GROUP BY Clause

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

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

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

SELECT AVG(salary) FROM employees GROUP BY department_id ;

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

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

Grouping by More Than One Column

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

Illegal Queries Using Group Functions

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

BY clause:

SELECT department_id, COUNT(last_name) FROM employees;

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

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

You cannot use the WHERE clause to restrict groups.

• You use the HAVING clause to restrict groups.

• You cannot use group functions in the WHERE clause.

SELECT department_id, AVG(salary) FROM employees WHERE AVG(salary) > 8000
GROUP BY department_id;

You can correct the error in the example by using the HAVING clause to restrict groups:

SELECT department_id, AVG(salary) FROM employees
HAVING AVG(salary) > 8000 GROUP BY department_id;

Restricting Group Results

With the HAVING Clause .When you use the HAVING clause, the Oracle server restricts groups as follows:

1. Rows are grouped.
2. The group function is applied.
3. Groups matching the HAVING clause are displayed.

Using the HAVING Clause

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

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

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

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

SELECT job_id, SUM(salary) PAYROLL FROM employees WHERE job_id NOT LIKE '%REP%'

GROUP BY job_id HAVING SUM(salary) > 13000 ORDER BY SUM(salary);

Nesting Group Functions

Display the maximum average salary:

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

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

Summary

In this exercise, students should have learned how to:

• Use the group functions COUNT, MAX, MIN, and AVG

• Write queries that use the GROUP BY clause

• Write queries that use the HAVING clause

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

2. Group functions include nulls in calculations.

False

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

True

The HR department needs the following reports:

4. Find the highest, lowest, sum, and average salary of all employees. Label the columns

Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number

select round(max(salary)) as maximum, round(min(salary)) as minimum, round(sum(salary)) as sum, round(avg(salary)) as average from employees;

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

select job_id, round(min(salary)) as minimum, round(max(salary)) as maximum, round(sum(salary)) as sum, round(avg(salary)) as average from employees group by job_id;

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

select job_id, count(*) as number_of_people from employees where job_id = :job_title group by job_id;

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

select count(distinct manager_id) as number_of_managers from employees where manager_id is not null;

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

select max(salary) - min(salary) as difference from employees;

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

select manager_id, min(salary) as salary from employees where manager_id is not null group by manager_id having min(salary) > 6000 order by salary desc;

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

select count(*) as total_employees, count(case when extract(year from hire_date) = 1995 then 1 end) as hired_1995, count(case when extract(year from hire_date) = 1996 then 1 end) as hired_1996, count(case when extract(year from hire_date) = 1997 then 1 end) as hired_1997, count(case when extract(year from hire_date) = 1998 then 1 end) as hired_1998 from employees;

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

select job_id, department_id, sum(salary) as total_salary from employees where department_id in (20, 50, 80, 90) group by job_id, department_id;

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

select d.department_name as name, l.city as location, count(e.employee_id) as number_of_people, round(avg(e.salary), 2) as salary from departments d join employees e on d.department_id = e.department_id join locations l on d.location_id = l.location_id group by d.department_name, l.city;

Ex. No. : P-5 Date: 03/09/2024

Register No.: 221701007 Name: Amritha.A

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.

```
SELECT ROUND(MONTHS_BETWEEN(SYSDATE, event_date)) AS months
FROM events
WHERE event_name = 'Vigil Wedding';
```

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."

```
select round((to_date('2023-09-01', 'yyyy-mm-dd') - to_date('2022-06-15', 'yyyy-mm-dd')) * 30.5) as Days
from dual;
```

3. Display the days between January 1 and December 31.

```
select (to_date('2024-12-31', 'yyyy-mm-dd') - to_date('2024-01-01', 'yyyy-mm-dd')) as days_between from
dual;
```

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.

```
select round(sysdate, 'MONTH') as rounded_month, round(sysdate, 'YEAR') as rounded_year, trunc(sysdate,
'MONTH') as truncated_month, trunc(sysdate, 'YEAR') as truncated_year from dual;
```

5. What is the last day of the month for June 2005? Use an alias for the output.

select last_day(to_date('2005-06-01', 'yyyy-mm-dd')) as last_day_of_june from dual;

6.Display the number of years between the Global Fast Foods employee Bob Miller's birthday and today. Round to the nearest year.

select round(months_between(sysdate, (select birth_date from employees where last_name = 'Miller' and first_name = 'Bob')) / 12) as years from dual;

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."

select add_months(sysdate, 6) as Appointment from dual;

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."

select last_day(sysdate) as Deadline from dual;

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

select months_between(to_date('2025-01-01', 'yyyy-mm-dd'), to_date('2024-08-15', 'yyyy-mm-dd')) as months_until_next_year from dual;

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

select next_day(to_date('2024-08-15', 'yyyy-mm-dd'), 'FRIDAY') as First_Friday from dual; -- Adjust the date to your birthday

select next_day(to_date('2024-08-15', 'yyyy-mm-dd'), 'FRIDAY') as first_friday from dual;

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

Example: months_between(start_date, end_date) returns the number of months as a number.

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

Example: add_months(date, n) returns a date that is n months later than the specified date.

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

Businesses often need to analyze sales trends over time, manage employee schedules, or track project deadlines, which requires accurate date calculations and comparisons.

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.

select last_name, to_char(birth_date, 'FMMonth DD, YYYY') as birthday from employees;

2. Convert January 3, 04, to the default date format 03-Jan-2004.

select to_date('January 3, 04', 'Month DD, RR') as default_date from dual;

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.

select 'The promotion began on the ' || to_char(start_date, 'fmDdspth "of" Month YYYY') as promotion_message
from f_promotional_menus
where promo_code = 110;

4. Convert today’s date to a format such as: “Today is the Twentieth of March, Two Thousand Four”

select 'Today is the ' || to_char(sysdate, 'fmDdspth "of" Month, Year') as today_message from dual;

5. List the ID, name and salary for all Global Fast Foods employees. Display salary with a $ sign and two decimal places.

select employee_id, last_name, first_name, to_char(salary, '$999,999.99') as formatted_salary from employees;

Ex. No. : 10 **Date: 03/09/2024**

Register No.: 221701007 **Name: Amritha.A**

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

Using Group Functions in a Subquery

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

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

The HAVING Clause with Subqueries

- The Oracle server executes subqueries first.

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

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

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

Example

Find the job with the lowest average salary.

```
SELECT job_id, AVG(salary)
FROM employees
GROUP BY job_id
```

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

What Is Wrong in this Statements?

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

Will This Statement Return Rows?

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

Multiple-Row Subqueries

• Return more than one row

• Use multiple-row comparison operators

Example

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

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

Using the ANY Operator in Multiple-Row Subqueries

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

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

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

Using the ALL Operator in Multiple-Row Subqueries

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

Displays employees whose salary is less than the salary of all employees with a job ID of IT_PROG and whose job is not IT_PROG.

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

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

Null Values in a Subquery

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

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

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

Display all employees who do not have any subordinates:

```sql
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).

```sql
select e.last_name, e.hire_date from employees e where e.department_id = (select department_id from employees where last_name = :input_last_name) and e.last_name != :input_last_name;
```

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

```sql
select employee_id, last_name, salary from employees where salary > (select avg(salary) from employees) order by salary asc;
```

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

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

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

select last_name, department_id, job_id from employees where department_id in (select department_id from departments where location_id = 1700);

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

select last_name, salary from employees where manager_id = (select employee_id from employees where last_name = 'king');

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

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

7. Modify the query 3 to display the employee number, last name, and salary of all employees who earn more than the average salary and who work in a department with any employee whose last name contains a *u*.
SELECT employee_id, last_name, salary
FROM employees
WHERE salary > (SELECT AVG(salary) FROM employees)
AND department_id IN (SELECT department_id FROM employees WHERE last_name LIKE '%u%');

Practice Questions

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.

```
SELECT first_name,
    last_name,
    salary AS "Current Salary",
    TO_CHAR(salary, '$99999.99') AS formatted_current_salary,
```

```
    TO_CHAR(salary + 2000, '$99999.99') AS "New Salary"
FROM employees
WHERE first_name = 'Ellen' AND last_name = 'Abel';
```

2. On what day of the week and date did Global Fast Foods' promotional code 110 Valentine's Special begin?

```
SELECT TO_CHAR(start_date, 'Day, DD-Mon-YYYY') AS promotion_day
FROM f_promotional_menus
WHERE promo_code = 110;
```

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

```
SELECT TO_CHAR(TO_DATE('25-Dec-2004', 'DD-Mon-YYYY'), 'Month DDth, YYYY') AS format_1,
    TO_CHAR(TO_DATE('25-Dec-2004', 'DD-Mon-YYYY'), 'MONTH DDth, YYYY') AS format_2,
    TO_CHAR(TO_DATE('25-Dec-2004', 'DD-Mon-YYYY'), 'DDth Month, YYYY') AS format_3
FROM dual;
```

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.

```
SELECT TO_CHAR(low_range, '$9999.00') AS low_range_cost,
    TO_CHAR(high_range, '$9999.00') AS high_range_cost
FROM d_packages;
```

5. Convert JUNE192004 to a date using the fx format model.

```
SELECT TO_DATE('JUNE192004', 'fxMONTHDDYYYY') AS converted_date
FROM dual;
```

6. What is the distinction between implicit and explicit datatype conversion? Give an example of each.

```
SELECT TO_NUMBER('123') FROM dual;
```

7. Why is it important from a business perspective to have datatype conversions?

Datatype conversions are important for accurate data manipulation, ensuring correct interpretations and calculations in business contexts, thus preventing errors in analysis and reporting.

