AURORA'S PG COLLEGE

MOOSARABAGH

MCA DEPARTMENT

INTRODUCTION

Database Management System

This model is like a hierarchical tree structure, used to construct a hierarchy of records in the form of nodes and branches. The data elements present in the structure have Parent-Child relationship. Closely related information in the parent-child structure is stored together as a logical unit. A parent unit may have many child units, but a child is restricted to have only one parent.

The drawbacks of this model are:

- The hierarchical structure is not flexible to represent all the relationship proportions, which occur in the real world.
- It cannot demonstrate the overall data model for the enterprise because of the non-availability of actual data at the time of designing the data model.
- It cannot represent the Many-to-Many relationship.

Network Model

It supports the One-To-One and One-To-Many types only. The basic objects in this model are Data Items, Data Aggregates, Records and Sets.

It is an improvement on the Hierarchical Model. Here multiple parent-child relationships are used. Rapid and easy access to data is possible in this model due to multiple access paths to the data elements.

Relational Model

- Does not maintain physical connection between relations
- Data is organized in terms of rows and columns in a table
- The position of a row and/or column in a table is of no importance
- The intersection of a row and column must give a single value

Features of an RDBMS

- The ability to create multiple relations and enter data into them
- An attractive query language
- Retrieval of information stored in more than one table
- An RDBMS product has to satisfy at least Seven of the 12 rules of Codd to be accepted as a full- fledged RDBMS.

Relational Database Management System

RDBMS is acronym for Relation Database Management System. Dr. E. F. Codd first introduced the Relational Database Model in 1970. The Relational model allows data to be represented in a simple row- column. Each data field is considered as a column and each record is considered as a row. Relational Database is more or less similar to Database Management S ystem. In relational model there is relation between their data elements. Data is stored in tables. Tables have columns, rows and names. Tables can be related to each other if each has a column with a common type of information. The most famous RDBMS packages are Oracle, Sybase and Informix.

Simple example of Relational model is as follows :

Student Details Table

Roll_no	Sname	S_Address
1	Rahul	Satelite
2	Sachin	Ambawadi
3	Saurav	Naranpura

Student Marksheet Table

Rollno	Sub1	Sub2	Sub3
1	78	89	94
2	54	65	77
3	23	78	46

Here, both tables are based on students details. Common field in both tables is Rollno. So we can say both tables are related with each other through Rollno column.

Degree of Relationship

- One to One (1:1)
- One to Many or Many to One (1:M / M: 1)
- Many to Many (M: M)

The Degree of Relationship indicates the link between two entities for a specified occurrence of each.

One to One Relationship : (1:1)

1 1

Student Has Roll No.

One student has only one Rollno. For one occurrence of the first entity, there can be, at the most one related occurrence of the second entity, and vice-versa.

One to Many or Many to One Relationship: (1:M/M: 1)

1 M

Course Contains Students

As per the Institutions Norm, One student can enroll in one course at a time however, in one course, there can be more than one student.

For one occurrence of the first entity there can exist many related occurrences of the second entity and for every occurrence of the second entity there exists only one associated occurrence of the first.

Many to Many Relationship: (M:M)

M M

Students Appears Tests

The major disadvantage of the relational model is that a clear-cut interface cannot be determined. Reusability of a structure is not possible. The Relational Database now accepted model on which major database system are built.

Oracle has introduced added functionality to this by incorporated object-oriented capabilities. Now it is known is as Object Relational Database Management System (ORDBMS). Object- oriented concept is added in Oracle8.

Some basic rules have to be followed for a DBMS to be relational. They are known as Codd's rules, designed in such a way that when the database is ready for use it encapsulates the relational theory to its full potential. These twelve rules are as follows.

E. F. Codd Rules

1. **The Information Rule**

   All information must be store in table as data values.

2. **The Rule of Guaranteed Access**

   Every item in a table must be logically addressable with the help of a table name.

3. **The Systematic Treatment of Null Values**

   The RDBMS must be taken care of null values to represent missing or inapplicable information.

4. **The Database Description Rule**

   A description of database is maintained using the same logical structures with which data was defined by the RDBMS.

5. **Comprehensive Data Sub Language**

   According to the rule the system must support data definition, view definition, data manipulation, integrity constraints, authorization and transaction management operations.

6. **The View Updating Rule**

   All views that are theoretically updateable are also updateable by the system.

7. **The Insert and Update Rule**

   This rule indicates that all the data manipulation commands must be operational on sets of rows having a relation rather than on a single row.

8. **The Physical Independence Rule**

   Application programs must remain unimpaired when any changes are made in storage representation or access methods.

9. **The Logical Data Independence Rule**

   The changes that are made should not affect the user's ability to work with the data.The change can be splitting table into many more tables.

10. **The Integrity Independence Rule**

    The integrity constraints should store in the system catalog or in the database.

11. **The Distribution Rule**

    The system must be access or manipulate the data that is distributed in other systems.

12. The Non-subversion Rule

If a RDBMS supports a lower level language then it should not bypass any integrity constraints defined in the higher level.

Object Relational Database Management System

Oracle8 and later versions are supported object-oriented concepts. A structure once created can be reused is the fundamental of the OOP's concept. So we can say Oracle8 is supported Object Relational model, Object – oriented model both. Oracle products are based on a concept known as a client-server technology. This concept involves segregating the processing of an application between two systems. One performs all activities related to the database (server) and the other performs activities that help the user to interact with the application (client). A client or front-end database application also interacts with the database by requesting and receiving information from database server. It acts as an interface between the user and the database.

The database server or back end is used to manage the database tables and also respond to client requests.

Introduction to ORACLE

ORACLE is a powerful RDBMS product that provides efficient and effective solutions for major database features. This includes:

- Large databases and space management control
- Many concurrent database users
- High transaction processing performance
- High availability
- Controlled availability
- Industry accepted standards
- Manageable security
- Database enforced integrity
- Client/Server environment
- Distributed database systems
- Portability

- Compatibility
- Connectivity

An ORACLE database system can easily take advantage of distributed processing by using its Client/ Server architecture. In this architecture, the database system is divided into two parts:

A front-end or a client portion

The client executes the database application that accesses database information and interacts with the user.

A back-end or a server portion

The server executes the ORACLE software and handles the functions required for concurrent, shared data access to ORACLE database.

ROADWAY TRAVELS

"Roadway Travels" is in business since 1977 with several buses connecting different places in India. Its main office is located in Hyderabad.

The company wants to computerize its operations in the following areas:

- Reservations
- Ticketing
- Cancellations

Reservations :

Reservations are directly handeled by booking office.reservations can be made 60 days in advance in either cash or credit. In case the ticket is not available,a wait listed ticket is issued to the customer. This ticket is confirmed against the cancellation.

Cancellation and modification:

Cancellations are also directly handed at the booking office. Cancellation charges will be charged.

Wait listed tickets that do not get confirmed are fully refunded.

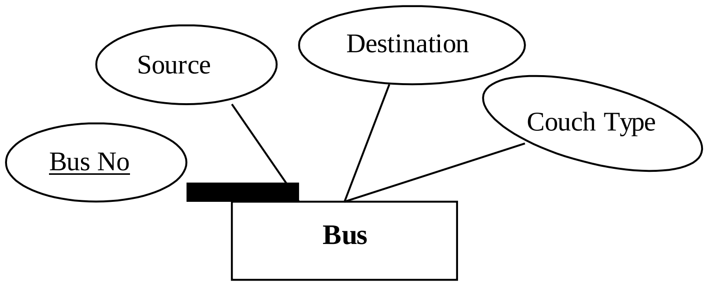
Exp No: 1 **Date: _ _/_ _/ _ _**

AIM: Analyze the problem and come with the entities in it. Identify what Data has to be persisted in the databases.

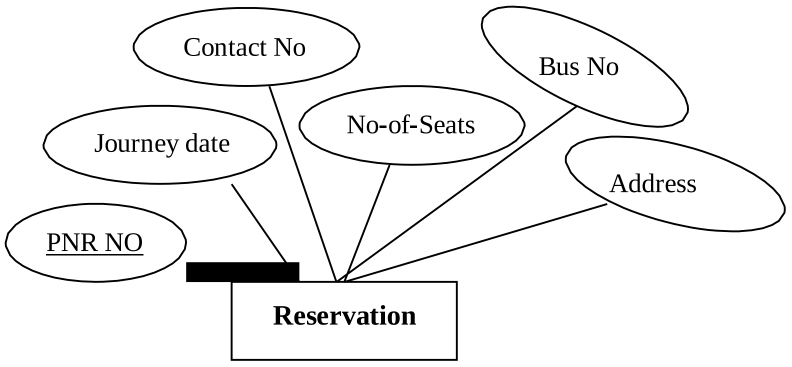
The Following are the entities:

1 .Bus
2. Reservation
3. Ticket
4. Passenger
5. Cancellation

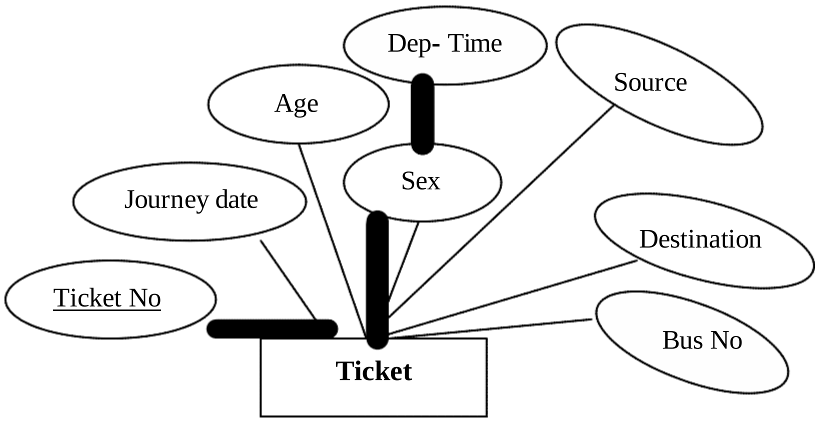
The attributes in the Entities:
Bus:(Entity)



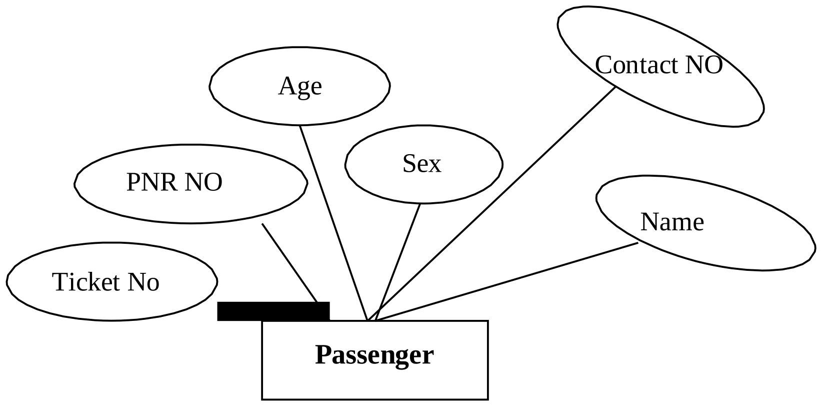
Reservation (Entity)



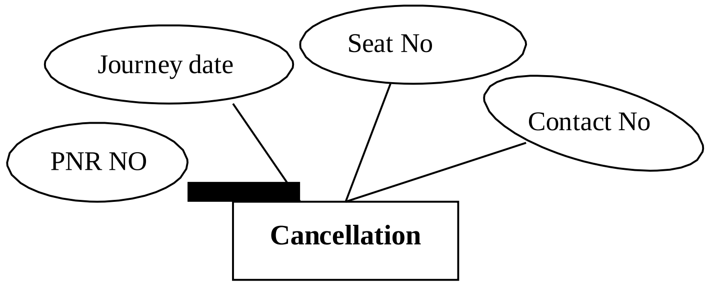
Ticket :(Entity)