```
SELECT TO_NUMBER('123') FROM dual;
```

Ex. No. : 11 **Date: 05/09/2024**

Register No.: 221701007 **Name: Amritha.A**

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_id
FROM employees
WHERE job_id <> 'ST_CLERK'
GROUP BY department_id
UNION
SELECT department_id
FROM departments
WHERE department_id NOT IN (
   SELECT department_id
   FROM employees
   WHERE job_id = 'ST_CLERK'
);
```

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

```
SELECT c.country_id, c.country_name
FROM countries c
MINUS
SELECT co.country_id, co.country_name
FROM departments d
JOIN locations l ON d.location_id = l.location_id
JOIN countries co ON l.country_id = co.country_id;
```

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

```
SELECT job_id, department_id
FROM (
   SELECT job_id, department_id
```

```
   FROM employees
   WHERE department_id = 10
   UNION ALL
   SELECT job_id, department_id
   FROM employees
   WHERE department_id = 50
   UNION ALL
   SELECT job_id, department_id
   FROM employees
   WHERE department_id = 20
) combined_results
ORDER BY
   CASE
      WHEN department_id = 10 THEN 1
      WHEN department_id = 50 THEN 2
      WHEN department_id = 20 THEN 3
   END;
```

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 e.employee_id, e.job_id
FROM employees e
JOIN job_history jh ON e.employee_id = jh.employee_id
WHERE jh.job_id = (
      SELECT job_id
      FROM job_history
      WHERE employee_id = e.employee_id
      AND start_date = (
```

```
        SELECT MIN(start_date)
        FROM job_history
        WHERE employee_id = e.employee_id
      )
   )
AND jh.end_date IS NULL;
```

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, department_id
FROM employees
UNION ALL
SELECT department_name AS name, department_id
FROM departments;
```

Ex. No. **:** **12** **Date: 10/09/2024**

Register No.: **221701007** **Name: Amritha.A**

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.

```
SELECT
   PROMO_NAME,
   START_DATE,
   CASE
      WHEN END_DATE IS NOT NULL THEN TO_CHAR(START_DATE + 14, 'YYYY-MM-DD')
      ELSE TO_CHAR(SYSDATE, 'YYYY-MM-DD')
   END AS END_DATE
FROM
   F_PROMOTIONAL_MENUS;
```

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”.

```
SELECT
   LAST_NAME,
   NVL(COMMISSION_PCT, 0) AS "Overtime Status"
FROM
   EMPLOYEES;
```

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.

```
SELECT
    LAST_NAME,
    NVL(COMMISSION_PCT, 5.00) AS "Overtime Rate"
FROM
    EMPLOYEES;
```

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.

```
SELECT
   LAST_NAME,
   NVL(MANAGER_ID, 9999) AS "Manager ID"
FROM
   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;

Ans:- option c) SELECT nullif(v_sal, 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;
```

The query returns a column named NAME that contains the last_name of the staff if it is not NULL;

otherwise, it returns the manager_id converted to a string. This ensures that each row has a value in the NAME column, either the last name or the manager's ID.

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).

```
SELECT first_name, last_name, TO_CHAR(hire_date, 'Month') AS month_of_hire
FROM EMPLOYEES;
```

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

```
SELECT first_name, last_name, NULLIF(TO_CHAR(hire_date, 'Month'), 'September') AS month_of_hire
FROM EMPLOYEES;
```

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.

```
SELECT first_name, COALESCE(specialty, 'No Specialty') AS specialty
FROM d_partners;
```

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".

```
SELECT
   CASE
      WHEN duration = 2 THEN 'shortest'
      WHEN duration = 10 THEN 'longest'
      ELSE TO_CHAR(duration)
   END AS "Play Times"
FROM d_songs;
```

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.

```
SELECT
   department_id,
   last_name,
   salary,
   CASE
      WHEN department_id = 10 THEN salary * 1.25
      WHEN department_id = 90 THEN salary * 1.5
      WHEN department_id = 130 THEN salary * 1.75
      ELSE salary
   END AS "New Salary"
FROM employees;
```

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.

```
SELECT
   first_name,
   last_name,
   manager_id,
   commission_pct,
   CASE
      WHEN manager_id IS NULL THEN commission_pct
```

```
    WHEN commission_pct IS NULL THEN 99999
    ELSE manager_id
  END AS "Review"
FROM employees
WHERE department_id IN (80, 90);
```

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.

```
SELECT
  e.last_name,
  d.department_name
FROM employees e
CROSS JOIN departments d;
```

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.

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

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.

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

Ex. No. : 13 **Date: 10/09/2024**

Register No.: 221701007 **Name: Amritha.A**

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

<u>Creating a view</u>

<u>Syntax</u>

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

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

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

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

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

<u>Example: 1</u> (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.deparment_id=d.deparment_id
GROUP BY d.department_name;
```

<u>Rules for performing DML operations on view</u>

- 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

<u>Example</u>: (Using the WITH CHECK OPTION clause)

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

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

Example – (Execute this and note the error)

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

Denying DML operations

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

Try this code:

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

Find the Solution for the following:

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

```
CREATE VIEW EMPLOYEE_VU AS
SELECT
    employee_id AS EMPNO,
    first_name || ' ' || last_name AS EMPLOYEE,
    department_id AS DEPTNO
FROM EMPLOYEES;
```

2. Display the contents of the EMPLOYEES_VU view.

```
SELECT * FROM EMPLOYEE_VU;
```

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

```
SELECT
    view_name,
    text
FROM USER_VIEWS
WHERE view_name = 'EMPLOYEE_VU';
```

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

```
SELECT EMPLOYEE, DEPTNO FROM EMPLOYEE_VU;
```

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

```
CREATE VIEW DEPT50 (EMPNO, EMPLOYEE, DEPTNO) AS
SELECT
    employee_id,
    last_name,
    department_id
FROM EMPLOYEES
```

```
WHERE department_id = 50
WITH CHECK OPTION;  -- Prevents updates that would violate the view's definition
```

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

```
DESC DEPT50;
```

7. Attempt to reassign Matos to department 80.

```
UPDATE DEPT50
SET DEPTNO = 80
WHERE EMPLOYEE = 'Matos';
```

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

```
CREATE VIEW SALARY_VU AS
SELECT
   e.last_name AS Employee,
   d.department_name AS Department,
   e.salary AS Salary,
   j.grade AS Grade
FROM EMPLOYEES e
JOIN DEPARTMENTS d ON e.department_id = d.department_id
JOIN JOB_GRADE j ON e.salary BETWEEN j.low_salary AND j.high_salary;
```

Ex. No. : P-6 Date: 10/09/2024

Register No.: 221701007 Name: Amritha.A

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.

```
SELECT
    l.location_id,
    l.city,
    d.department_id,
    d.department_name
FROM locations l
JOIN departments d ON l.location_id = d.location_id;
```

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.

```
SELECT
    dpl.song_id,
    dc.cd_number,
    dt.title,
    dt.comments
FROM
    d_play_list_items dpl
JOIN
    d_track_listings dt ON dpl.song_id = dt.song_id
JOIN
```

```
d_cds dc ON dt.cd_number = dc.cd_number;
```

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

```
SELECT
    l.city,
    d.department_name,
    l.location_id,
    d.department_id
FROM
    departments d
JOIN
    locations l ON d.location_id = l.location_id;
```

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

```
SELECT
    c.country_name,
    r.region_id,
    r.region_name
FROM
    countries c
JOIN
    regions r ON c.region_id = r.region_id
WHERE
    r.region_name = '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.

```
SELECT
    e.first_name,
    e.last_name,
    e.hire_date,
    e.job_id,
    j.job_title,
    j.max_salary
FROM
    employees e
JOIN
    jobs j ON e.job_id = j.job_id
WHERE
    j.max_salary > 12000;
```

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.

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

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.

```sql
SELECT
    e.first_name,
    e.last_name,
    d.department_name
FROM
    employees e
RIGHT JOIN
    departments d ON e.department_id = d.department_id;
```

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.

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

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.

```sql
SELECT
    c.first_name,
    c.last_name,
    e.event_date,
    e.description
```

```
FROM
    clients c
LEFT JOIN
    events e ON c.client_id = e.client_id;
```

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.

```
SELECT
    s.shift_description,
    sa.shift_assignment_date
FROM
    shifts s
LEFT JOIN
    shift_assignments sa ON s.shift_id = sa.shift_id;
```

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.

```
SELECT
    e.last_name AS Employee,
    e.employee_id AS "Emp#",
    m.last_name AS Manager,
    m.employee_id AS "Mgr#"
FROM
    employees e
```

```
LEFT JOIN
    employees m ON e.manager_id = m.employee_id;
```

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.

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

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.

```
SELECT
    e.first_name || ' ' || e.last_name AS Employee,
    m.first_name || ' ' || m.last_name AS Manager
FROM
    employees e
LEFT JOIN
    employees m ON e.manager_id = m.employee_id;
```

4. Write a report that shows the hierarchy for Lex De Haans department. Include last name,

salary, and department id in the report.

```
SELECT department_id
FROM employees
WHERE employee_id = (SELECT employee_id FROM employees WHERE last_name = 'De Haan' AND first_name = 'Lex');
```

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;
```

```
SELECT last_name, department_id, salary
FROM employees
START WITH employee_id = (SELECT employee_id FROM employees WHERE last_name = 'King')
CONNECT BY PRIOR employee_id = manager_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.

```
SELECT
   LPAD('-', LEVEL * 2, '-') || last_name AS employee_name,
   department_id,
   salary
FROM
   employees
START WITH
   manager_id IS NULL
```

```
CONNECT BY
    PRIOR employee_id = manager_id;
```

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

```
SELECT

    LPAD('-', LEVEL * 2, '-') || last_name AS employee_name,

    department_id,

    salary

FROM

    employees

WHERE

    employee_id NOT IN (

        SELECT employee_id

        FROM employees

        START WITH employee_id = (SELECT employee_id FROM
employees WHERE last_name = 'De Haan' AND first_name = 'Lex')

        CONNECT BY PRIOR employee_id = manager_id

    )

START WITH

    manager_id IS NULL

CONNECT BY
```

```
PRIOR employee_id = manager_id;
```

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.

```
SELECT
   p.*,
   t.*
FROM
   d_play_list_items p,
   d_track_listings t;
```

2. Correct the Cartesian product produced in question 1 by creating an equijoin using a common column.

```
SELECT
   p.*,
   t.*
FROM
   d_play_list_items p
JOIN
   d_track_listings t ON p.song_id = t.song_id;
```

3. Write a query to display the title, type, description, and artist from the DJs on Demand database.

```
SELECT
   title,
   duration as "TYPE",
   comments
FROM
```

```
    d_track_listings;
```

4. Rewrite the query in question 3 to select only those titles with an ID of 47 or 48.

```
SELECT
    title,
    duration,
    comments
FROM
    d_track_listings
WHERE
    song_id IN (47, 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.

```
SELECT
    c.client_id,
    c.first_name,
    e.event_id,
    e.event_date,
    e.event_venue,
    ja.job_assignment_id,
    ja.dj_id,
    ja.job_status
FROM
    clients c
JOIN
    events e ON c.client_id = e.event_id
JOIN
    d_job_assignments ja ON e.event_id = ja.event_id
WHERE
    ja.job_status = 'active';
```

Group Functions

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

AVG: Calculates the average value of a numeric column.

- ➔ Example: SELECT AVG(salary) FROM employees;

COUNT: Counts the number of rows or non-NULL values in a column.

- ➔ Example: SELECT COUNT(employee_id) FROM employees;

MAX: Returns the maximum value in a set.

- ➔ Example: SELECT MAX(salary) FROM employees;

MIN: Returns the minimum value in a set.

- ➔ Example: SELECT MIN(salary) FROM employees;

STDDEV: Calculates the standard deviation of a numeric column.

- ➔ Example: SELECT STDDEV(salary) FROM employees;

SUM: Calculates the total sum of a numeric column.

- ➔ Example: SELECT SUM(salary) FROM employees;

VARIANCE: Calculates the variance of a numeric column.

- ➔ Example: SELECT VARIANCE(salary) FROM employees;

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

SELECT ROUND(AVG(cost), 2) AS average_cost FROM events;

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

select avg(salary) as average_salary from global_fast_foods_staff where manager_id = 19;

4. Find the sum of the salaries for Global Fast Foods staff members whose IDs are 12 and 9.
select sum(salary) as total_salary from global_fast_foods_staff where employee_id in (12, 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

select min(salary) as lowest_salary,max(hire_date) as most_recent_hire_date, (select last_name from employees where department_id in (50, 60) order by last_name fetch first 1 row only) as first_employee,(select last_name from employees where department_id in (50, 60) order by last_name desc fetch first 1 row only) as last_employee from employees where department_id in (50, 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;
select sum(total_sales) from 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?
The unexpected high average salaries could be due to including hourly employees in the average calculation, which skews the results if their pay is significantly lower. Additionally, there may be

null or incorrect salary values affecting the overall average.

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?

If you select MIN(birthdate) from the provided birth dates—July 1, 1980; March 19, 1979; and March 30, 1969—the date that will be returned is March 30, 1969. This is because the MIN function returns the earliest date in the set.

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.

select avg(total_sales) as average_order_total from orders where order_date between to_date('2002-01-01', 'yyyy-mm-dd') and to_date('2002-12-21', 'yyyy-mm-dd');

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

select first_name, last_name, hire_date, company from employees where company = 'oracle' order by hire_date desc;

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;

select sum(total_sales) from orders;

Ex. No. : P-7 **Date: 12/09/2024**

Register No.: 221701007 **Name: Amritha.A**

COUNT, DISTINCT, NVL

1. How many songs are listed in the DJs on Demand D_SONGS table?

    select count(*) from songs;

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

select count(distinct loc_type) as number_of_location_types from d_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?

select count(song_id) as total_song_ids, count(distinct cd_number) as total_cd_numbers from d_track_listings;

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

select count(*) as customers_with_email from customers where email is not null and email <> '';

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?

select count(*) as partners_with_auth_expense from partners where authorized_expense is not null and authorized_expense > 0;

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;

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

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.

select round(avg(nvl(authorized_expense, 100000)), 2) as average_authorized_expense from partners;

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. - True

_c. There will be no null values in the selling_bonus column when the average is calculated. - True
_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. - True
_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. - True
b. The GROUP BY clause has an error because the manager_id is not listed in the SELECT clause. - False
c. Only salaries greater than 16001 will be in the result set. - False
d. Names beginning with Ki will appear after names beginning with Ko. - False
e. Last names such as King and Kochhar will be returned even if they don't have salaries > 16000. - False

```
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;

select manager_id from employees group by manager_id having avg(salary) < 16000;

b. SELECT cd_number,
COUNT(title) FROM d_cds
WHERE cd_number < 93;

select inventory_item, count(title) from d_cds where inventory_item< 93 group by inventory_item;

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;

select song_id, artist as artist from songs where duration in ('3 min', '6 min', '10 min') and song_id < 50;

d. SELECT loc_type, rental_fee AS
Fee FROM d_venues
WHERE id <100
GROUP BY
"Fee" ORDER
BY 2;

select loc_type, rental_fee as fee from d_venues where venue_id < 100 group by loc_type, rental_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);
```

```
SELECT 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. - True

b. You can use a column alias in the GROUP BY clause. - True

c. The GROUP BY clause always includes a group function. - False

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

```
SELECT MAX(average_salary) AS max_average_salary, MIN(average_salary) AS
min_average_salary
FROM (
   SELECT AVG(salary) AS average_salary
   FROM employees
   GROUP BY department_id
) avg_salaries;
```

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

```
SELECT AVG(max_salary) AS average_of_max_salaries
```

```
FROM (
   SELECT MAX(salary) AS max_salary
   FROM employees
   GROUP BY department_id
) max_salaries;
```

Using Set Operators

1. Name the different Set operators?

The different set operators in SQL are:

UNION: Combines the results of two or more SELECT statements, removing duplicates.

UNION ALL: Combines the results of two or more SELECT statements, including duplicates.

INTERSECT: Returns only the rows that are present in both SELECT statements.

MINUS: Returns rows from the first SELECT statement that are not present in the second SELECT statement.

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.

select employee_id, job_id, hire_date as start_date from employees union select employee_id, job_id, start_date from job_history order by employee_id;

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.

select employee_id, job_id, hire_date as start_date from employees union all select employee_id, job_id, start_date from job_history order by employee_id;

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

```
select e.employee_id, e.job_id, e.hire_date, e.department_id
from employees e
where e.employee_id not in (select j.employee_id from job_history j);
```

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

```
select distinct employee_id
from job_history;
```

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 just display a 0 (zero) in its place.

```
select employee_id, job_id, coalesce(salary, 0) as salary
from employees
union
select employee_id, job_id, 0 as salary
from job_history;
```

Ex. No. **:** **P-8** **Date: 12/09/2024**

Register No.: **221701007** **Name: Amritha.A**

Fundamentals of Subqueries

1. What is the purpose of using a subquery?

The purpose of using a subquery is to perform an operation that requires a nested query. Subqueries allow you to:

- ➔ Retrieve data that will be used in the main query. This can simplify complex queries by breaking them into smaller, manageable parts.
- ➔ Filter results based on conditions evaluated in the subquery.
- ➔ Perform calculations or aggregations that inform the outer query.

2. What is a subquery?

A subquery is a query nested inside another SQL query. It can be placed in various parts of the main query, such as the SELECT, FROM, WHERE, or HAVING clauses. A subquery is typically enclosed in parentheses and can return a single value, a set of values, or a table of data.

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

```
select song_id from
d_play_list_items where
playlist_item_id = (select
playlist_item_id from
d_play_list_items where
song_id = 45);
```

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

```
select * from events
where cost > (select
cost from events
where event_id =
45);
```

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

```
SELECT song_title, cd_number
FROM songs
WHERE song_title = 'Party Music for All Occasions' OR cd_number = 1;
```

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

```
SELECT *
FROM events
WHERE theme_code = (SELECT theme_code FROM events WHERE event_name = 'Vigil Wedding');
```

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

```
SELECT staff_name
FROM staffs
WHERE salary > (SELECT salary FROM staffs WHERE staff_id = 12);
```

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

```
SELECT staff_name
```

FROM staffs
WHERE position <> (SELECT position FROM staffs WHERE staff_name = 'Bob Miller');

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

SELECT first_name
FROM employees
WHERE department_id = (SELECT department_id FROM departments WHERE department_name = 'IT');

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

SELECT department_name FROM departments WHERE location_id IN (SELECT location_id FROM locations WHERE city = 'Seattle');

11. Which statement(s) regarding subqueries is/are true?

a. It is good programming practice to place a subquery on the right side of the comparison operator. - False
b. A subquery can reference a table that is not included in the outer query's FROM clause. - True
c. Single-row subqueries can return multiple values to the outer query. - False

Single-Row Subqueries

1. 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.

SELECT *
FROM employees
WHERE salary > (SELECT salary FROM employees WHERE last_name = 'Lorentz')
AND department_id = (SELECT department_id FROM employees WHERE last_name = 'Abel');

2. Write a query to return all those employees who have the same job id as Rajs and were hired after Davies.

```
SELECT *
FROM employees
WHERE job_id = (SELECT job_id FROM employees WHERE last_name = 'Rajs')
  AND hire_date > (SELECT hire_date FROM employees WHERE last_name = 'Davies');
```

3. What DJs on Demand events have the same theme code as event ID = 100?

```
SELECT *
FROM events
WHERE theme_code = (SELECT theme_code FROM events WHERE 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?

```
SELECT position
FROM staffs
GROUP BY position
HAVING MAX(salary) < (
    SELECT MAX(salary)
    FROM staffs
    WHERE position = 'Cook'
);
```

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.

```
SELECT staff_id, AVG(salary) AS avg_salary
FROM staffs
GROUP BY staff_id
```

```
HAVING AVG(salary) > (
    SELECT salary
    FROM staffs
    WHERE staff_name = 'Ernst'
);
```

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.

```
SELECT staff_id, MIN(salary) AS min_salary
FROM staffs
GROUP BY staff_id
HAVING MIN(salary) > (
    SELECT MIN(salary)
    FROM staffs
    WHERE staff_id <> 50
);
SELECT staff_id, MIN(salary) AS min_salary
FROM staffs
GROUP BY staff_id
HAVING MIN(salary) > (
    SELECT MIN(salary)
    FROM staffs
    WHERE staff_id <> 50
);
```

Multiple-Row Subqueries

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

```
SELECT staff_name, (SELECT MAX(salary) FROM staffs WHERE staff_id = 999) AS
max_salary
```

FROM staffs;

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.

SELECT s.song_id, s.title, s.duration, s.artist_name

FROM songs s

JOIN d_types t ON s.type_id = t.type_id

WHERE t.type_name IN ('Jazz', 'Pop');

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

SELECT staff_name
FROM staffs
WHERE salary = (SELECT MIN(salary) FROM staffs);

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

SELECT staff_name
FROM staffs
WHERE salary IN (SELECT MIN(salary) FROM staffs);

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 ...

WHERE year < (SELECT year FROM d_cds WHERE title = 'Carpe Diem');

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

WHERE salary_________(SELECT salary ...

WHERE salary < ANY (SELECT salary FROM employees WHERE job_title = 'Programmer' AND department = 'IT');

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

WHERE year ________(SELECT year …

WHERE year = ANY (SELECT year FROM d_cds WHERE title IN ('Party Music for All Occasions', 'Carpe Diem'));

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

WHERE duration ________(SELECT duration ...

WHERE duration > ALL (SELECT duration FROM d_songs WHERE type_code = 77);

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. - True

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. - False

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. - True

d. WHERE color NOT IN -- If the inner query returns red, green, blue, black, and then the outer query could return white. - True

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. - True

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;
```

```
SELECT department_id, MIN(salary)
FROM employees
GROUP BY department_id
HAVING MIN(salary) < (SELECT MIN(salary) FROM employees 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). - False

b. The query wants the names of employees who make the same salary as the smallest salary in any department. - True

c. The query first selects the employee ID and last name, and then compares that to the salaries in every department. - False

d. This query will not execute. -False

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.

```
SELECT last_name, first_name, department_id, manager_id
FROM employees e
WHERE (e.department_id, e.manager_id) = (
    SELECT department_id, manager_id
    FROM employees
    WHERE employee_id = 141
)
AND e.employee_id != 141;
```

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.

```
SELECT last_name, first_name, department_id, manager_id
FROM employees
WHERE department_id = (SELECT department_id FROM employees WHERE employee_id =
141)
  AND manager_id = (SELECT manager_id FROM employees WHERE employee_id = 141)
```

AND employee_id != 141;

Correlated Subqueries

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

SELECT e.employee_id, e.last_name
FROM employees e
WHERE e.salary > (SELECT AVG(salary) FROM employees WHERE department_id = e.department_id);

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

```
SELECT e.last_name, e.department_id, e.salary
FROM employees e
WHERE e.salary = (
   SELECT MAX(salary)
   FROM employees
   WHERE department_id = e.department_id
)
ORDER BY e.department_id;
```

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.

```
SELECT e.last_name, e.department_id, e.salary
FROM employees e
WHERE EXISTS (
   SELECT 1
   FROM employees e2
   WHERE e2.manager_id = e.employee_id
);
```

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.