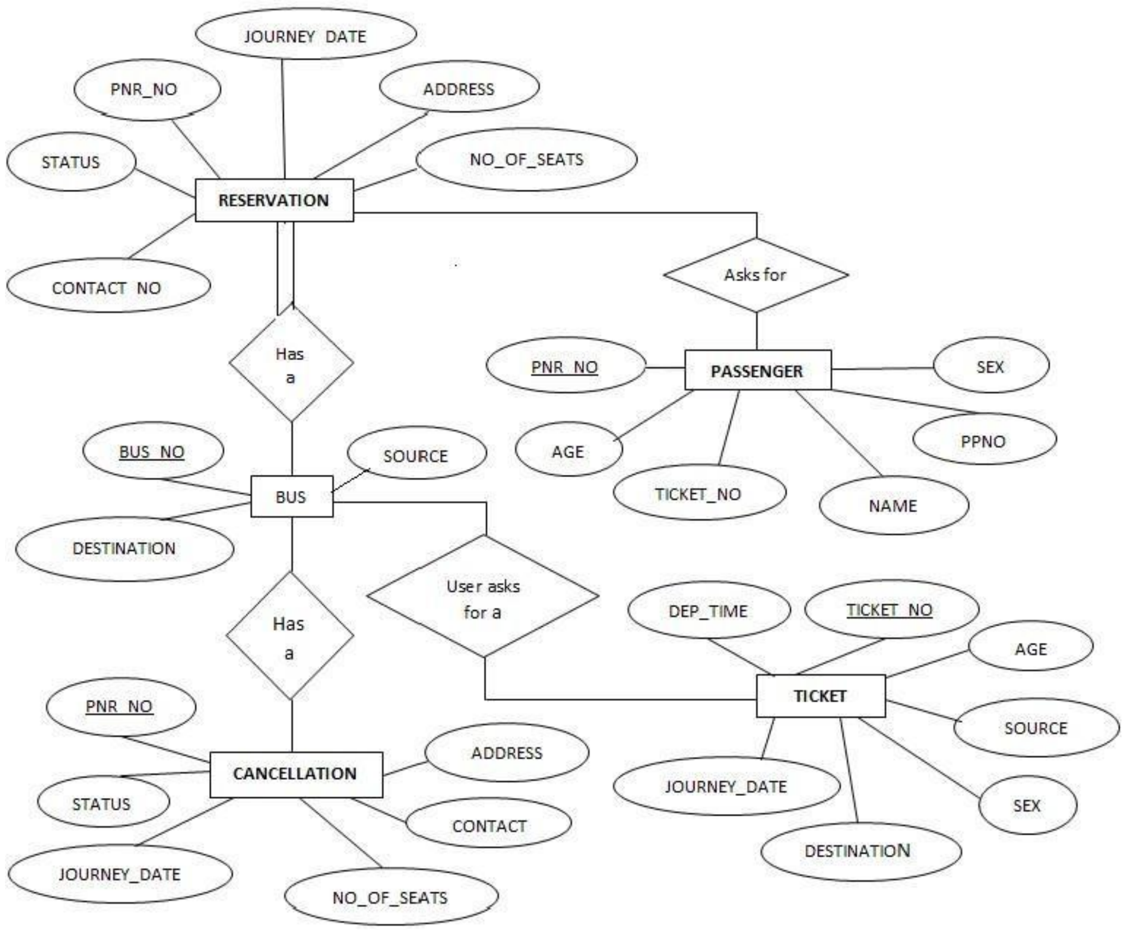
Passenger:



Cancellation (Entity)



Concept design with E-R Model:



Exp No: 2 **Date: _ _/_ _/ _ _**

AIM: **Represent all entities in a tabular fashion. Represent all relationships in a tabular fashion**.

What is SQL and SQL*Plus

Oracle was the first company to release a product that used the English-based Structured Query Language or SQL. This language allows end users to manipulate information of table(primary database object). To use SQL you need not to require any programming experience. SQL is a standard language common to all relational databases. SQL is database language used for storing and retrieving data from the database. Most Relational Database Management Systems provide extension to SQL to make it easier for application developer.

A table is a primary object of database used to store data. It stores data in form of rows and columns.

SQL*Plus is an Oracle tool (specific program) which accepts SQL commands and PL/SQL blocks and executes them. SQL *Plus enables manipulations of SQL commands and PL/SQL blocks. It also performs additional tasks such as calculations, store and print query results in the form of reports, list column definitions of any table, access and copy data between SQL databases and send messages to and accept responses from the user. SQL *Plus is a character based interactive tool, that runs in a GUI environment. It is loaded on the client machine.

To communicate with Oracle, SQL supports the following categories of commands:

1. Data Definition Language

Create, Alter, Drop and Truncate

2. Data Manipulation Language

Insert, Update, Delete and Select

3. Transaction Control Language

Commit, Rollback and Save point

4. Data Control Language

Grant and Revoke

Before we take a look on above-mentioned commands we will see the data types available in Oracle.

Oracle Internal Data types

When you create a table in Oracle, a few items should be important, not only do you have to give each table a name(e.g. employee, customer), you must also list all the columns or fields (e.g. First_name, Mname, Last_name) associated with the table. You also have to specify what type of information thattable will hold to the database. For example, the column Empno holds numeric information. An Oracle database can hold many different types of data.

Data type Description

Char(Size) Stores fixed-length character data to store alphanumeric values, with a maximum size of 2000 bytes. Default and minimum size is 1 byte.

Varchar2(Size) Stores variable-length character data to store alphanumeric values, with maximum size of 4000 bytes.

char(Size) Stores fixed-length character data of length size characters or bytes, depending on the choice of national character set. Maximum size if determined by the number of bytes required storing each character with an upper limit of 2000 bytes. Default and minimum size is 1 character or 1 byte, depending on the character set.

Nvarchar2(Size) Stores variable-length character string having maximum length size characters or bytes, depending on the choice of national character set. Maximum size is determined by the number of bytes required to store each character, with an upper limit of 4000 bytes.

Long Stores variable-length character data up to 2GB(Gigabytes). Its lenth would be restricted based on memory space available in the computer.

Number [p,s] Number having precision p and scale s. The precision p indicates total number of digit varies from 1 to 38. The scale s indicates number of digit in fraction part varies from –84 to 127.

Date Stores dates from January 1, 4712 B.C. to December 31, 4712 A.D. Oracle predefine format of Date data type is DD-MON-YYYY.

Raw(Size) Stores binary data of length size. Maximum size is 2000 bytes. One must have to specify size with RAW type data, because by default it does not specify any size.

Long Raw Store binary data of variable length up to 2GB(Gigabytes).

LOBS – LARGE OBJECTS

LOB is use to store unstructured information such as sound and video clips, pictures upto 4 GB size.

CLOB A Character Large Object containing fixed-width multi-byte characters. Varying-

width character sets are not supported. Maximum size is 4GB.

NCLOB A National Character Large Object containing fixed-width multi-byte characters.

Varying-width character sets are not supported. Maximum size is 4GB. Stores national character set data.

BLOB To store a Binary Large Object such a graphics, video clips and sound files.

Maximum size is 4GB.

BFILE Contains a locator to a large Binary File stored outside the database. Enables byte stream I/O access to external LOBs residing on the database server. Maximum size is 4GB.Apart from oracle internal data types, user can create their own data type, which is used in database and other database object. We will discuss it in the later part.

The following are tabular representation of the above entities and relationships

BUS:

COLOUMN NAME	**DATA TYPE**	**CONSTRAINT**
Bus No	varchar2(10)	**Primary Key**
Source	varchar2(20)	
Destination	varchar2(20)	
Couch Type	varchar2(20)	

Reservation:

COLOUMN NAME	**DATA TYPE**	**CONSTRAINT**
PNRNo	number(9)	**Primary Key**
Journey date	Date	
No-of-seats	integer(8)	
Address	varchar2(50)	
Contact No	Number(9)	Should be equal to 10 numbers and not allow other than numeric
BusNo	varchar2(10)	**Foreign key**
Seat no	Number	

Ticket:

<u>COLOUMN NAME</u>	<u>DATA TYPE</u>	<u>CONSTRAINT</u>
Ticket_No	number(9)	**Primary Key**
Journey date	Date	
Age	int(4)	
Sex	Char(10)	
Source	varchar2(10)	
Destination	varchar2(10)	
Dep-time	varchar2(10)	
Bus No	Number2(10)	

Passenger:

<u>COLOUMN NAME</u>	<u>DATA TYPE</u>	<u>CONSTRAINT</u>
PNR No	Number(9)	**Primary Key**
Ticket No	Number(9)	Foreign key
Name	varchar2(15)	
Age	integer(4)	
Sex	char(10)	(Male/Female)
Contact no	Number(9)	Should be equal to 10 numbers and not allow other than numeric

Cancellation:

<u>COLOUMN NAME</u>	<u>DATA TYPE</u>	<u>CONSTRAINT</u>
PNR No	Number(9)	Foriegn-key
Journey-date	Date	
Seat no	Integer(9)	
Contact_No	Number(9)	Should be equal to 10 numbers and not allow other than numeric

Exp No: 3 Date: _ _/_ _/ _ _

AIM: Installation of MySQL and practicing DDL & DML commands.

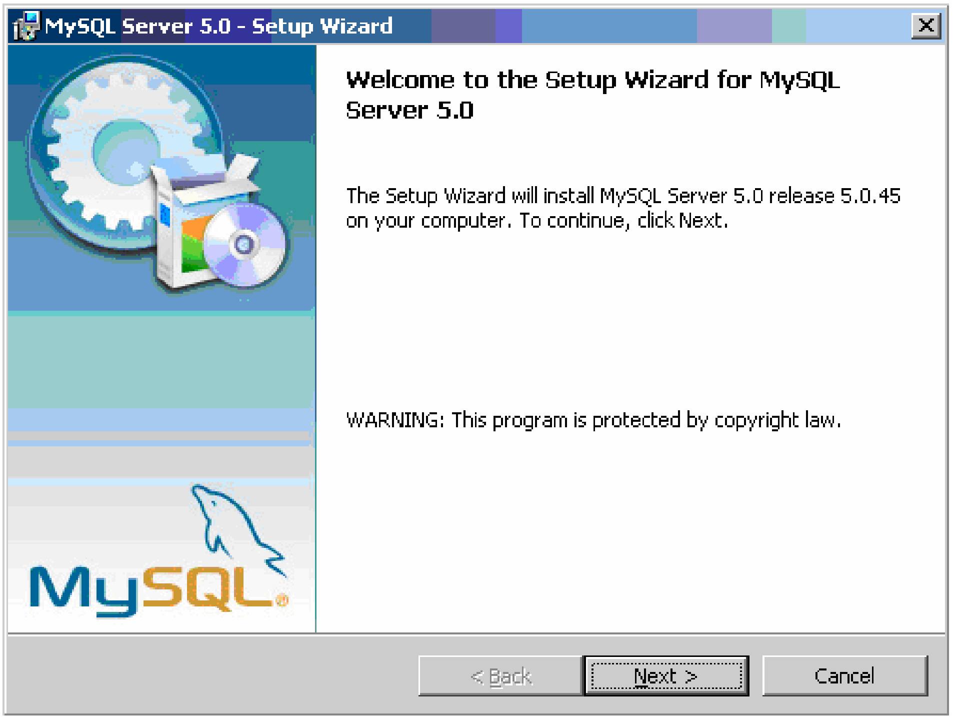
1. **Steps for installing MySQL**

Step1 **1**

Make sure you already downloaded the **MySQL essential 5.0.45 win32.msi file**. Double click on the .msi file.