```
SELECT MAX(salary) AS max_salary, MAX(salary) / 2 AS half_max_salary
FROM employees;
```

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.

Correcting Incorrect Data: It's important to alter data to fix errors, such as correcting customer details to ensure accurate transactions and services.

Reflecting Business Changes: Altering data allows databases to accommodate evolving business needs, such as updating employee salary information when compensation policies change.

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

```
CREATE TABLE copy_d_cds (
   CD_NUMBER INT PRIMARY KEY,
   TITLE VARCHAR2(100),
   PRODUCER VARCHAR2(100),
   YEAR INT
);
INSERT INTO copy_d_cds VALUES (97, 'Celebrate the Day', 'R&B Inc.', 2003);
INSERT INTO copy_d_cds VALUES (98, 'Holiday Tunes for All Ages', 'Tunes are Us', 2004);
INSERT INTO copy_d_cds VALUES (99, 'Party Music', 'Old Town Records', 2004);
INSERT INTO copy_d_cds VALUES (100, 'Best of Rock and Roll', 'Old Town Records', 2004);
SELECT * FROM copy_d_cds;
```

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.

```
CREATE TABLE copy_d_cds (
   CD_NUMBER INT PRIMARY KEY,
   TITLE VARCHAR2(100),
   PRODUCER VARCHAR2(100),
   YEAR INT
);
INSERT INTO copy_d_cds VALUES (97, 'Celebrate the Day', 'R&B Inc.', 2003);
INSERT INTO copy_d_cds VALUES (98, 'Holiday Tunes for All Ages', 'Tunes are Us', 2004);
INSERT INTO copy_d_cds VALUES (99, 'Party Music', 'Old Town Records', 2004);
INSERT INTO copy_d_cds VALUES (100, 'Best of Rock and Roll', 'Old Town Records', 2004);
SELECT * FROM copy_d_cds;
```

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

```
CREATE TABLE copy_d_clients (
   CLIENT_NUMBER NUMBER PRIMARY KEY,
   FIRST_NAME VARCHAR2(50),
   LAST_NAME VARCHAR2(50),
   PHONE VARCHAR2(15),
   EMAIL VARCHAR2(100)
);
INSERT INTO copy_d_clients VALUES (6655, 'Ayako', 'Dahish', '3608859030',
'dahisha@harbor.net');
INSERT INTO copy_d_clients VALUES (6689, 'Nick', 'Neuville', '9048953049',
```

'nnicky@charter.net');

SELECT * FROM copy_d_clients;

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

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.

SELECT * FROM copy_d_events;

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.

```
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)
);
```

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.

```
CREATE TABLE copy_f_food_items (
   item_id NUMBER PRIMARY KEY,
   item_name VARCHAR2(50),
   price NUMBER(5, 2)
);

INSERT INTO copy_f_food_items (item_id, item_name, price) VALUES (1, 'Strawberry Shake',
3.59);
INSERT INTO copy_f_food_items (item_id, item_name, price) VALUES (2, 'Fries', 1.00);

UPDATE copy_f_food_items
SET price = CASE
   WHEN item_name = 'Strawberry Shake' THEN 3.75
   WHEN item_name = 'Fries' THEN 1.20
END
WHERE item_name IN ('Strawberry Shake', 'Fries');
select * from  copy_f_food_items;
```

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?)

```
CREATE TABLE copy_f_staffs (
    staff_id NUMBER PRIMARY KEY,
    first_name VARCHAR2(20),
    last_name VARCHAR2(20),
    salary NUMBER(5, 2),
    overtime_pay NUMBER(5, 2)
INSERT INTO copy_f_staffs (staff_id, first_name, last_name, salary, overtime_pay) VALUES
(102, 'Sue', 'Doe', 18.00, 0.50);
INSERT INTO copy_f_staffs (staff_id, first_name, last_name, salary, overtime_pay) VALUES
(101, 'Bob', 'Miller', 20.00, 1.65);
UPDATE copy_f_staffs
SET overtime_pay = CASE
    WHEN first_name = 'Bob' AND last_name = 'Miller' THEN NVL(overtime_pay, 0) + 0.75
    WHEN first_name = 'Sue' AND last_name = 'Doe' THEN NVL(overtime_pay, 0) + 0.85
END
WHERE (first_name = 'Bob' AND last_name = 'Miller')
   OR (first_name = 'Sue' AND last_name = 'Doe');
select * from copy_f_staffs;
```

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

```
CREATE TABLE copy_f_orders (
    order_number NUMBER PRIMARY KEY,
    order_date DATE,
    order_total NUMBER(6, 2),
    cust_id NUMBER,
    staff_id NUMBER
);
INSERT INTO copy_f_orders VALUES (5680, TO_DATE('12-JUN-2004', 'DD-MON-YYYY'),
159.78, 145, 9);
INSERT INTO copy_f_orders VALUES (5691, TO_DATE('23-SEP-2004', 'DD-MON-YYYY'),
145.98, 225, 12);
INSERT INTO copy_f_orders VALUES (5701, TO_DATE('04-JUL-2004', 'DD-MON-YYYY'),
229.31, 230, 12);
select * from copy_f_orders;
```

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

```
CREATE TABLE copy_f_customers (
   id NUMBER PRIMARY KEY,
   first_name VARCHAR2(20),
   last_name VARCHAR2(20),
   address VARCHAR2(50),
   city VARCHAR2(20),
   state VARCHAR2(2),
   zip VARCHAR2(10),
   phone_number VARCHAR2(15)
);
INSERT INTO copy_f_customers VALUES (145, 'Katie', 'Hernandez', '92 Chico Way', 'Los Angeles', 'CA', '98008', '8586667641');
INSERT INTO copy_f_customers VALUES (225, 'Daniel', 'Spode', '1923 Silverado', 'Denver', 'CO', '80219', '7193343523');
```

```
INSERT INTO copy_f_customers VALUES (230, 'Adam', 'Zurn', '5 Admiral Way', 'Seattle', 'WA',
NULL, '4258879009');
select * from copy_f_customers;
```

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.

```
UPDATE copy_f_staffs
SET salary = (SELECT salary FROM copy_f_staffs WHERE first_name = 'Bob' AND last_name =
'Miller')
WHERE first_name = 'Sue' AND last_name = 'Doe';
```

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

```
INSERT INTO copy_f_staffs (staff_id, first_name, last_name, birthdate, salary, staff_type)
VALUES (25, 'Kai', 'Kim', TO_DATE('03-NOV-1988', 'DD-MON-YYYY'), 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.

```
UPDATE copy_f_staffs
SET manager_id = (SELECT manager_id FROM copy_f_staffs WHERE first_name = 'Sue' AND
last_name = 'Doe'),
    overtime_pay = 0
```

WHERE first_name = 'Kai' AND last_name = 'Kim';

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.

DELETE FROM copy_f_staffs WHERE first_name = 'Kai' AND last_name = 'Kim';

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.

CREATE TABLE lesson7_emp AS SELECT * FROM employees;

DEFAULT Values, MERGE, and Multi-Table Inserts

1. When would you want a DEFAULT value?

A DEFAULT value is used to automatically assign a specified value to a column when no value is provided during an INSERT operation. It's helpful when you want to ensure a column always has a default value or avoid NULL values.

2. Currently, the Global Foods F_PROMOTIONAL_MENUS 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_MENUS table using the following SQL statement:

CREATE TABLE copy_f_promotional_menus AS SELECT * FROM
F_PROMOTIONAL_MENUS WHERE 1=2;

b. Alter the current START_DATE column attributes using:

ALTER TABLE F_PROMOTIONAL_MENUS

MODIFY START_DATE DATE DEFAULT SYSDATE;

c. INSERT the new information and check to verify the results.

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?

INSERT INTO copy_f_promotional_menus(PROMO_CODE, PROMO_NAME, START_DATE, END_DATE, GIVEAWAY)

VALUES (120, 'New Customer', DEFAULT, TO_DATE('01-JUN-2005', 'DD-MON-YYYY'), '10% Discount Coupon');

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.

Use a sequence or just increment the cd_number manually for the new CDs.

b. Create a copy of the D_CDS table called manager_copy_d_cds. What was the correct syntax used?

CREATE TABLE manager_copy_d_cds AS SELECT * FROM D_CDS WHERE 1=2;

c. INSERT into the manager_copy_d_cds table each new CD title using an INSERT statement. Make up one example or use this data: 20, 'Hello World Here I Am', 'Middle Earth Records', '1998' What was the correct syntax used?

INSERT INTO manager_copy_d_cds VALUES (1001, 'Hello World Here I Am', 'Middle Earth

Records', '1998');

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?

```
MERGE INTO manager_copy_d_cds target
USING original_d_cds source
ON (target.cd_id = source.cd_id)
WHEN MATCHED THEN
  UPDATE SET target.title = source.title,
             target.year = source.year
WHEN NOT MATCHED THEN
  INSERT (cd_id, title, year)
  VALUES (source.cd_id, source.title, source.year);
```

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

```
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;

INSERT ALL
INTO sal_history (employee_id, hire_date, salary)
VALUES (employee_id, hire_date, salary)
INTO mgr_history (employee_id, manager_id, salary)
VALUES (employee_id, manager_id, salary)
```

```
WHEN salary > 20000 THEN
INTO special_sal (employee_id, salary)
VALUES (employee_id, salary)
SELECT employee_id, hire_date, salary, manager_id
FROM employees;

SELECT COUNT(*) FROM sal_history;

SELECT COUNT(*) FROM mgr_history;

SELECT COUNT(*) FROM special_sal;
```

Creating Tables

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

candidate_id: Primary Key
name: Candidate name
degree: Degree type
credits: Foreign Key referencing the requirements table

2. Write the syntax to create the grad_candidates table.

```
CREATE TABLE grad_candidates (
   candidate_id NUMBER PRIMARY KEY,
   name VARCHAR2(100),
   degree VARCHAR2(50),
   credits NUMBER,
   CONSTRAINT fk_credits FOREIGN KEY (credits) REFERENCES requirements(credits)
);
```

3. Confirm creation of the table using DESCRIBE.

```
DESCRIBE grad_candidates;
```

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.

```
CREATE TABLE smith_table AS
SELECT * FROM grad_candidates;
```

```
CREATE TABLE smith_table AS
SELECT * FROM grad_candidates;
```

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

INSERT INTO smith_table (candidate_id, name, degree, credits)
VALUES (1, 'John Smith', 'MS', 30);

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.

SELECT * FROM USER_TABLES;
SELECT * FROM USER_OBJECTS;
SELECT * FROM USER_CATALOG;

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:

```
CREATE TABLE o_jobs (
   job_id NUMBER PRIMARY KEY,
   job_title VARCHAR2(100),
   min_salary NUMBER,
   max_salary NUMBER
);
CREATE TABLE o_employees (
   employee_id NUMBER PRIMARY KEY,
```

```
  first_name VARCHAR2(50),
  last_name VARCHAR2(50),
  job_id NUMBER,
  salary NUMBER,
  hire_date DATE,
  department_id NUMBER,
  FOREIGN KEY (job_id) REFERENCES o_jobs(job_id),
  FOREIGN KEY (department_id) REFERENCES o_departments(department_id)
);
CREATE TABLE o_departments (
  department_id NUMBER PRIMARY KEY,
  department_name VARCHAR2(100)
);
```

2. Add the Human Resources job to the jobs table:

```
INSERT INTO o_jobs (job_id, job_title, min_salary, max_salary)
VALUES (1, 'Human Resources', 40000, 80000);
```

3. Add the three new employees to the employees table:

```
INSERT INTO o_employees (employee_id, first_name, last_name, job_id, salary, hire_date,
department_id)
VALUES (101, 'John', 'Doe', 1, 50000, SYSDATE, 10),
    (102, 'Jane', 'Smith', 1, 60000, SYSDATE, 10),
    (103, 'Mike', 'Brown', 1, 55000, SYSDATE, 10);
```

4. Add Human Resources to the departments table:

```
INSERT INTO o_departments (department_id, department_name)
VALUES (10, 'Human Resources');
```

5. Why is it important to be able to modify a table?

It is important to modify a table to:

- Adapt to changing data requirements.

- Add new columns to store additional information.
- Update constraints or relationships between tables.
- Remove unnecessary data or columns to optimize performance.

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

```
CREATE TABLE Artists (
   artist_id NUMBER PRIMARY KEY,
   first_name VARCHAR2(50),
   last_name VARCHAR2(50),
   band_name VARCHAR2(100),
   email VARCHAR2(100),
   hourly_rate NUMBER,
   song_id NUMBER,
   FOREIGN KEY (song_id) REFERENCES d_songs(song_id)
);
```

b. INSERT one artist from the d_songs table.

```
INSERT INTO Artists (artist_id, first_name, last_name, band_name, email, hourly_rate, song_id)
SELECT 1, 'ArtistFirst', 'ArtistLast', 'BandName', 'artist@example.com', 50, song_id
FROM d_songs
WHERE song_id = 1;
```

c. INSERT one artist of your own choosing; leave song_id blank.

```
INSERT INTO Artists (artist_id, first_name, last_name, band_name, email, hourly_rate)
```

VALUES (2, 'YourFirst', 'YourLast', 'YourBand', 'your.email@example.com', 60);

d. Give an example how each of the following may be used on the table that you have created:

1) ALTER TABLE

ALTER TABLE Artists ADD phone_number VARCHAR2(15);

2) DROP TABLE

DROP TABLE Artists;

3) RENAME TABLE

RENAME Artists TO Artist_List;

4) TRUNCATE

TRUNCATE TABLE Artists;

5) COMMENT ON TABLE

COMMENT ON TABLE Artists IS 'This table stores artist information';

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.

ALTER TABLE o_employees
ADD Termination VARCHAR2(50) DEFAULT TO_CHAR(SYSDATE, 'Month DDth, YYYY');

3. Create a new column in the o_employees table called start_date. Use the TIMESTAMP WITH LOCAL TIME ZONE as the datatype.

ALTER TABLE o_employees

ADD start_date TIMESTAMP WITH LOCAL TIME ZONE;

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

```
TRUNCATE TABLE o_jobs;
SELECT * FROM o_jobs;
```

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

· **TRUNCATE**: Removes all rows but keeps the table structure.

· **DELETE**: Removes specific rows or all rows but allows rollback.

· **DROP**: Removes the entire table, including its structure and data.

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

· You **can** modify data types, add new columns, and change constraints.

· You **cannot** remove a column if it's part of a primary key or foreign key without dropping those constraints.

7. Add the following comment to the o_jobs
table: "New job description added"
View the data dictionary to view your comments.

```
COMMENT ON TABLE o_jobs IS 'New job description added';
```

8. Rename the o_jobs table to o_job_description.

```
RENAME o_jobs 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.

CREATE TABLE copy_f_staffs AS SELECT * FROM f_staffs;

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

DESCRIBE copy_f_staffs;

B. Drop the table.

DROP TABLE copy_f_staffs;

D.Try to select from the table.

SELECT * FROM copy_f_staffs;

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

SELECT OBJECT_NAME FROM RECYCLEBIN;

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;

SELECT * FROM copy_f_staffs;

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

UPDATE copy_f_staffs SET salary = 12 WHERE first_name = 'Sue' AND last_name = 'Doe';
COMMIT;

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

SELECT * FROM copy_f_staffs;

d. For Sue Doe, update the salary to 2 and commit the change.

UPDATE copy_f_staffs SET salary = 2 WHERE first_name = 'Sue' AND last_name = 'Doe';
COMMIT;

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

SELECT * FROM copy_f_staffs;

f. Now, issue a FLASHBACK QUERY statement against the copy_f_staffs table, so you can see all the changes made.

SELECT * FROM copy_f_staffs AS OF TIMESTAMP (SYSTIMESTAMP - INTERVAL '5' MINUTE);

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.

UPDATE copy_f_staffs SET salary = <original_salary> WHERE first_name = 'Sue' AND last_name = 'Doe';
COMMIT;

Ex. No. : 14 **Date: 17/09/2024**

Register No.: 221701007 **Name: Amritha.A**

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 a database enforces rules at the column or table level to maintain the accuracy and reliability of the data. Constraints ensure that the data entered into a database meets specific conditions such as being unique, non-null, or within a certain range. Common types of constraints include:

- **NOT NULL**: Ensures that a column cannot contain NULL values.
- **UNIQUE**: Ensures that all values in a column are distinct.
- **PRIMARY KEY**: A combination of NOT NULL and UNIQUE. It uniquely identifies each row in a table.
- **FOREIGN KEY**: Ensures referential integrity between two related tables.

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

· **Column-level constraints** are applied directly to a specific column and can include constraints such as NOT NULL, UNIQUE, and CHECK.

- **Limitation**: Only applies to a single column, so more complex conditions involving multiple columns cannot be applied at this level.

· **Table-level constraints** are defined separately and can apply to multiple columns, such as a PRIMARY KEY across several columns or a CHECK condition involving multiple fields.

- **Limitation**: More complex to write, and any constraints defined at the table level could potentially slow down performance when involving multiple columns or rows.

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

· Identify the purpose of the constraint in case of errors or debugging.

· Maintain the database and enforce data integrity rules.

· Communicate the role of the constraint to other database users or developers.

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.

Column Name Data Type Length Precision Scale Nullable

id NUMBER 4 NOT NULL

loc_name VARCHAR2 20 NOT NULL

date_opened DATE NOT NULL

address VARCHAR2 30 NOT NULL

city VARCHAR2 20 NOT NULL

zip_postal VARCHAR2 20 NULL

phone VARCHAR2 15 NULL

email VARCHAR2 80 NOT NULL (UNIQUE)

manager_id NUMBER 4 NULL

contact VARCHAR2 40 NULL

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

· id (NOT NULL)

· loc_name (NOT NULL)

· date_opened (NOT NULL)

· address (NOT NULL)

· city (NOT NULL)

· zip_postal (nullable)

· phone (nullable)

· email (NOT NULL and UNIQUE)

· manager_id (nullable)

· contact (nullable)

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(4) CONSTRAINT pk_global_locations_id PRIMARY KEY,
   loc_name VARCHAR2(20) NOT NULL,
   date_opened DATE NOT NULL,
   address VARCHAR2(30) NOT NULL,
   city VARCHAR2(20) NOT NULL,
   zip_postal VARCHAR2(20),
   phone VARCHAR2(15),
   email VARCHAR2(80) NOT NULL CONSTRAINT unique_email UNIQUE,
   manager_id NUMBER(4),
   contact VARCHAR2(40)
);
```

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

Once you have this statement, you can execute it in Oracle Application Express or your database management system.

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

DESCRIBE global_locations;

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	

```
CREATE TABLE global_locations (
    id NUMBER(4) CONSTRAINT pk_global_locations_id PRIMARY KEY,
    loc_name VARCHAR2(20) NOT NULL,
    date_opened DATE NOT NULL,
    address VARCHAR2(30) NOT NULL,
    city VARCHAR2(20) NOT NULL,
    zip_postal VARCHAR2(20),
    phone VARCHAR2(15),
    email VARCHAR2(80) NOT NULL,
    manager_id NUMBER(4),
    contact VARCHAR2(40),
    CONSTRAINT unique_email UNIQUE (email)
);
```

Ex. No. : 15 **Date: 20/09/2024**

Register No.: 221701007 **Name: Amritha.A**

Creating Views

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

· **Data Security**: Views can be used to limit access to sensitive data. For example, a view can exclude salary details while still allowing access to other employee information.

· **Simplified Queries**: Complex queries can be encapsulated in views, simplifying the way end-users or applications interact with the database.

· **Data Abstraction**: Views can present data in different formats without altering the underlying tables, allowing DBAs to hide the complexity of the data model.

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 d_songs
WHERE type_code = 'New Age';
```

3. SELECT * FROM view_d_songs. What was returned?

```
SELECT * FROM view_d_songs;
```

REPLACE view_d_songs. Add type_code to the column list. Use aliases for all columns. Or use alias after the CREATE statement as shown.

4. 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 OR REPLACE VIEW view_d_songs AS
SELECT id AS "Song ID", title AS "Song Title", artist AS "Artist", type_code AS "Genre Type"
FROM d_songs
WHERE type_code = 'New Age';
```

5. 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.

```
CREATE VIEW view_jason_events AS
SELECT name AS "Event Name", event_date AS "Event Date", theme_description AS "Theme"
FROM d_events
JOIN d_themes ON d_events.theme_code = d_themes.theme_code;
```

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.

SELECT table_name, column_name, updatable, insertable, deletable
FROM user_updatable_columns
WHERE table_name = 'COPY_D_SONGS';

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.

CREATE OR REPLACE VIEW view_copy_d_songs AS
SELECT *
FROM 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

INSERT INTO view_copy_d_songs (id, title, duration, artist, type_code)
VALUES (88, 'Mello Jello', 2, 'The What', 4);

SELECT * FROM copy_d_songs;

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.

```
CREATE VIEW read_copy_d_cds AS
SELECT *
FROM copy_d_cds
WHERE year = 2000
WITH READ ONLY;
```

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

This query will fail since the read_copy_d_cds view was created with the WITH READ ONLY option. You cannot perform DELETE, INSERT, or UPDATE operations through a read-only view.

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.

```
 CREATE OR REPLACE VIEW read_copy_d_cds AS
SELECT *
FROM copy_d_cds
WHERE year = 2000
WITH CHECK OPTION CONSTRAINT ck_read_copy_d_cds;

SELECT * FROM read_copy_d_cds;
```

7. Use the read_copy_d_cds view to delete any CD of year 2000 from the underlying copy_d_cds.
This will fail because the view is constrained by WITH CHECK OPTION. You cannot delete records that do not satisfy the WHERE clause condition (year = 2000).

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

DELETE FROM copy_d_cds
WHERE cd_number = 90;

SELECT * FROM copy_d_cds;

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

This query will fail because the read_copy_d_cds view only allows modification of records where the year = 2000. Since the WITH CHECK OPTION is applied, any record outside of the 2000 year cannot be deleted.