Step2 **2**

This is MySQL Server 5.0 setup wizard. The setup wizard will install MySQL Server 5.0 release 5.0.45 on your computer. To continue, click **next.**



MySQL Server 5.0 - Setup Wizard

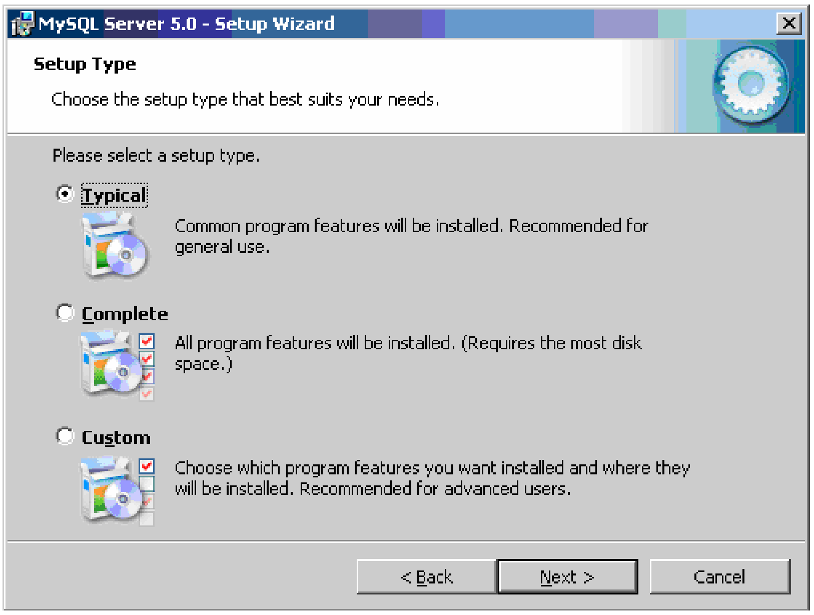
Welcome to the Setup Wizard for MySQL Server 5.0

The Setup Wizard will install MySQL Server 5.0 release 5.0.45 on your computer. To continue, click Next.

WARNING: This program is protected by copyright law.

Step3 **3**

Choose the setup type that best suits your needs. For common program features select ***Typical*** and it's recommended for general use. To continue, click **next**.


MySQL Server 5.0 - Setup Wizard

Setup Type

Choose the setup type that best suits your needs.

Please select a setup type.

(●) Typical

Common program features will be installed. Recommended for general use.

( ) Complete

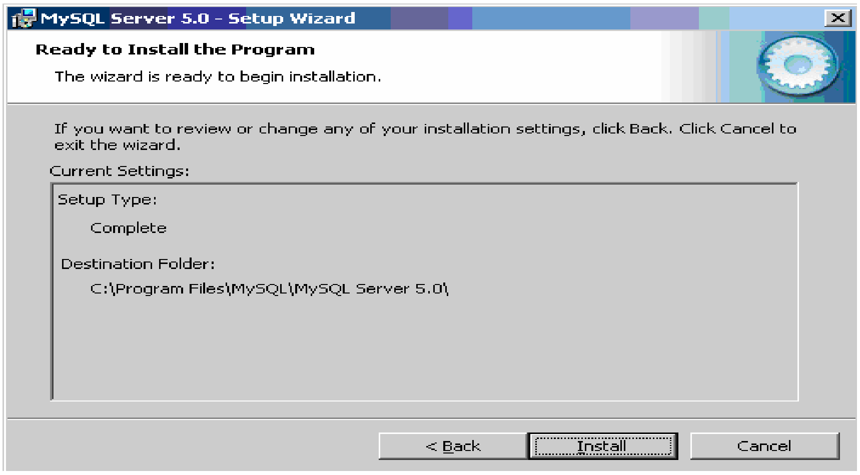
All program features will be installed. (Requires the most disk space.)

( ) Custom

Choose which program features you want installed and where they will be installed. Recommended for advanced users.

Step4 **4**

This wizard is ready to begin installation. Destination folder will be in **C:\Program Files\MySQL\MySQL Server 5.0**. To continue, click **next**.


MySQL Server 5.0 - Setup Wizard

Ready to Install the Program

The wizard is ready to begin installation.

If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.

Current Settings:

Setup Type:

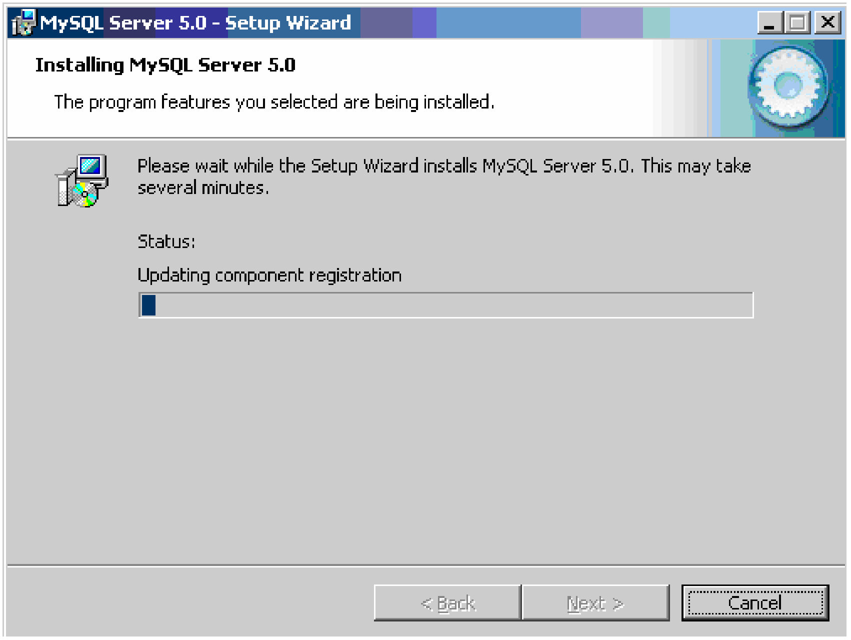
Complete

Destination Folder:

C:\Program Files\MySQL\MySQL Server 5.0\

Step5 **5**

The program features you selected are being installed. Please wait while the setup wizard installs MySQL 5.0. This may take several minutes.



Installing MySQL Server 5.0

The program features you selected are being installed.

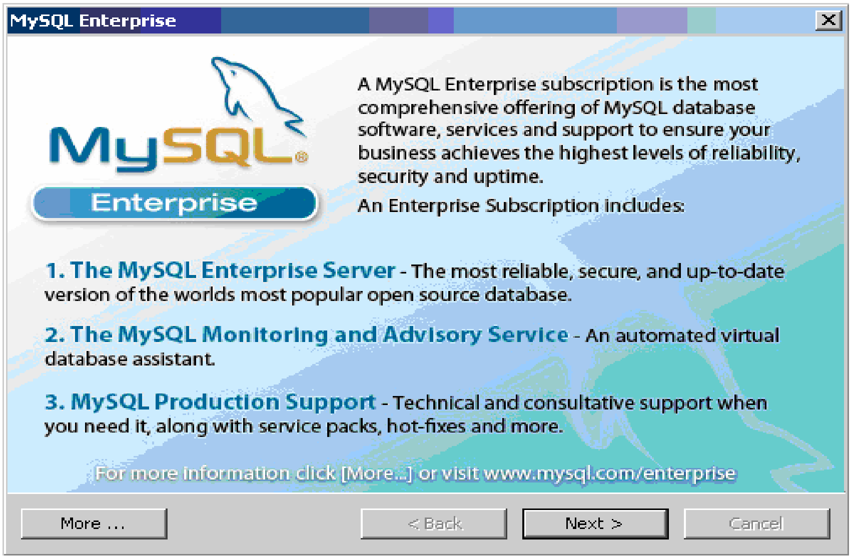
Please wait while the Setup Wizard installs MySQL Server 5.0. This may take several minutes.

Status:

Updating component registration

Step6 6

To continue, click **next**.



A MySQL Enterprise subscription is the most comprehensive offering of MySQL database software, services and support to ensure your business achieves the highest levels of reliability, security and uptime.

An Enterprise Subscription includes:

1. The MySQL Enterprise Server - The most reliable, secure, and up-to-date version of the worlds most popular open source database.

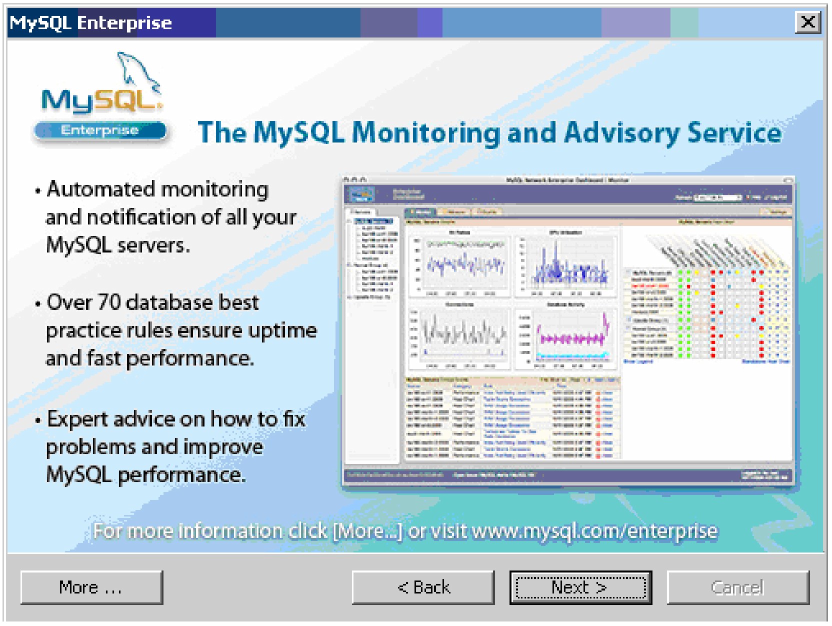
2. The MySQL Monitoring and Advisory Service - An automated virtual database assistant.

3. MySQL Production Support - Technical and consultative support when you need it, along with service packs, hot-fixes and more.

For more information click [More...] or visit www.mysql.com/enterprise

Step7 7

To continue, click **next**.



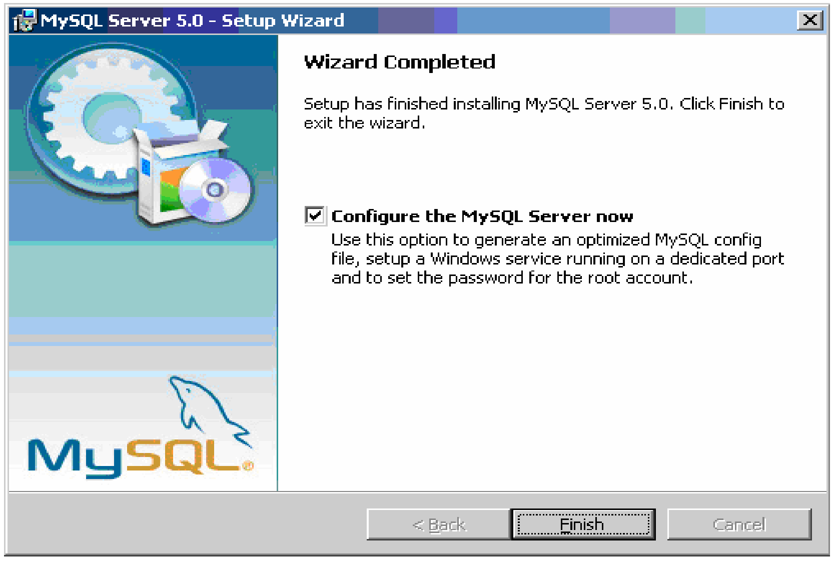
The MySQL Monitoring and Advisory Service

- Automated monitoring and notification of all your MySQL servers.
- Over 70 database best practice rules ensure uptime and fast performance.
- Expert advice on how to fix problems and improve MySQL performance.

For more information click [More...] or visit www.mysql.com/enterprise

Step8 **8**

Wizard Completed. Setup has finished installing MySQL 5.0. **Check** the configure the MySQL server now to continue. Click **Finish** to exit the wizard



Wizard Completed

Setup has finished installing MySQL Server 5.0. Click Finish to exit the wizard.