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

Only records where cd_number = 90 or year = 2000 could be deleted (if deletion was allowed for that specific condition).

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

1. **Read-Only Views**: If a view is created with WITH READ ONLY, no DML operations (INSERT, UPDATE, DELETE) are allowed.
2. **Complex Views**: Views that contain complex queries (e.g., using GROUP BY, DISTINCT, JOIN, UNION) typically do not allow DML operations.
3. **Check Option**: If a view is created with WITH CHECK OPTION, modifications to the view cannot result in rows that violate the WHERE clause conditions.

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

Moore's Law predicts that the number of transistors on a microchip will double approximately every two years, leading to increased computing power and decreased costs. However, due to physical limitations, it may not continue indefinitely.

13. What is the "singularity" in terms of computing?

The Singularity refers to a future point where AI surpasses human intelligence, leading to rapid technological advancements beyond human control or understanding. It remains a debated and speculative concept.

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.

```
 CREATE VIEW view_copy_d_songs AS
SELECT title, artist
FROM copy_d_songs;

SELECT * FROM view_copy_d_songs;
```

2. Issue a DROP view_copy_d_songs. Execute a SELECT * statement to verify that the view has been deleted.

```
 DROP VIEW view_copy_d_songs;
SELECT * FROM view_copy_d_songs;
```

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.

```
 SELECT last_name, salary
FROM employees
```

```
ORDER BY salary DESC
FETCH FIRST 3 ROWS ONLY;
```

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.

```
 SELECT last_name, salary, department_id,
      (SELECT MAX(salary) FROM employees e2 WHERE e2.department_id =
e1.department_id) AS max_salary
FROM employees e1;
```

5. Create a query that will return the staff members of Global Fast Foods ranked by salary from lowest to highest.

```
 SELECT last_name, salary
FROM F_STAFFS
ORDER BY salary ASC;
```

Indexes and Synonyms

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

An index is a database object that improves the speed of data retrieval operations on a table. It functions like a table of contents in a book, helping the database quickly locate the data without scanning the entire table.

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

ROWID is a unique identifier assigned to each row in a database. It represents the physical location of the row in the data files. It is often used to fetch rows directly, which can speed up certain queries.

3. When will an index be created automatically?

An index is created automatically when a primary key or unique constraint is defined on a column.

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.

```
CREATE INDEX idx_cd_number
ON d_track_listings(cd_number);
```

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.

```
SELECT i.index_name, i.uniqueness, u.column_name
FROM user_indexes i
JOIN user_ind_columns u ON i.index_name = u.index_name
WHERE i.table_name = 'D_SONGS';
```

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.

```
SELECT index_name, table_name, uniqueness
FROM user_indexes
WHERE table_name = 'D_EVENTS';
```

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

```
CREATE SYNONYM dj_tracks FOR d_track_listings;
```

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.

```
CREATE INDEX idx_last_name
ON d_partners(LOWER(last_name));

SELECT *
FROM d_partners
WHERE LOWER(last_name) = 'smith';
```

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

```
CREATE SYNONYM my_tracks FOR
d_track_listings;

SELECT synonym_name, table_name
FROM user_synonyms
WHERE synonym_name = 'MY_TRACKS';
```

10.Drop the synonym that you created in question

```
DROP SYNONYM my_tracks;
```

Ex. No. : 16 **Date: 20/09/2024**

Register No.: 221701007 **Name: Amritha.A**

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.)

<u>Creating a Sequence</u>

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

<u>EXAMPLE:</u>

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

<u>Confirming Sequences</u>

- 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.

<u>EXAMPLE:</u>

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

<u>NEXTVAL and CURRVAL Pseudocolumns</u>

• 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;
```

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, last_number
FROM user_sequences
WHERE sequence_name = 'DEPT_ID_SEQ';
```

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 (DEPT_ID, DEPT_NAME)
VALUES (DEPT_ID_SEQ.NEXTVAL, 'Education');
INSERT INTO DEPT (DEPT_ID, DEPT_NAME)
VALUES (DEPT_ID_SEQ.NEXTVAL, 'Administration');
SELECT * FROM DEPT WHERE DEPT_NAME IN ('Education', 'Administration');
```

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

```
 CREATE INDEX IDX_DEPT_ID ON EMP (DEPT_ID);
```

6. 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';
```

Ex. No. : 17 Date: 24/09/2024

Register No.: 221701007 Name: Amritha.A

<u>Controlling User Access</u>

<u>Objectives</u>

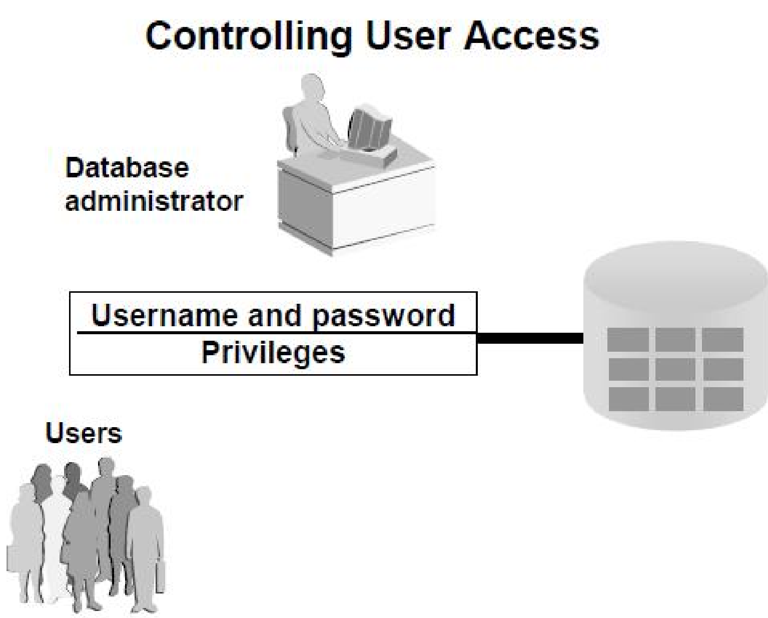
After the completion of this exercise, the students will be able to do the following:

• 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



<u>Controlling User Access</u>

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.

<u>Granting System Privileges</u>

The DBA can grant a user specific system privileges.

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

<u>What is a Role</u>?

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	√	√		

<u>Object Privileges</u>

• 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

<u>Granting Object Privileges</u>

• 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?

The privilege required for a user to log on to the Oracle server is the CREATE SESSION privilege. This is a **system privilege** because it allows the user to establish a connection to the database.

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

The privilege required for a user to create tables is the CREATE TABLE privilege. This is a **system privilege**.

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

As the owner of the table, you can grant privileges to other users. You, as the table owner, can pass along the privileges such as SELECT, INSERT, UPDATE, DELETE, etc., on your table to other users.

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

You should create a **role** that includes the necessary system privileges and then grant that role to the users. This allows you to manage multiple users with the same set of privileges more easily.

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

ALTER USER <username> IDENTIFIED BY <new_password>;

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

GRANT SELECT ON DEPARTMENTS TO <other_user>;

7. Query all the rows in your DEPARTMENTS table.

SELECT * FROM DEPARTMENTS;

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

INSERT INTO DEPARTMENTS (DEPARTMENT_ID, DEPARTMENT_NAME)
VALUES (500, 'Education');
INSERT INTO DEPARTMENTS (DEPARTMENT_ID, DEPARTMENT_NAME)
VALUES (510, 'Human Resources');

SELECT * FROM DEPARTMENTS WHERE DEPARTMENT_NAME IN ('Education', 'Human Resources');

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

SELECT * FROM USER_TABLES;

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

REVOKE SELECT ON DEPARTMENTS FROM <other_user>;

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

DELETE FROM DEPARTMENTS WHERE DEPARTMENT_ID = 500;
COMMIT;
_DELETE FROM DEPARTMENTS WHERE DEPARTMENT_ID = 510;
COMMIT;

Ex. No. : 18 **Date: 27/09/2024**

Register No.: 221701007 **Name: Amritha.A**

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.

```
 DECLARE
  v_employee_id   employees.employee_id%TYPE := 110;
  v_salary        employees.salary%TYPE;
  v_incentive     NUMBER;
BEGIN
  SELECT salary
  INTO v_salary
  FROM employees
  WHERE employee_id = v_employee_id;

  v_incentive := v_salary * 0.10;

  DBMS_OUTPUT.PUT_LINE('Incentive for Employee ID ' || v_employee_id || ' is: ' ||
v_incentive);
EXCEPTION
  WHEN NO_DATA_FOUND THEN
    DBMS_OUTPUT.PUT_LINE('Employee with ID ' || v_employee_id || ' not found.');
  WHEN OTHERS THEN
    DBMS_OUTPUT.PUT_LINE('An error occurred: ' || SQLERRM);
```

```
END;
```

PROGRAM 2

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

```
 DECLARE
  my_variable VARCHAR2(50);
BEGIN
  my_variable := 'Hello, world!';
  DBMS_OUTPUT.PUT_LINE(my_variable);
  "MY_VARIABLE" := 'This will fail';
  DBMS_OUTPUT.PUT_LINE("my_variable");
EXCEPTION
  WHEN OTHERS THEN
    DBMS_OUTPUT.PUT_LINE('Error: ' || SQLERRM);
END;
```

PROGRAM 3

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

Sample table: employees

```
 DECLARE
 v_employee_id   employees.employee_id%TYPE := 122;
 v_salary        employees.salary%TYPE;
 v_new_salary    employees.salary%TYPE;
BEGIN
 SELECT salary
 INTO v_salary
 FROM employees
 WHERE employee_id = v_employee_id;

 v_new_salary := v_salary * 1.10;

 UPDATE employees
 SET salary = v_new_salary
 WHERE employee_id = v_employee_id;

 COMMIT;
```

```
  DBMS_OUTPUT.PUT_LINE('Salary updated for Employee ID ' || v_employee_id || ' to ' ||
v_new_salary);

EXCEPTION

  WHEN NO_DATA_FOUND THEN

    DBMS_OUTPUT.PUT_LINE('Employee with ID ' || v_employee_id || ' not found.');

  WHEN OTHERS THEN

    DBMS_OUTPUT.PUT_LINE('An error occurred: ' || SQLERRM);

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.

```
DECLARE
 v_salary    employees.salary%TYPE;
 v_commission employees.commission_pct%TYPE;
 v_bonus     NUMBER;
BEGIN
 SELECT salary, commission_pct
 INTO v_salary, v_commission
 FROM employees
 WHERE employee_id = 101;

 IF v_salary IS NOT NULL AND v_commission IS NOT NULL THEN
   v_bonus := v_salary * v_commission;
   DBMS_OUTPUT.PUT_LINE('Bonus calculated: ' || v_bonus);
 ELSE
   DBMS_OUTPUT.PUT_LINE('Salary or Commission is NULL');
 END IF;
EXCEPTION
 WHEN NO_DATA_FOUND THEN
```

```
    DBMS_OUTPUT.PUT_LINE('Employee not found.');
  WHEN OTHERS THEN
    DBMS_OUTPUT.PUT_LINE('An error occurred: ' || SQLERRM);
END;
```

PROGRAM 5

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

```
 DECLARE

  v_employee_name employees.last_name%TYPE;

BEGIN

  FOR emp IN (SELECT last_name FROM employees WHERE last_name LIKE 'Smi%' )
LOOP

    DBMS_OUTPUT.PUT_LINE('Employee with last name starting with "Smi": ' ||
emp.last_name);

  END LOOP;



  FOR emp IN (SELECT last_name FROM employees WHERE last_name LIKE 'J\_n%'
ESCAPE '\') LOOP

    DBMS_OUTPUT.PUT_LINE('Employee with last name starting with "J_n": ' ||
emp.last_name);

  END LOOP;

EXCEPTION

  WHEN OTHERS THEN

    DBMS_OUTPUT.PUT_LINE('An error occurred: ' || SQLERRM);

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.

```
 DECLARE

 num1 NUMBER := 45;

 num2 NUMBER := 30;

 num_small NUMBER;

 num_large NUMBER;

BEGIN

 IF num1 < num2 THEN

   num_small := num1;

   num_large := num2;

 ELSE

   num_small := num2;

   num_large := num1;

 END IF;



 DBMS_OUTPUT.PUT_LINE('Small number: ' || num_small);

 DBMS_OUTPUT.PUT_LINE('Large number: ' || num_large);

END;
```

PROGRAM 7

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

```
 CREATE OR REPLACE PROCEDURE calculate_incentive (p_employee_id IN
employees.employee_id%TYPE) IS

  v_target_achieved employees.target_achieved%TYPE;

  v_incentive      NUMBER;

BEGIN

  SELECT target_achieved

  INTO v_target_achieved

  FROM employees

  WHERE employee_id = p_employee_id;



  IF v_target_achieved IS NOT NULL THEN

    v_incentive := v_target_achieved * 0.10;



    UPDATE employees

    SET incentive = v_incentive

    WHERE employee_id = p_employee_id;
```

```
  COMMIT;

  DBMS_OUTPUT.PUT_LINE('Record updated with incentive: ' || v_incentive);
 ELSE
  DBMS_OUTPUT.PUT_LINE('Target not achieved for Employee ID ' || p_employee_id || '. Record not updated.');
 END IF;
EXCEPTION
 WHEN NO_DATA_FOUND THEN
  DBMS_OUTPUT.PUT_LINE('Employee with ID ' || p_employee_id || ' not found.');
 WHEN OTHERS THEN
  DBMS_OUTPUT.PUT_LINE('An error occurred: ' || SQLERRM);
END;
```

PROGRAM 8

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

```
 CREATE OR REPLACE PROCEDURE calculate_incentive_based_on_sales(p_employee_id
IN employees.employee_id%TYPE) IS

  v_sales        employees.sales%TYPE;

  v_incentive    NUMBER;

BEGIN

  SELECT sales

  INTO v_sales

  FROM employees

  WHERE employee_id = p_employee_id;



  IF v_sales >= 100000 THEN

    v_incentive := v_sales * 0.15;

  ELSIF v_sales >= 50000 THEN

    v_incentive := v_sales * 0.10;

  ELSE

    v_incentive := v_sales * 0.05;

  END IF;
```

```
  UPDATE employees

  SET incentive = v_incentive

  WHERE employee_id = p_employee_id;



  COMMIT;



  DBMS_OUTPUT.PUT_LINE('Incentive calculated and updated for Employee ID ' ||
p_employee_id || ': ' || v_incentive);

EXCEPTION

  WHEN NO_DATA_FOUND THEN

    DBMS_OUTPUT.PUT_LINE('Employee with ID ' || p_employee_id || ' not found.');

  WHEN OTHERS THEN

    DBMS_OUTPUT.PUT_LINE('An error occurred: ' || SQLERRM);

END;
```

PROGRAM 9

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

```
DECLARE
  v_employee_count NUMBER;
  v_vacancies      NUMBER := 45;
BEGIN
  SELECT COUNT(*)
  INTO v_employee_count
  FROM employees
  WHERE department_id = 50;


  DBMS_OUTPUT.PUT_LINE('Number of employees in department 50: ' || v_employee_count);


  IF v_employee_count < v_vacancies THEN
    DBMS_OUTPUT.PUT_LINE('There are vacancies available in department 50.');
  ELSE
    DBMS_OUTPUT.PUT_LINE('No vacancies available in department 50.');
  END IF;
END;
```

PROGRAM 10

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

```
DECLARE
  v_department_id NUMBER := 50;
  v_employee_count NUMBER;
  v_vacancies      NUMBER := 45;
  v_vacancies_left NUMBER;
BEGIN
  SELECT COUNT(*)
  INTO v_employee_count
  FROM employees
  WHERE department_id = v_department_id;


  DBMS_OUTPUT.PUT_LINE('Number of employees in department ' || v_department_id || ': ' ||
v_employee_count);


  v_vacancies_left := v_vacancies - v_employee_count;
```

```
  IF v_vacancies_left > 0 THEN

    DBMS_OUTPUT.PUT_LINE('There are ' || v_vacancies_left || ' vacancies available in department ' || v_department_id || '.');

  ELSE

    DBMS_OUTPUT.PUT_LINE('No vacancies available in department ' || v_department_id || '.');

  END IF;

END;
```

PROGRAM 11

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

```
 DECLARE

  CURSOR employee_cursor IS

    SELECT employee_id, first_name, last_name, job_title, hire_date, salary

    FROM employees;

BEGIN

  FOR emp IN employee_cursor LOOP

    DBMS_OUTPUT.PUT_LINE('Employee ID: ' || emp.employee_id || ', Name: ' ||
emp.first_name || ' ' || emp.last_name ||

                         ', Job Title: ' || emp.job_title || ', Hire Date: ' || emp.hire_date || ', Salary: ' ||
emp.salary);

  END LOOP;

END;
```

PROGRAM 12

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

```
 DECLARE

  CURSOR employee_cursor IS

    SELECT e.employee_id, e.first_name, e.last_name, d.department_name

    FROM employees e

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

BEGIN

  FOR emp IN employee_cursor LOOP

    DBMS_OUTPUT.PUT_LINE('Employee ID: ' || emp.employee_id || ', Name: ' ||
emp.first_name || ' ' || emp.last_name ||

                          ', Department: ' || emp.department_name);

  END LOOP;

END;
```

PROGRAM 13

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

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

PROGRAM 14

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

```
DECLARE
 CURSOR job_history_cursor IS
   SELECT e.employee_id, e.first_name, e.last_name, jh.start_date
   FROM employees e
   JOIN job_history jh ON e.employee_id = jh.employee_id;
BEGIN
 FOR emp IN job_history_cursor LOOP
   DBMS_OUTPUT.PUT_LINE('Employee ID: ' || emp.employee_id || ', Name: ' || emp.first_name || ' ' || emp.last_name ||
                        ', Job History Start Date: ' || emp.start_date);
 END LOOP;
END;
```

PROGRAM 15

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

```
 DECLARE
  CURSOR job_history_cursor IS
    SELECT e.employee_id, e.first_name, e.last_name, jh.end_date
    FROM employees e
    JOIN job_history jh ON e.employee_id = jh.employee_id;
BEGIN
  FOR emp IN job_history_cursor LOOP
    DBMS_OUTPUT.PUT_LINE('Employee ID: ' || emp.employee_id || ', Name: ' ||
emp.first_name || ' ' || emp.last_name ||
                         ', Job History End Date: ' || emp.end_date);
  END LOOP;
END;
```

Ex. No. : 19 **Date: 04/10/2024**

Register No.: 221701007 **Name: Amritha.A**

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;

```
begin
select actualprice into price from ititems where itemid=identity;
if price is null then
raise null_price;
else
update ititems set actualprice=actualprice+total where itemid=identity;
end if;
exception
when null_price then
dbms_output.put_line('price is null');
end;
/
```

Procedure created.

```
SQL> exec itsum(101, 500);
```

PL/SQL procedure successfully completed.

```
SQL> select * from ititems;
```

ITEMID	ACTUALPRICE	ORDID	PRODID
101	2500	500	201
102	3000	1600	202
103	4000	600	202

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

```
SQL> set serveroutput on;

SQL> create procedure yyy (a IN number) is price number;
begin
```

```
select actualprice into price from ititems where itemid=a;
dbms_output.put_line('Actual price is ' || price);
if price is null then
dbms_output.put_line('price is null');
end if;
end;
/
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;
begin
select ordid into identity from ititems where itemid=a;
if identity<1000 then
 b:=100;
end if;
end;
/
Procedure created.

SQL> declare
a number;
b number;
```

```
begin
zzz(101,b);
dbms_output.put_line('The value of b is '|| b);
end;
/
The value of b is 100
PL/SQL procedure successfully completed.
```

<u>PROCEDURE FOR ‘INOUT’ PARAMETER – CREATION, EXECUTION</u>

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

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

<u>CREATE THE TABLE ‘ITTRAIN’ TO BE USED FOR FUNCTIONS</u>

```
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;
```

```
begin
total:=aaa (1001);
dbms_output.put_line('Train fare is Rs. '||total);
end;
/
```

Train fare is Rs.550

PL/SQL procedure successfully completed.

Program 1

FACTORIAL OF A NUMBER USING FUNCTION

```
 CREATE OR REPLACE FUNCTION factorial (n IN NUMBER) RETURN NUMBER IS
  result NUMBER := 1;
BEGIN
  FOR i IN 1..n LOOP
    result := result * i;
  END LOOP;
  RETURN result;
END;
/

DECLARE
  num NUMBER := 5;
  fact NUMBER;
BEGIN
  fact := factorial(num);
  DBMS_OUTPUT.PUT_LINE('Factorial of ' || num || ' is: ' || fact);
END;
```

Program 2

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

```
 CREATE OR REPLACE PROCEDURE get_book_info (
  p_book_id IN NUMBER,
  p_title OUT VARCHAR2,
  p_author OUT VARCHAR2,
  p_publish_year OUT NUMBER
) IS
BEGIN
  SELECT title, author, publish_year
  INTO p_title, p_author, p_publish_year
  FROM library_books
  WHERE book_id = p_book_id;
EXCEPTION
  WHEN NO_DATA_FOUND THEN
    p_title := 'Not Found';
    p_author := 'Not Found';
    p_publish_year := NULL;
  WHEN OTHERS THEN
    p_title := 'Error';
    p_author := 'Error';
    p_publish_year := NULL;
END;
/

DECLARE
  v_title VARCHAR2(100);
```

```
  v_author VARCHAR2(100);
  v_publish_year NUMBER;
BEGIN
  get_book_info(101, v_title, v_author, v_publish_year);
  DBMS_OUTPUT.PUT_LINE('Book Title: ' || v_title);
  DBMS_OUTPUT.PUT_LINE('Author: ' || v_author);
  DBMS_OUTPUT.PUT_LINE('Publish Year: ' || v_publish_year);
END;
```