[✓] Configure the MySQL Server now

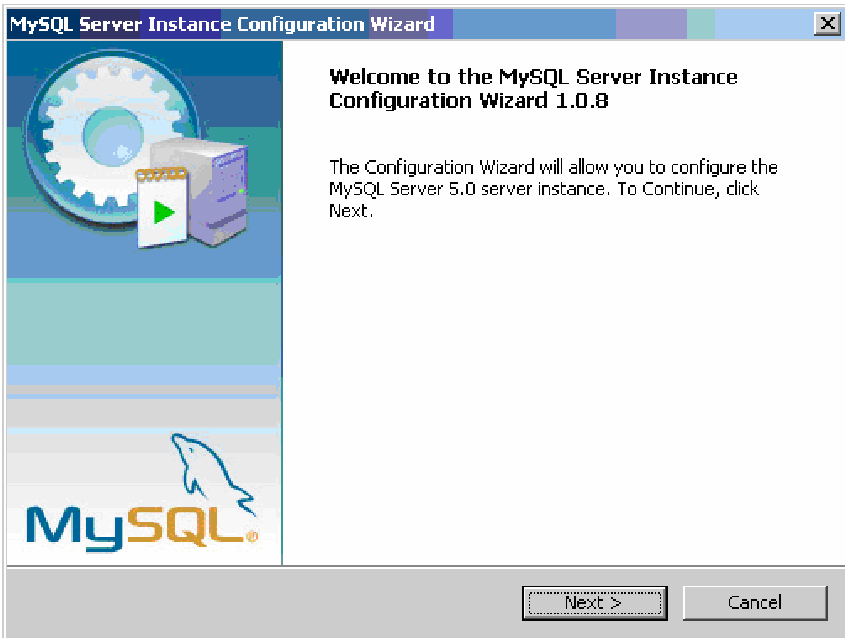
Use this option to generate an optimized MySQL config file, setup a Windows service running on a dedicated port and to set the password for the root account.

d.

Step9 **9**

The configuration wizard will allow you to configure the MySQL Server 5.0 server instance.

To continue, click **next**.

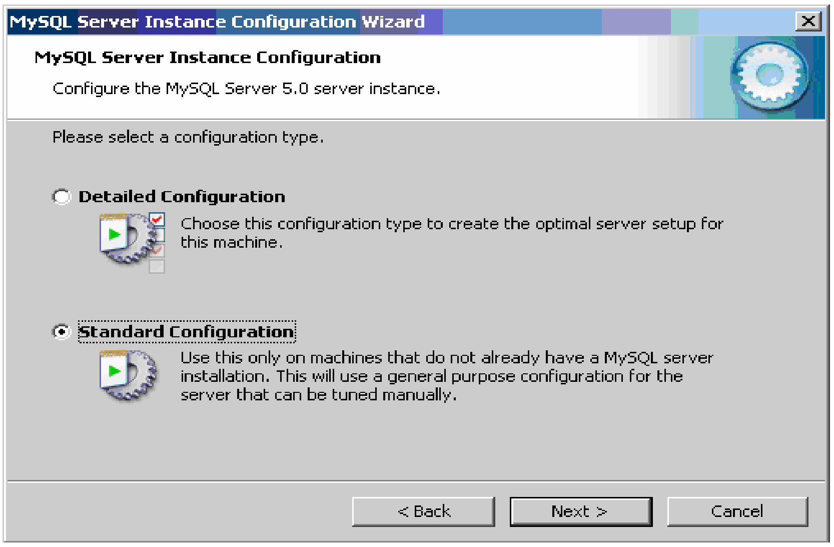

MySQL Server Instance Configuration Wizard

Welcome to the MySQL Server Instance Configuration Wizard 1.0.8

The Configuration Wizard will allow you to configure the MySQL Server 5.0 server instance. To Continue, click Next.

Step10 **10**

Select a **standard configuration** and this will use a general purpose configuration for the server that can be tuned manually. To continue, click **next**.


MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration

Configure the MySQL Server 5.0 server instance.

Please select a configuration type.

Detailed Configuration

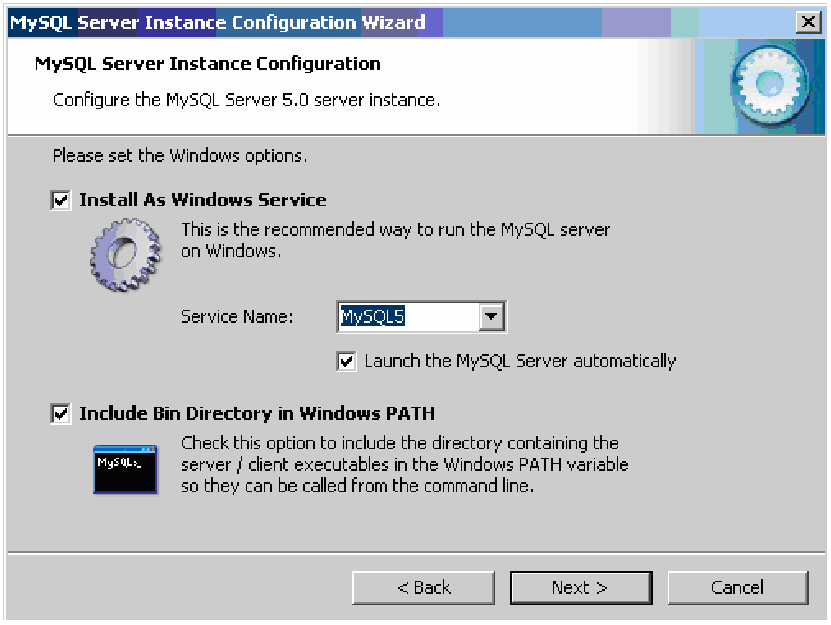
Choose this configuration type to create the optimal server setup for this machine.

[✓ **Standard Configuration**]

Use this only on machines that do not already have a MySQL server installation. This will use a general purpose configuration for the server that can be tuned manually.

Step11 **11**

Check on the **install as windows service** and **include bin directory in windows path**. To continue, click **next**.



MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration

Configure the MySQL Server 5.0 server instance.

Please set the Windows options.

☑ Install As Windows Service

This is the recommended way to run the MySQL server on Windows.

Service Name: MySQL5

☑ Launch the MySQL Server automatically

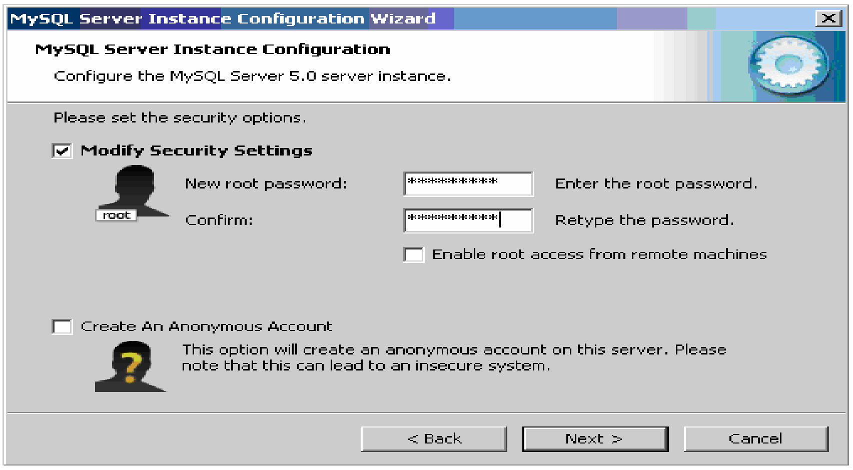
☑ Include Bin Directory in Windows PATH

Check this option to include the directory containing the server / client executables in the Windows PATH variable so they can be called from the command line.

< Back | Next > | Cancel

Step12 **12**

Please set the security options by entering the root password and confirm retype the password. To continue, click next.



MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration

Configure the MySQL Server 5.0 server instance.

Please set the security options.

☑ Modify Security Settings

New root password: *********** Enter the root password.

Confirm: *********** Retype the password.

☐ Enable root access from remote machines

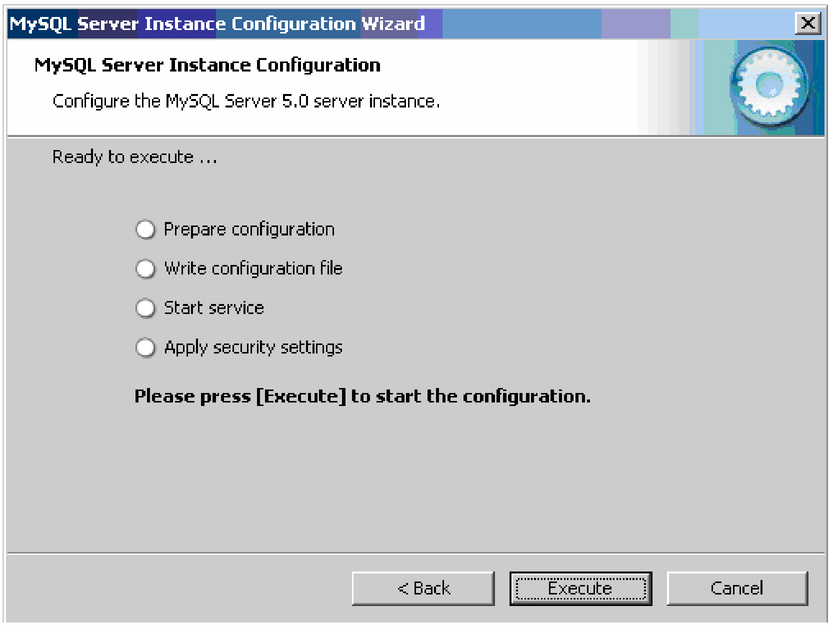
☐ Create An Anonymous Account

This option will create an anonymous account on this server. Please note that this can lead to an insecure system.

< Back | Next > | Cancel

Step13 **13**

Ready to execute? Clicks **execute** to continue.


MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration

Configure the MySQL Server 5.0 server instance.

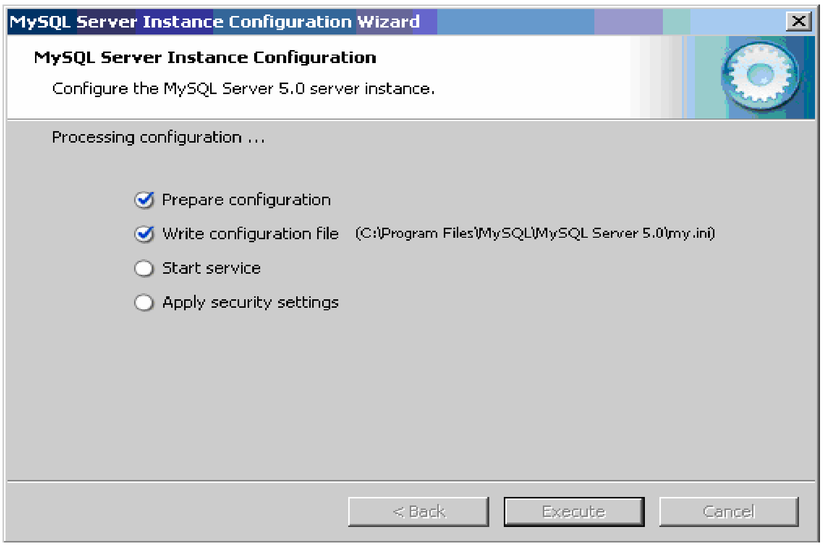
Ready to execute ...

- Prepare configuration
- Write configuration file
- Start service
- Apply security settings

Please press [Execute] to start the configuration.

Step14 **14**

Processing configuration in progress.


MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration

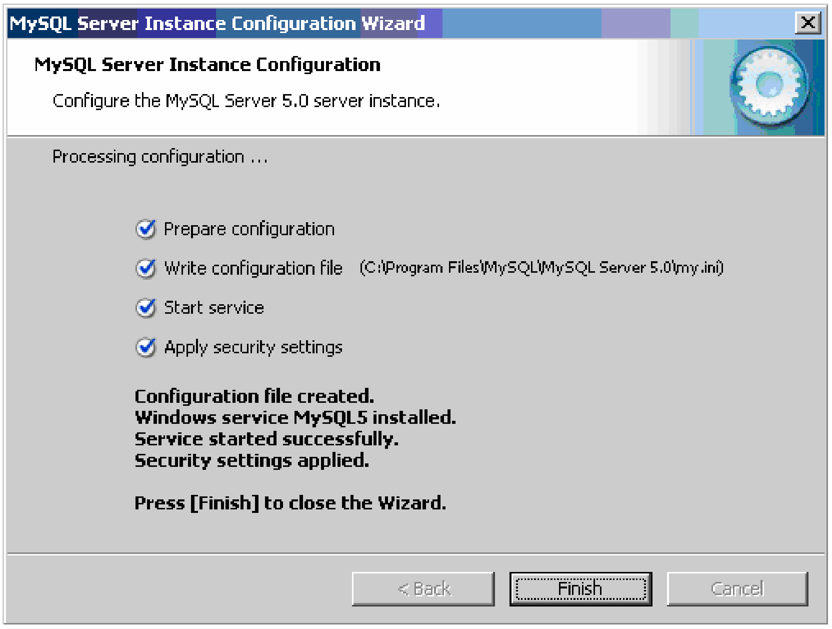
Configure the MySQL Server 5.0 server instance.

Processing configuration ...

- ✓ Prepare configuration
- ✓ Write configuration file (C:\Program Files\MySQL\MySQL Server 5.0\my.ini)
- Start service
- Apply security settings

Step15 **15**

Configuration file created. Windows service MySQL5 installed. Press **finish** to close the wizard.



MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration

Configure the MySQL Server 5.0 server instance.

Processing configuration ...

- ✓ Prepare configuration
- ✓ Write configuration file (C:\Program Files\MySQL\MySQL Server 5.0\my.ini)
- ✓ Start service
- ✓ Apply security settings

Configuration file created.
Windows service MySQL5 installed.
Service started successfully.
Security settings applied.

Press [Finish] to close the Wizard.

2. Practicing DDL & DML Commands

Data Definition Language

The data definition language is used to create an object, alter the structure of an object and also drop already created object. The Data Definition Languages used for table definition can be classified into following:

- ❖ Create table command
- ❖ Alter table command
- ❖ Truncate table command
- ❖ Drop table command

Creating of Tables on ROAD WAY TRAVELS:

Table is a primary object of database, used to store data in form of rows and columns. It is created using following command:

Create Table <table_name> (column1 datatype(size), column2 datatype(size),

- _,column(n) datatype(size));

Where, table_name is a name of the table and coulumn1, column2 _ column n is a name of the column available in table_name table.

R Each column is separated by comma.

Pointes to be remember while creating a table.

- ❖ Table Name must be start with an alphabet.
- ❖ Table name and column name should be of maximum 30 character long.
- ❖ Column name should not be repeated in same table.
- ❖ Reserve words of Oracle cannot be used as a table and column name.
- ❖ Two different tables should not have the same name.
- ❖ Underscores, numerals and letters are allowed but not blank space or single quotes.

Example:

SQL> create table Bus(Bus_No varchar(5), source varchar(20), destination varchar(20),CouchType varchar2(10),fair number);

Table Created.

Above definition will create simple table. Still there are more additional option related with create table for the object-relation feature we will discuss it afterwards.

Desc command

Describe command is external command of Oracle. The describe command is used to view the structure of a table as follows.

Desc <table name>

```
SQL> desc bus;
 Name                                      Null?      Type
 ----------------------------------------- --------   ----------------------------
 BUS_NO                                   NOT NULL     INTEGER2(5)
 SOURCE                                                VARCHAR2(20)
 DESTINATION                                           VARCHAR2(20)
CouchType                                              VARCHAR2(10)
FAIR                                                   NUMBER
```

Reservation Table:

```
SQL> create table Reservation(PNR_NO Numeric(9), No_of_seats Number(8), Address
varchar(50), Contact_No Numeric(9), Status char(3));
Table created.
SQL> desc Reservation
 Name                                      Null?      Type
 ----------------------------------------- -------- ----------------------------
 PNR_NO                                               NUMBER(9)
 NO_OF_SEATS                                          NUMBER(8)
 ADDRESS                                              VARCHAR2(50)
 CONTACT_NO                                         NUMBER(9)
 STATUS                                             CHAR(3)
```

Cancellation Table:

```
 SQL> create table Cancellation(PNR_NO Numeric(9), No_of_seats Number(8), Address
 varchar(50), Contact_No Numeric(9), Status char(3));
 Table created.
 SQL> desc Cancellation
  Name                                      Null?    Type
  ----------------------------------------- -------- ----------------------------
  PNR_NO                                             NUMBER(9)
  NO_OF_SEATS                                       NUMBER(8)
  ADDRESS                                            VARCHAR2(50)
  CONTACT_NO                                        NUMBER(9)
  STATUS                                            CHAR(3)
```

Ticket Table:

```
SQL> create table Ticket(Ticket_No Numeric(9) primary key, age number(4), sex  char(4)
Not null, source varchar(2), destination varchar(20), dep_time varchar(4));
Table created.
SQL> desc Ticket
 Name                                      Null?      Type
 ----------------------------------------- --------   ----------------------------
 TICKET_NO                                 NOT NULL   NUMBER(9)
 AGE                                                  NUMBER(4)
 SEX                                       NOT NULL   CHAR(4)
 SOURCE                                               VARCHAR2(2)
 DESTINATION                                          VARCHAR2(20)
 DEP_TIME                                             VARCHAR2(4)
```

Alteration of Table

Once Simple Table is created, if there is a need to change the structure of a table at that time alter command is used. It is used when a user want to add a new column or change the width of datatype or datatype itself or to add or drop integrity constraints or column. (we will see about constraints very soon.).i.e. table can be altered in one of three way : by adding column, by changing column definition or by dropping column.

Addition of Column(s)

Addition of column in table is done using:

Alter table <table_name> add(column1 datatype, column2 datatype · _);

Add option is used with alter table_ when you want to add a new column in existing table. If you want to Add more than one column then just write column name, data type and size in brackets. As usual Comma sign separates each column. For Example, suppose you want to add column comm in emp_master, then you have to perform the following command.

```
SQL> ALTER TABLE Passenger ADD FOREIGN KEY (PNR_NO) REFERENCES
Reservation(PNR_NO);
Table altered.

SQL> ALTER TABLE Cancellation ADD FOREIGN KEY (PNR_NO) REFERENCES
Reservation(PNR_NO);
Table altered.
```

SQL> alter table Ticket modify tiketnonumber(10);
Table altered.

Deletion of Column

Till Oracle8 it is not possible to remove columns from a table but in Oracle8i, drop option is used withAlter table_ when you want to drop any existing column.

Alter table <table_name> drop column <column name>;

Using above command you cannot drop more than one column at a time.

For Example, suppose you want to delete just before created column comm from the emp_master, then you have to apply following command.

SQL>Alter Table Emp_master drop column comm;

Table altered.

Dropping column is more complicated than adding or modifying a column, because of the additional work that Oracle has to do. Just removing the column from the list of columns in the table actually recover the space that was actually taken up by the column values that is more complex, and potentially very time- consuming for the database. For this reason, you can drop a column using unused clause. Column can be immediately remove column b y drop clause, the action may impact on performance or one make marked column as unused using unused caluse, there will be no impact on performance. When unused caluse is used the column can actually be dropped at a later time when the database is less heavily used. One can marked column as a unused using :

Alter table <table_name> set unused column <column name>;

For Example,

SQL>Alter Table Emp_master set unused column comm;

Table altered.

Making a column as Unused_ does not release the spcace previously used by the colum, until you drop the unused columns. It can be possible using:

Alter table <table_name> drop unused columns;

Once you have marked column as unused_ you cannot access that column

You can drop multiple columns at a time using single command as per follows

Alter table <table_name> drop (Column1, Column2,_);

The multiple columns name must be enclosed in parentheses.

Modification in Column

Modify option is used with Alter table_ when you want to modify any existing column.

If you want to

modify data type or size of more than one column then just write column name, data type and size in brackets and each column is separated by comma sign as per follows:

Alter table <table name> modify (column1 datatype, · _);

For Example, if you want to change size of salary column of emp_master the following command is performed.

SQL> Alter table emp_master modify salary number(9,2);

Table altered.

It will change size of salary column from 7 to (9,2).

When you want to decrease the size of column, table must be empty. If table has any rows then it will not allow decrement in the column width.

Truncate Table

If there is no further use of records stored in a table and the structure is required then only data can be deleted using Truncate command. Truncate command will delete all the records permanently of specified table as follows.

Truncate table <table name> [Reuse Storage];

Example

Following command will delete all the records permanently from the table.

SQL>Truncate Table Emp_master;

Or

SQL>Truncate Table Emp_master Reuse Storage;

Table truncated.

Exp No: 4 **Date: _ _/_ _/ _ _**

AIM: Applying Constraints on Road Way Travels Tables.

Constraints

Maintaining security and integrity of a database is the most important factor. Such limitations have to be enforced on the data, and only that data which satisfies the conditions will actually be stored for analysis.

If the data gathered fails to satisfy the conditions set, it is rejected. This technique ensures that the data that is stored in the database will be valid, and has integrity. Rules, which are enforced on data being entered and prevents user from entering invalid data into tables are called constraints. Thus, constraints are super control data being entered in tables for permanent storage.

Oracle permits data constraints to be attached to table columns via SQL syntax that will check data for integrity. Once data constraints are part of a table column construction, the Oracle engine checks the data being entered into a table column against the data constraints. If the data passes this check, it is stored in the table, else the data is rejected. Even if a single column of the record being entered into the table fails a constraint, the entire record is rejected and not stored in the table. Both the Create table_ and Alter table_ SQL verbs can be used to write SQL sentences that attach constraints to a table column.

Until now we have created table without using any constraint, Hence the tables have not been given any instructions to filter what is being stored in the table.

The following are the types of integrity constraints

- ❖ Domain Integrity constraints
- ❖ Entity Integrity constraints
- ❖ Referential Integrity constraint

Oracle allows programmers to define constraints

- ❖ Column Level
- ❖ Table Level

Column Level constraints

If data constraints are defined along with the column definition when creating or altering a table structure, they are column level constraints. Column level constraints are applied to the current column. The current column is the column that immediately precedes the constraints i.e. they are local to a specific column.Column level constraints cannot be applied if the data constraints span across the multiple columns in a table.

Table Level Constraint

If the data constraints are defined after defining all the table columns when creating or altering a table structure, it is a table level constraint. Table Level constraints mostly used when data constraints spans across multiple columns in a table.

Domain Integrity Constraints

These constraints set a range and any violations that take place will prevent the user from performing the manipulations that caused the breached.

Domain integrity constraints are classified into two types

• Not Null constraint

• Check constraint

Not Null Constraint

Often there may be records in a table that do not have values for every field, either because the information is not available at the time of data entry or because field is not applicable in every case. Oracle will place a null value in the column in the absence of a user-defined value. By default every column will accept null values.A Null values is different from a blank or a zero. We can say that Null means undefined. Null are treated specially by Oracle. When a column is defined as not null, then that column becomes mandatory column. It implies that a value must be entered into the column. Remember that not null constraints can be applied on column level only.

Example

```
SQL> create table Ticket(Ticket_No Numeric(9) , age number(4), sex char(4)  Not  null,
source varchar(2), destination varchar(20), dep_time  varchar(4));
```

Table created.

Check Constraint

Business rule validations can be applied on a column using Check constraint. Check constraint must be specified by logical or boolean expressions.

Create a client_master table with following check constraints.

- ❖ Data values being inserted into the column client_no must starts with the capital letter 'C'
- ❖ Data values being inserted into the column name should be in upper case only.
- ❖ Only allow Mumbai_ or Ahmedabad_ values for the city column.