Ex. No. : 20 **Date: 08/10/2024**

Register No.: 221701007 **Name: Amritha.A**

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'
```

<u>TO DROP THE CREATED TRIGGER</u>

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

Trigger created.

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

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

Cursor for loop

Explicit cursor

Implicit cursor

TO CREATE THE TABLE 'SSEMPP'

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

Table created.

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

1 row created.

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

1 row created.

SQL> insert into ssempp values(5,'ajay','lecturer',30000,11);

1 row created.

SQL> insert into ssempp values(6,'vijay','lecturer',18000,11);

1 row created.

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

1 row created.

SQL> select * from ssempp;

EID	ENAME	JOB	SAL	DNO
1	nala	lecturer	34000	11
2	kala	seniorlecturer	20000	12
5	ajay	lecturer	30000	11
6	vijay	lecturer	18000	11
3	nila	professor	60000	12

EXTRA PROGRAMS

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

```
SQL> set serveroutput on;
SQL> declare
begin
for emy in (select eid,ename from ssempp)
loop
dbms_output.put_line('Employee id and employee name  are '|| emy.eid ‘and’|| emy.ename);
end loop;
end;
/
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
cursor cem is select eid,ename,sal,dno from ssempp where dno=11;
begin
```

```
--open cem;
for rem in cem
loop
update ssempp set sal=rem.sal+5000 where eid=rem.eid;
end loop;
--close cem;
end;
/
```

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

```
declare
cursor cenl is select eid,sal from ssempp where dno=11;
ecode ssempp.eid%type;
esal empp.sal%type;
begin
open cenl;
```

```
loop
fetch cenl into ecode,esal;
exit when cenl%notfound;
dbms_output.put_line(' Employee code and employee salary are' || ecode ‘and’|| esal);
end loop;
close cenl;
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
county number;
begin
update ssempp set sal=sal+10000 where job='lecturer';
county:= sql%rowcount;
if county > 0 then
dbms_output.put_line('The number of rows are '|| county);
end if;
if sql %found then
dbms_output.put_line('Employee record modification successful');
else if sql%notfound then
```

```
dbms_output.put_line('Employee record is not found');
end if;
end if;
end;
/
```

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
a varchar2(20);
begin
a:='Hello';
```

```
  5  dbms_output.put_line(a);
  6  end;
  7  /
Hello

PL/SQL procedure successfully completed.
```

<u>TO INPUT A VALUE FROM THE USER AND DISPLAY IT</u>

```
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.
```

<u>GREATEST OF TWO NUMBERS</u>

```
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.
```

<u>PRINT NUMBERS FROM 1 TO 5 USING SIMPLE LOOP</u>

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

```
SQL> declare
a number:=1;
begin
loop
dbms_output.put_line (a);
a:=a+1;
exit when a>5;
end loop;
end;
/
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
a number:=1;
begin
while(a<5)
loop
dbms_output.put_line (a);
```

```
a:=a+1;
end loop;
end;
/
1
2
3
4
PL/SQL procedure successfully completed.
```

PRINT NUMBERS FROM 1 TO 5 USING FOR LOOP

```
SQL> set serveroutput on;

SQL> declare
a number:=1;
begin
for a in 1..5
loop
dbms_output.put_line (a);
end loop;
end;
/
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
```

<u>TO CREATE TABLE SROUTES</u>

SQL> create table sroutes (rno number(5), origin varchar2(20), destination varchar2(20), fare numbe

r(10), distance number(10));

Table created.

SQL> insert into sroutes values (2, 'chennai', 'dindugal', 400,230);

1 row created.

SQL> insert into sroutes values (3, 'chennai', 'madurai', 250,300);

1 row created.

SQL> insert into sroutes values (6, 'thanjavur', 'palani', 350,370);

1 row created.

SQL> select * from sroutes;

```
      RNO ORIGIN               DESTINATION               FARE  DISTANCE
--------- -------------------- -------------------- --------- ---------
        2 chennai              dindugal                   400       230
        3 chennai              madurai                    250       300
        6 thanjavur            palani                     350       370
```

SQL> set serveroutput on;

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

PL/SQL procedure successfully completed.

SQL> select * from sroutes;

       RNO ORIGIN               DESTINATION               FARE   DISTANCE
--------- -------------------- -------------------- --------- ---------
         2 chennai              dindugal                   400        230
```

```
  3 chennai        madurai          400    300
  6 thanjavur      palani           350    370
```

<u>TO CREATE SCA LCULATE TABLE</u>

```
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
```

<u>TO CALCULATE FACTORIAL OF A GIVEN NUMBER</u>

```
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 parents

FOR EACH ROW

DECLARE

  v_child_count NUMBER;

BEGIN

  SELECT COUNT(*)

  INTO v_child_count

  FROM children

  WHERE parent_id = :OLD.parent_id;



  IF v_child_count > 0 THEN

    RAISE_APPLICATION_ERROR(-20001, 'Cannot delete parent record because child records
exist.');

  END IF;

END;
```

Program 2

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

```
 CREATE OR REPLACE TRIGGER check_duplicate_column
BEFORE INSERT OR UPDATE ON your_table
FOR EACH ROW
DECLARE
  v_count NUMBER;
BEGIN
  SELECT COUNT(*)
  INTO v_count
  FROM your_table
  WHERE your_column = :NEW.your_column;

  IF v_count > 0 THEN
    RAISE_APPLICATION_ERROR(-20002, 'Duplicate value found in your_column.');
  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 check_column_total

BEFORE INSERT ON your_table

FOR EACH ROW

DECLARE

  v_total NUMBER;

  v_threshold NUMBER := 10000;

BEGIN

  SELECT SUM(your_column)

  INTO v_total

  FROM your_table;



  IF v_total + :NEW.your_column > v_threshold THEN

    RAISE_APPLICATION_ERROR(-20003, 'Insertion failed: Total of the column exceeds the
threshold value.');

  END IF;

END;
```

Program 4

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

```
 CREATE OR REPLACE TRIGGER audit_column_changes
AFTER INSERT OR UPDATE OR DELETE ON your_table
FOR EACH ROW
DECLARE
BEGIN
  IF INSERTING THEN
    INSERT INTO audit_table (action_type, table_name, column_name, old_value, new_value,
change_time)
    VALUES ('INSERT', 'your_table', 'your_column', NULL, :NEW.your_column, SYSDATE);
  ELSIF UPDATING THEN
    INSERT INTO audit_table (action_type, table_name, column_name, old_value, new_value,
change_time)
    VALUES ('UPDATE', 'your_table', 'your_column', :OLD.your_column, :NEW.your_column,
SYSDATE);
  ELSIF DELETING THEN
    INSERT INTO audit_table (action_type, table_name, column_name, old_value, new_value,
change_time)
    VALUES ('DELETE', 'your_table', 'your_column', :OLD.your_column, NULL, SYSDATE);
```

```
  END IF;

END;
```

Program 5

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

```
 CREATE OR REPLACE TRIGGER audit_user_activity

AFTER INSERT OR UPDATE OR DELETE ON your_table

FOR EACH ROW

DECLARE

BEGIN

  IF INSERTING THEN

    INSERT INTO audit_log (action_type, table_name, record_id, old_values, new_values,
action_time, user_id)

    VALUES ('INSERT', 'your_table', :NEW.record_id, NULL, :NEW.column_name, SYSDATE,
USER);

  ELSIF UPDATING THEN

    INSERT INTO audit_log (action_type, table_name, record_id, old_values, new_values,
action_time, user_id)

    VALUES ('UPDATE',
'your_table', :NEW.record_id, :OLD.column_name, :NEW.column_name, SYSDATE, USER);

  ELSIF DELETING THEN

    INSERT INTO audit_log (action_type, table_name, record_id, old_values, new_values,
action_time, user_id)
```

```
  VALUES ('DELETE', 'your_table', :OLD.record_id, :OLD.column_name, NULL, SYSDATE, USER);
 END IF;
END;
```

Program 6

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

```
  CREATE OR REPLACE TRIGGER update_running_total
AFTER INSERT ON your_table
FOR EACH ROW
DECLARE
  v_running_total NUMBER;
BEGIN
  SELECT NVL(MAX(running_total), 0) + :NEW.amount
  INTO v_running_total
  FROM your_table;

  UPDATE your_table
  SET running_total = v_running_total
  WHERE record_id = :NEW.record_id;
END;
```

Program 7

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

```
CREATE OR REPLACE TRIGGER validate_item_availability
BEFORE INSERT ON orders
FOR EACH ROW
DECLARE
  v_available_stock NUMBER;
  v_pending_orders NUMBER;
BEGIN
  SELECT available_stock - NVL(SUM(order_quantity), 0)
  INTO v_available_stock
  FROM inventory
  LEFT JOIN orders
  ON inventory.item_id = orders.item_id
  WHERE inventory.item_id = :NEW.item_id
  GROUP BY inventory.available_stock;

  IF v_available_stock < :NEW.order_quantity THEN
    RAISE_APPLICATION_ERROR(-20001, 'Insufficient stock to fulfill the order.');
  END IF;
END;
```

MONGO DB

Ex. No. : 21 **Date: 25/10/2024**

Register No.: 221701007 **Name: Amritha.A**

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-existant.

Change or Create a Database

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

Create Collection using mongosh

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

Insert Documents

insertOne()

```
db.posts.insertOne({
  title: "Post Title 1",
  body: "Body of post.",
  category: "News",
  likes: 1,
  tags: ["news", "events"],
  date: Date()
})
```

Ex. No. : 22 **Date: 05/11/2024**

Register No.: 221701007 **Name: Amritha.A**

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: [
   { cuisine: { $nin: ['American', 'Chinese'] } },
   { name: { $regex: '^Wil', $options: 'i' } }
 ]
}, { restaurant_id: 1, name: 1, borough: 1, cuisine: 1 })
```

2. 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.grade": "A",
 "grades.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")
}, { restaurant_id: 1, name: 1, grades: 1 })
```

4. Write a MongoDB query to find the restaurant Id, name, address and geographical location for those restaurants where 2nd element of coord array contains a value which is more than 42 and upto 52.

```
db.restaurants.find({
  "address.coord.1": { $gt: 42, $lte: 52 }
}, { restaurant_id: 1, name: 1, address: 1, "address.coord": 1 })
```

5. Write a MongoDB 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 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, $ne: "" } })
```

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', $options: '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', $options: 'i' }
}, { name: 1, borough: 1, "address.coord": 1, cuisine: 1 })
```

12. 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": { $in: [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": { $in: [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": { $in: [2, 6] },
  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": { $in: [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": { $in: [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({ "released": { $gte: ISODate("1893-01-01T00:00:00Z"), $lt: ISODate("1894-01-01T00:00:00Z") } })

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 } })
```

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("1893-05-09T00:00:00.000Z") },

 { 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(

 { released: ISODate("1893-05-09T00:00:00.000Z") },

 { title: 1, languages: 1, released: 1, directors: 1, writers: 1, countries: 1 })
```