Check constraint defined at column level as per follows:

SQL> create table Reservation(PNR_NO Numeric(9), No_of_seats Number(8), Address varchar(50), Contact_No Numeric(10) constraint ck check(length(contact_no)=10), Status char(3));

Table created.

Check constraint with alter command

SQL> alter table Ticket add constraint check_age check(age>18);

Table altered.

Entity Integrity Constraints

This type of constraints are further classified into

- ❖ Unique Constraint
- ❖ Primary Key Constraint

Unique Constraint

The purpose of unique key is to ensure that information in the column(s) is unique i.e. the value entered in column(s) defined in the unique constraint must not be repeated across the column. A table may have many unique keys. If unique constraint is defined in more than one column (combination of columns), it is said to be composite unique key. Maximum combination of columns that a composite unique key can contain is 16.

Example:

SQL> create table Ticket(Ticket_No Numeric(9) unique, age number(4), sex char(4) l,
source varchar(2), destination varchar(20), dep_time varchar(4));

Table created.

Unique constraint with alter command

Example:

```
SQL> Alter table ticket add constraint uni1 Unique (ticket_no);
```

Primary Key Constraint

A primary key is one or on more columns(s) in a table to uniquely identify each row in the table. A primary key column in a table has a special attribute. It defines the column, as a mandatory column i.e. the column cannot be left blank and should have a unique value. Here by default not null constraint is attached with the column.A multicolumn primary key is called a Composite primary key. The only function of a primary key in a table is to uniquely identify a row. A table can have only one primary key.

Primary key constraint at the column level

Example:

```
SQL> create table Ticket(Ticket_No Numeric(9) constraint pk primary key, age number(4),
sex char(4)l, source varchar(2), destination varchar(20), dep_time varchar(4));
```

Table created.

```
SQL> insert into ticket values (1001,26, ‘M’, ‘KPHB’,’MTM’,’20:00’);
```

1 row created.

```
SQL> insert into ticket values (1001,26, ‘M’, ‘KPHB’,’MTM’,’20:00’);
```

18

```
ERROR at line 1:
ORA-00001: unique constraint (SCOTT.PR_ONO) violated
```

If we insert already inserted ticket_no the above mentioned error will generate.

```
SQL> insert into ticket values (null,26, ‘M’, ‘KPHB’,’MTM’,’20:00’);
ERROR at line 1:
ORA-01400 :cannot insert NULL into (SCOTT_.ORDER_MASTER_ .ORDER_NO”)
```

If we try to insert null values it will generate error message.

Composite Primary key defined at the table level: Composite Primary key is a primary key created with the combination of more than one key and combination values of both the fields should be unique

Example:

SQL> create table vendor_master (ven_code varchar(5), ven_name varchar(20), venadd1 varchar(15), venadd2 varchar(15),vencity varchar(15), constraint pr_com primary key (ven_code,ven_name));

Table created.

Primary key with alter command:

SQL> alter table bus add constraint pr primary key (busno);

Table altered.

Referential Integrity Constraint

In this category there is only one constraint and it is Foreign Key & References

To establish a Parent-child_ or a Master-detail_ relationship between two tables having a

common column, we make use of referential integrity constraint.Foreign key represent relationships between tables. A foreign key is a column whose values are derived from the primary key or unique key. The table in which the foreign key is defined is called a foreign table or Detail table. The table that defines the primary or unique keys and is referenced b y the foreign key is called the Primary table or Master table.The master table can be referenced in the foreign key definition by using references keyword. If the column name is not specified, by default, Oracle references the primary key in the master table.

The existence of a foreign key implies that the table with the foreign key is related to the master table from which the foreign key is derived. A foreign key must have a corresponding primary key or a unique key value in a master table.

Principles of Foreign Key Constraint

- ❖ Rejects an insert or update of a value in a particular column, if a corresponding value does not exist in the master table.
- ❖ Deletion of rows from the Master table is not possible if detail table having corresponding values.
- ❖ Primary key or unique key must in Master table.
- ❖ Requires that the Foreign key column(s) and reference column(s) have same data type

References constraint defined at column level

Example:

```
SQL> create table Passenger(PNR_NO Numeric(9) references reservation , Ticket_NO Numeric(9) references ticket, Name varchar(20), Age Number(4), Sex char(10), PPNO varchar(15));
```

Table created.

Foreign Key Constraint with alter command

```
SQL> alter table reservation add constraint fk_icode foreign key (busno) references

bus(bus_no);
```

Table altered.

Remember that when we add constraint at table level foreign key keyword is must.

```
SQL> delete from bus where bus_no = 2011;

ERROR at line 1:

ORA-02292: integrity constraint (SCOTT.FK_ONO) violated - child record found
```

Exp No: 5 **Date: _ _/_ _/ _ _**

AIM : Applying DML commands on Road Way Travels Tables.

Data Manipulation Command

Data Manipulation commands are most widely used SQL commands and they are

- Insert
- Update
- Delete
- Select

a) Insert command

After creation of table, it is necessary it should have data in it. The insert command is used to add data in form of one or more rows to a table as per follows:

Insert into <table name> values(a list of data values);

In a list of data values you have to specify values for each and every column in the same order as they are defined. A value of each column is separated by comma in the list.

The value of char, nchar, varchar2, nvarchar2, raw, long and date data types are enclosed in single quotes.

Using insert command one can insert values in specific columns as follows:

Insert into <table name>(column list) values(a list of data);

Here number of column and a list of data should be same and list of data should be in order to column list.

```
SQL> insert into emp_master (empno,ename,salary) values (1122,‘Smith’,8000);
1 row created.
```

Above command insert one row but values are inserted in only three columns. Remaining four columns have null values.If you have define not null constraint in any of remaining columns it want allow you to insert data in a table.

Adding values in a table using Variable method

Till now we have seen static method to insert data. One can add data in a table using variable method with & (ampersand) sign. It will prompt user to enter data of mention field.

Generally It is used to add more than one row in a table without typing whole command

repetitively using / sign.

```
SQL> insert into Passenger values(&PNR_NO,&TICKET_NO, '&Name', &Age, '&Sex',
'&PPNO');
Enter value for pnr_no: 1
Enter value for ticket_no: 1
Enter value for name: SACHIN
Enter value for age: 12
Enter value for sex: m
Enter value for ppno: sd1234
old   1: insert into Passenger values(&PNR_NO,&TICKET_NO, '&Name', &Age, '&Sex',

'&PPNO')

new 1: insert into Passenger values(1,1,'SACHIN',12,'m','sd1234')

1 row created.
SQL> /
Enter value for pnr_no: 2
Enter value for ticket_no: 2
Enter value for name: rahul
Enter value for age: 34
Enter value for sex: m
Enter value for ppno: sd3456
old   1: insert into Passenger values(&PNR_NO,&TICKET_NO, '&Name', &Age, '&Sex',
'&PPNO')
new  1: insert into Passenger  values(2,2,'rahul',34,'m','sd3456')
1 row created.
SQL> /
Enter value for pnr_no: 3
Enter value for ticket_no: 3
Enter value for name: swetha
Enter value for age: 24
Enter value for sex: f
Enter value for ppno: sdqw34
old   1: insert into Passenger values(&PNR_NO,&TICKET_NO, '&Name', &Age, '&Sex',
'&PPNO')
new  1: insert into Passenger  values(3,3,'swetha',24,'f','sdqw34')
1 row created.
SQL> /
Enter value for pnr_no: 4
Enter value for ticket_no: 4
Enter value for name: ravi
Enter value for age: 56
Enter value for sex: m
Enter value for ppno: sdqazx
old     1: insert into Passenger values(&PNR_NO,&TICKET_NO, '&Name', &Age, '&Sex',
'&PPNO')
new  1: insert into Passenger  values(4,4,'ravi',56,'m','sdqazx')
1 row created.
SQL> /
Enter value for pnr_no: 4
Enter value for ticket_no: 5
Enter value for name: asif
Enter value for age: 33
Enter value for sex: m
Enter value for ppno: iuyhjk
old     1: insert into Passenger values(&PNR_NO,&TICKET_NO, '&Name', &Age, '&Sex',
'&PPNO')
new 1: insert into Passenger values(4,5,'asif',33,'m','iuyhjk')
insert into Passenger values(4,5,'asif',33,'m','iuyhjk')
*
ERROR at line 1: ORA-00001: unique constraint (SYSTEM.SYS_C004023) violated

SQL> insert into Bus values('&Bus_No','&source','&destination');
Enter value for bus_no: 1
Enter value for source: hyd
Enter value for destination:  ban

old 1: insert into Bus values('&Bus_No','&source','&destination')
new 1: insert into Bus values('1','hyd','ban')
1 row created.
SQL> /
Enter value for bus_no: 2
Enter value for source: hyd
Enter value for destination: chn

old 1: insert into Bus values('&Bus_No','&source','&destination')
new 1: insert into Bus values('2','hyd','chn')
1 row created.
SQL> /
Enter value for bus_no: 4
Enter value for source: hyd
Enter value for destination: mum

old 1: insert into Bus values('&Bus_No','&source','&destination')
new 1: insert into Bus values('4','hyd','mum')

1 row created.
```

```
SQL> /
Enter value for bus_no:  5
Enter value for source: hyd
Enter value for destination:  kol

old 1: insert into Bus values('&Bus_No','&source','&destination')
new 1: insert into Bus values('5','hyd','kol')
1 row created.
SQL> /
Enter value for bus_no: 5
Enter value for source: sec
Enter value for destination: ban

old 1: insert into Bus values('&Bus_No','&source','&destination')
new 1: insert into Bus values('5','sec','ban')
insert into Bus values('5','sec','ban')
*
ERROR at line 1:
ORA-00001: unique constraint (SYSTEM.SYS_C004025) violated
SQL> insert into Reservation values(&PNR_NO, &No_of_seats, '&Address', &Contact_No ,
'&Status');
Enter value for pnr_no: 1
Enter value for no_of_seats:  2
Enter value for address:  masabtank
Enter value for contact_no: 9009897812
Enter value for status:  s

old 1: insert into Reservation values(&PNR_NO, &No_of_seats, '&Address',
&Contact_No,' &Status')
new  1: insert into Reservation  values(1,2,'masabtank',9009897812,'s')
1 row created.


SQL> insert into Reservation
values(&PNR_NO,&No_of_seats,'&Address',&Contact_No,'&Status');
Enter value for pnr_no: 8
Enter value for no_of_seats: 3
Enter value for address:  cbt
Enter value for contact_no: 9090887753
Enter value for status: s

old 1: insert into Reservation values(&PNR_NO, &No_of_seats, '&Address', &Contact_No,
'&Status')
new 1: insert into Reservation values(8,3,'cbt',9090887753,'s')
insert into Reservation values(8,3,'cbt',9090887753,'s')
*
ERROR at line 1:
```

```
ORA-02291: integrity constraint (SYSTEM.SYS_C004024) violated - parent key not found
```

b) Simple Select Command

Stored information can be retrieved from the table through select command. Select is the most frequently used command, as access to information is needed all the time. Syntax of simple select command is as per follows:

Select <column1>,<column2>,_,<column(n)> from <table name>;

The following command will select all the rows and columns from emp_master.

```
SQL> select * from emp_master;

EMPNO    ENAME     JOB      HIREDATE    SALARY   DEPTNO   COMM
1122     Allen     Manager  1-JAN-00    10000       10    1000
1122     Smith              1-JAN-00    8000
1123      King     Clerk    30-JUN-00    3400       20     300
1124     Martin     Manager 30-AUG-00   7000        20    1000
1125     Tanmay             16-SEP-00 10
5 rows selected.
```

The '*' will indicate all the columns. But If you want to retrieve only specific columns from a table then you have to specify column names with select commands.

```
SQL> select empno,ename,salary from emp_master;
```

This query will give information from only three columns.

```
EMPNO    ENAME     SALARY
1122     Allen     10000
1122     Smith      8000
1123     King      3400
1124     Martin     7000
5 rows selected.
SQL> select * from Passenger;

   PNR_NO    TICKET_NO     NAME              AGE    SEX     PPNO
```

```
----------        ----------          --------------------     ---------- ---------- ---------------
     1                 1                 SACHIN                  12        m         sd1234
     2                 2                  rahul                  34        m          sd3456
     3                3                  swetha                  24        f         sdqw34
     4                4                   ravi                  56         m          sdqazx
```

Select Command

Previously we have seen simple use of select statement to retrieve the data from the table.

Now we have look further use of Select statement.

Distinct Clause

To prevent the selection of distinct rows, we can include distinct clause with select command.The following command will exclude duplicate empno.

```
SQL> select distinct deptno from emp_master;

DEPTNO

10

20

2 rows selected.
```

Select command with where clause:

To list out specific rows from a table we can include where clause. We have to specify conditions with where clause to filter the records. The where clause is similar which we have used with delete and update command. It can be done using :

Select <column(s)> from <table name> where [condition(s)];

Example

Suppose you want to view only those rows where HireDate is 1-JAN-00.

```
SQL> select empno,ename from emp_master where hiredate = ‘1-jan- 00’;


EMPNO      ENAME

1122           Allen

1 row selected.
```

UPDATE Table

```
SQL> update Passenger set age='43' where PNR_NO='2';
```

```
1 row updated.
SQL> select * from Passenger;
   PNR_NO      TICKET_NO         NAME               AGE        SEX       PPNO
----------             ----------               --------------------      ----------      -----  ---- ---------------
        1              1                  SACHIN              12          m         sd1234
        2              2                  rahul               43          m         sd3456
        3              3                  swetha              24          f         sdqw34
        4              4                  ravi                56          m         sdqazx
```

DELETE

```
SQL> delete from Passenger where PNR_NO='4';
1 row deleted.
SQL> select * from Passenger;
   PNR_NO       TICKET_NO         NAME                  AGE     SEX       PPNO
---------- -           ---------            --------------------           ---------- ---------- ---------------
        1               1                 SACHIN               12        m        sd1234
        2              2                  rahul                43        m        sd3456
        3             3                   swetha               24        f        sdqw34
```

DROP Table

```
SQL> drop table Cancellation;
Table dropped.
```

Select command with DDL and DML command.

Select command is used to provide information of the table. But apart from retrieving data it is used with some DDL and DML commands.

Table Creation with select statement

One can create table using select statement as per follows :

create table <table name> as select <columnname(s)> from <existing table name>;

Example

Using following command we can copy emp_master table into emp_master_copy.

SQL>create table emp_master_copy as select * from emp_master;

It will create emp_master_copy table with the same Structure and data of emp_master table. Suppose if you want to create new table with some specific columns only, then you have to specify column name in select statement as per follows:

SQL>create table emp_master_copy1 (eno,nm) as select empno,ename from emp_master;

This command will create a new table emp_master_copy1 with only two columns eno and nm similar to *empno and ename available in emp_master* If you want to make a copy of table without any data i.e. only structure of table, one have to specifywrong condition (like 1=2, 2=3,11=13).SQL>create table emp_copy as select * from emp_master where 1=2;

The condition 1=2 will never satisfy so select statement will retrieve none row and only structure will copy.

Insert data using Select statement

Inserting records from one table to another table can also possible through select statement.

Syntax:

Inert into <tablename> (select <columns> from <tablename>);

Example

SQL> insert into emp_copy (select * from emp_master);

This will insert all the rows of emp_master.

R When you insert data into one table from another table data structure should be same of both the table.

If you want to make copy of selected columns data from one table to another table the data structure of both the columns should be same.

Example

SQL> insert into emp_copy(nm) (select name from emp_master);

Change Table Name

One can change the existing table name with a new name.

Syntax

Rename <OldName> To <NewName>;

Example:

SQL> Rename emp_master_copy1 To emp_master1;

Table Renamed.

Exp No: 6 **Date: _ _/_ _/ _ _**

Aim: **Practice Queries using ANY, ALL, IN, EXISTS, UNION, INTERSECT**

Set Operators

Set operators combine the results of two queries into a single one. The following set operators are availablein SQL.

- ❖ Union
- ❖ Union All
- ❖ Intersect
- ❖ Minus

While we are using set operators the following points must be keep in mind The queries, which are related by a set operator should have the same number of column and the corresponding columns, must be of the data types.Such a query should not contain any columns of long data type.The label under which the rows are displayed are those from the first select statement.

Union: The union operator returns all distinct rows selected by two or more queries.

The following example

combines the result of two queries with the union operator, which eliminates duplicate rows.

```
SQL> select order_no from order_master;
ORDER_NO
O001
O002
O003
O004
SQL> select order_no from order_detail;
ORDER_NO
O003
O004
```

```
O005
O006
O007
```

Now we check output using union operator.

Example:

```
SQL>select order_no from order_master union select order_no from
order_detail;
```

```
ORDER_NO
O001
O002
O003
O004
O005
O006
O007
```

Union All : The union all operators returns all rows selected by either query including duplicates. The following example combines the result with the aid of union all operator, which does not eliminates duplicate rows.

Example:

```
SQL> select order_no from order_master union all select order_no from
order_detail
```

```
ORDER_NO
O001
O002
O003
O004
O003
O004
O005
O006
```

O007

Intersect : The intersect operator outputs only rows produced by both the queries intersected i.e. the output in an intersect clause will include only those rows that are retrieved by both the queries.

Example:

SQL> select order_no from order_master intersect select order_no from order_detail;

ORDER_NO

O003

O004

Minus : The Minus operator outputs the rows produced by the first query, after filtering the rows retrieved by the second query.

Example:

SQL> select order_no from order_master minus select order_no from order_detail;

ORDER_NO

O001

O002

EXAMPLE QUERIES:

1. Display Unique PNR_NO of all Passengers

```
SQL> select PNR_NO from Passenger;
            PNR_NO
            ----------
                1
               2
               3
               4
               5
               6
               7
7 rows selected.
```

2. Display all the names of male Passengers

```
SQL> select Name from Passenger where Sex='m';
        NAME
        --------------------
        SACHIN
        rahul
        rafi
        salim
        riyaz
```

3. Display Ticket numbers and names of all Passengers

```
SQL> select Ticket_NO,Name from Passenger;
      TICKET_NO      NAME
      ----------      --------------------
              1       SACHIN
              2       rahul
              3       swetha
             23       rafi
             12      salim
             34      riyaz
             21       neha
7 rows selected.
```

4. Display the source and destination having journey time more than 10 hours.

```
SQL> select source, destination from Ticket where Journey_Dur>10;
         SOURCE             DESTINATION
          ----------          --------------------
           HYD               BAN
           SEC               BAN
           HYD               MUM
```

5. Find the ticket number of passenger whose name starts with ‘S’ and ends with ‘H’

```
SQL> select Ticket_NO from Passenger where Name like'S%'and name like'%N';
        TICKET_NO
          ----------
                1
```

6. Find the names of the passenger whose age is between 20 and 40

```
SQL> select Name from Passenger where age between 20 and 40;

        NAME
        --------------------
        swetha
        rafi
        riyaz
        neha
```

7. Display all the name of the passengers beginning with ‘r’

```
SQL> select Name from Passenger where Name like 'r%';
          NAME
          --------------------
          rahul
          rafi
          riyaz
```

8. Display the sorted list of Passenger Names

```
SQL> select Name from Passenger ORDER BY Name;
         NAME
         --------------------
         SACHIN
         neha
         rafi
         rahul
         riyaz
         salim
         swetha
         7 rows selected.
```

Exp No: 7 **Date: _ _/_ _/ _ _**

AIM: Practice Queries using Aggregate functions, Group By, Having Clause and Order Clause.

Group Functions:

A group functions returns a result based on a group of rows. Some of these are just purely mathematical functions. The group functions supported by Oracle are summarized below:

1) Avg (Average): This function will return the average of values of the column specified in the argument of the column.

Example:

```
SQL> select avg(comm) from emp_master;
AVG(COMM)
---------
766.66667
```

2) Min (Minimum): The function will give the least of all values of the column present in the argument.

Example:

```
SQL>Select min(salary) from emp_master;
MIN(SALARY)
-----------
3400
```

3) Max (Maximum): To perform an operation, which gives the maximum of a set of values the max, function can be made use of.

Example:

```
SQL>select max(salary) from emp_master;
```

This query will return the maximum value of the column specified as the argument.

```
MAX(SALARY)
-----------
```

10000

4) Sum: The sum function can be used to obtain the sum of a range of values of a record set.

Example:

SQL>Select sum(comm) from emp_master;

SUM(COMM)

2300

5) Count: This function is used to count number rows. It can take three different arguments, which mentioned below.

Syntax: Count(*)

Count(column name)

Count(distinct column name)

Count (*): This will count all the rows, including duplicates and nulls.

Example:

SQL>Select count(*) from emp_master;

COUNT(*)

4

Count (Column name) : It counts the number of values present in the column without including nulls.

Example:

SQL> select count(comm) from emp_master;

COUNT(comm)

3

Count (distinct column name) : It is similar to count(column name) but eliminates duplicate values while counting.

Example:

SQL>Select count(distinct deptno) from emp_master;

```
COUNT(DEPTNO)
2
```

Group By Clause

Group by clause is used with group functions only. Normally group functions returns only one row. But group by clause will group on that column. The group by clause tells Oracle to group rows based on distinct values for specified columns, i.e. it creates a data set, containing several sets of records grouped together based on a condition.

Select group function from table name group by column name

Example:

SQL>select deptno,count(*) from emp_master group by deptno;

```
DEPTNO COUNT(*)
10          2
20           2
```

Having Clause

The having clause is used to satisfy certain conditions on rows, retrieved by using group by clause.Having clause should be preceding by a group by clause. Having clause further filters the rows return by **group by clause.**

Example

SQL> select deptno,count(*) from emp_master group by deptno having Deptno is not null;

```
DEPTNO     COUNT(*)
10           2
20          2
```

Order By Clause

Order by clause is used to arrange rows in either ascending or descending order. The order by clause can also be used to arrange multiple columns. The order by clause should be the last clause in select statement.It is used as per follows :

select <column(s)> from <TableName> where [condition(s)] [order by <column name> [asc/]desc];

Example

If you want to view salary in ascending order the following command can performed:

```
SQL> select empno,ename,salary from emp_master order by salary;
EMPNO        ENAME         SALARY
1123         King          3400
1124         Martin         7000
1122         Allen          10000
1125         Tanmay        10000
4 rows selected.
```

If you have not specify any order by default it will consider ascending order and salary will be displayed in ascending order. To retrieve data in descending order the desc keyword is used after order by clause.

SQL> select empno,ename,salary from emp_master order by salary desc;

And the output will opposite from above.

```
EMPNO        ENAME           SALARY
1122          Allen              10000
1125         Tanmay             10000
1124         Martin               7000
1123         King               3400
4 rows selected.
```

SQL *Plus having following operators.

- Arithmetic Operators
- Comparison Operators
- Logical Operator

Arithmetic Operator

Arithmetic operators are used to perform calculations based on number values. The arithmetic operators are + (addition), - (subtraction), * (multiplication) and / (division). We can include them in sql command.

Example

```
SQL> select salary+comm from emp_master;
Salary+comm
11000
 3700
 8000
(Null)
4 rows selected.
```

Example:

```
SQL> select salary+comm net_sal from emp_master;
NET_S
11000
3700
8000
(Null)
4 rows selected.
```

In above query, it will give output of salary+comm and net_sal is column alias, which is used to change column heading. So the output will be displayed under the net_sal heading. If you calculate any number value with null value, it will always return null value.

In arithmetic operators * and / have equal higher precedence. And + and – have equal lower precedence.

Check the following illustrates the precedence of operators.

```
SQL> Select 12*(salary+comm) annual_netsal from emp_master;
ANNUAL_
132000
44400
96000
```

(Null)

4 rows selected.

If the parenthesis is omitted then multiplication will be performed first followed by addition.

We can change the order of evaluation by using parenthesis.

Comparison Operators:

Comparison operators are used in condition to compare one expression with other. The comparison operators are =, >, <, >=, <=, !=, between, like , is null and in operators.

Between operator is used to check between two values.

33

Example:

SQL> select * from emp_master where salary between 5000 and 8000;

```
EMPNO     ENAME      JOB     HIREDATE          SALARY    DEPTNO   COMM
1124      Martin     Manager  30-aug-00        7000             20         1000
```

1 row selected.

The above select statement will display only those rows where salary of employee is between 5000 and 8000.

IN Operator:

The in operator can be used to select rows that match one of the values in a list.

SQL>Select * from emp_master where deptno in(10,30);

```
EMPNO     ENAME     JOB     HIREDATE          SALARY    DEPTNO   COMM
1122       Allen      Manager 1-JAN-00        10000           10        1000
1125      Tanmay              16-SEP-00        10000           10
```

2 rows selected.

The above query will retrieve only those rows where deptno is either in 10 or 30.

LIKE Operator:

Like operator is used to search character pattern, we need not know the exact character value. The like operator is used with special character % and _ (underscore).

SQL> select * from emp_master where job like ‘M%’;

```
EMPNO     ENAME     JOB      HIREDATE      SALARY   DEPTNO    COMM
1122      Allen      Manager  1-jan-00        10000        10               1000
```

```
1124       Martin     Manager  30-aug-00     7000      20       1000
```

2 rows selected.

The above select statement will display only those rows where job is starts with ‘M’ followed by any number of any characters. % sign is used to refer number of characters (it similar to * asterisk wildcard in DOS), while _ (underscore) is used to refer single character(it similar to ? question wildcard in DOS).

SQL>Select * from emp_master where job like ‘_lerk’;

```
EMPNO     ENAME    JOB     HIREDATE      SALARY     DEPTNO   COMM
------------------------------------------------------------------
1123           King    Clerk   30-jun-00      3400           20     300
```

1 row selected.

In above query, it will display only those rows where job is start with any single character but ends with ‘clerk’.

Logical Operators:

Logical operators are used to combine the results of two conditions to produce a single result. The logical operators are AND, NOT and OR.

AND Operator:

The Oracle engine will process all rows in a table and display the result only when all the conditions specified using the AND operator are satisfied.

SQL> select * from emp_master where salary > 5000 and comm < 750 ;

No rows selected.

The select statement will return only those rows where salary is greater than 5000 and comm is less than 750. If both the conditions are true then only it will retrieve rows.

OR Operator:

The Oracle engine will process all rows in a table and display the result only when any of the conditions specified using the OR operators are satisfied.

SQL>select * from emp_master where salary > 5000 or comm < 750;

```
EMPNO    ENAME    JOB     HIREDATE         SALARY   DEPTNO   COMM
-------------------------------------------------------------------
1122       Allen    Manager   1-jan-00        10000      10        1000
1123        King      Clerk   30-jun-00       3400       20        300
1124        Martin  Manager   30-aug-00       7000      20        1000
```

```
1125          Tanmay                16-SEP-00        10000        10
```

4 rows selected.

This select statement will check either salary is greater than 5000 or comm is less than 750. ie it will return all the records either of any one condition returns true.

NOT Operator:

The Oracle engine will process all rows in a table and display the result only when none of the conditions specified using the NOT operator are satisfied.

SQL> select * from emp_master where not salary = 10000;

```
EMPNO       ENAME     JOB      HIREDATE       SALARY      DEPTNO    COMM
---------------------------------------------------------------------------
1123         King         Clerk     30-jun-00        3400              20        300
1124         Martin        Manager 30-aug-00       7000              20        1000
```

2 rows selected.

This select statement will return all the records where salary is NOT equal to 10000.

Pre-define Functions

Oracle functions serve the purpose of manipulating data items and returning a resu lt. Functions are also capable of accepting user-supplied variables or constants and operations on them. Such variables and constants are called arguments.

Functions are classified into Group Functions and Single Row Functions (Scalar Functions).Before we check single row function and group function, we will take a look on Dual table"

The Oracle Table Dual"

Dual is a small oracle worktable, which consists of only one row and one column, and contains the value x in that column. Besides arithmetic calculations, it also supports date retrieval and it's formatting.

SQL> select 2*2 from dual;

```
2*2
---
  4
```

Single Row Functions (Scalar Functions):

Functions that act on only one value at a time are called as Single Row Functions. A Single Row function returns one result for every row of a queried table or view.

Single Row functions can be further grouped together by the data type of their arguments and return values. Functions can be classified corresponding to different data types as :

- ❖ String Functions : Work for String Data type
- ❖ Numeric Functions : Work for number Data type
- ❖ Conversion Functions : Work for conversion of one data type to another
- ❖ Date Functions : Work for Date Data type **36**

String Functions:

String functions accept string input and return either string or number values.

1) Initcap (Initial Capital): This String function is used to capitalize first character of the input string.

Syntax:

initcap(string)

Example:

SQL> select initcap(‘azure’) from dual;

INITC

Azure

2) Lower: This String function will convert input string in to lower case.

Syntax:

Lower(string)

Example:

SQL> select lower(‘AZURE’) from dual;

<u>LOWER</u>

azure

3) Upper: This string function will convert input string in to upper case.

Syntax:

Upper(string)

Example:

SQL> select upper(‘azure’) from dual;

UPPER

AZURE

4) Ltrim (Left Trim): Ltrim function accepts two string parameters; it will fetch only those set of characters from the first string from the left side of the first string, and displays only those characters which are not present in second string. If same set of characters are not found in first string it will display whole string

Syntax:

Ltrim(string,set)

Example:

SQL>select ltrim('azuretech','azure') from dual;

<u>LTRI</u>

tech

5) Rtrim (Right Trim): Rtrim function accepts two string parameters; it will fetch only those characters from the first string, which is present in set of characters in second string from the right side of the first string.

Syntax:

Rtrim(string,set)

Example:

SQL>select rtrim('azuretrim','trim') from dual;

<u>RTRIM</u>

azure

6) Translate: This function is useful when you want to encrypt string. It will take first character from string1 and search the same character in string2 if that character is found than it replaces that character out of string3 on base of position of character found in string2. In below given example first character of string1 is found at position no 2 in string2, so it will extract second character from string3. Same way second character is found at position number 4 in string2, so it will extract fourth character from string3 and so on. If any character in string1 is not found in string2 then it is kept unchanged.

Syntax:

Translate(string1, string2, string3)

Example:

SQL>select translate(‘abcde’,’xaybzcxdye’,’tanzmulrye’) from dual;

TRANS

azure

7) Replace: This function is useful when you want to search a specified string and replace it with particular string form the string provided. For example, you want to search ‘A’ from the ‘TACHNOLOGIAS’ and replace it with ‘E’ to make it ‘TECHNOLOGIES’. Replace function accepts three arguments first argument is, from which string you want to search, second argument is what you want to search from the first argument and third argument is replace string, value of second argument, if found will be replaced with value passed in third argument.

Syntax:

Replace(string, searchstring, replacestring)

Example:

SQL> select replace(‘jack and jue’,’j’,’bl’) from dual;

8) Substr: Substring fetches out a piece of the string beginning at start and going for count characters, if count is not specified, the string is fetched from start and goes till end of the string.

Syntax:

Substr(string, starts [, count])

Example:

SQL>select substr(‘azuretechnology’,4,6) from dual;

SUBSTR

retech

9) Chr: Character function except character input and return either character or number values. The first among character function is chr. This returns the character value of given number within braces.

Syntax:

Chr(number)

Example:

SQL>select chr(65) from dual;

A

10) Lpad (Left Pad): This function takes three arguments. The first argument is character string, which has to be displayed with the left padding. Second is a number, which indicates total length of return value and third is the string with which left padding has to be done when required.

Syntax:

Lpad(String,length,pattern)

Example:

Sql > select lpad('Welcome',15,'*') from dual;

LPAD('WELCOME',

———————-

********Welcome

11) Rpad (Right Pad): Rpad does exact opposite then Lpad function.

Syntax:

Lpad(String,length,pattern)

Example:

SQL> select rpad('Welcome',15,'*') from dual;

RPAD('WELCOME',

———————-

Welcome********

12) Length: When the length function is used in a query. It returns length of the input string.

Syntax:

Length(string)

Example:

SQL>select length('auzre') from dual;

LENGTH('AUZRE')

———————-

5

13) Decode: Unlike the translate function which performs character-by-character replacement the decode function does a value-by-value replacement.

Syntax:

Select decode(column name,if,then,if,then_....) from <tablename>;

Example:

```
SQL> select deptno,decode(deptno,10, ‘Sales’, 20, ‘Purchase’, ‘Account’)
DNAME from emp_master;
DEPTNO DNAME
______ ________
10 Sales
20 Purchase
20 Purchase
10 Sales
4 rows selected.
```

14) Concatenation (||) Operator: This operator is used to merge two or more strings.

Syntax:

Concat(string1,string2)

```
SQL> select concat(‘Azure’,’ Technology’) from dual;
CONCAT(‘AZURE’,’
________________
Azure Technology
SQL> select ‘ename is ‘||ename from emp_master;
‘ENAME IS’||ENAME
________________-
ename is Allen
ename is King
ename is Martin
ename is Tanmay
4 rows selected.
```

Numeric Functions:

1) Abs (Absolute): Abs() function always returns positive number.

Syntax:

Abs(Negetive Number)

Example:

SQL> select Abs(-10) from dual;

<u>ABS(-10)</u>

10

2) Ceil: This function will return ceiling value of input number. i.e. if you enter 20.10 it will return 21 and if you enter 20.95 then also it will return 21. so if there is any decimal value it will add value by one and remove decimal value.

Syntax:

Ceil (Number)

Example:

SQL>select Ceil (23.77) from dual;

<u>CEIL(23.77)</u>

24

3) Floor: This function does exactely opposite of the ceil function.

Syntax:

Floor(Number)

Example:

SQL>select Floor(45.3) from dual;

<u>FLOOR(45.3)</u>

45

4) Power: This function will return power of raise value of given number.

Syntax:

Power(Number, Raise)

Example:

SQL>Select power (5,2) from dual;

<u>POWER(5,2)</u>

25

5) Mod: The function gives the remainder of a value divided by another value.

Syntax:

Mod(Number, DivisionValue)

Example:

SQL>select Mod(10,3) from dual;

MOD(10,3)

1

6) Sign: The sign function gives the sign of a value without it's magnitude.

SQL>select sign(-45) from dual;

SIGN(-45)

-1

SQL>Select sign(45) from dual;

SIGN(45)

1

Date Function:

1) Add_Months: The add_months data function returns a date after adding a specified data with the specified number of months. The format is add_months(d,n), where d is the date and n represents the number of months.

Syntax:

Add_Months(Date,no.of Months)

Example:

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

This will add two months in system date.

```
ADD_MONTH
_______
02-NOV-01
```

2) Last_day: Returns the last date of month specified with the function.

Syntax:

Last_day(Date)

Example:

SQL> select sysdate, last_day(sysdate) from dual;

```
SYSDATE LAST_DAY
———————— ————————-
02-SEP-01 30-SEP-01
```

3) Months_Between: Where Date1, Date2 are dates. The output will be a number. If Date1 is later than Date2, result is positive; if earlier, negative. If Date1 and Date2 are either the same days of the month or both last days of months, the result is always an integer; otherwise Oracle calculates the fractional portion of the result based on a 31-day month and considers the difference in time components of Date1 and Date2.

Syntax:

Months_Between(Date1,Date2)

Example:

SQL>select months_between(sysdate,'02-AUG-01') 溺 onths_ from dual;

<u>MONTHS</u>

4

4) Next_Day: Returns the date of the first weekday named by 'char' that is after the date named by'Date'. 'Day' must be the day of the week.

Syntax:

Next_Day(Date,Day)

Example:

SQL>select next_day(sydate, 'sunday') 哲 ext_ from dual;

This will return date of next sunday.

<u>NEXT_DAY</u>

09-SEP-00

5) Round: This function returns the date, which is rounded to the unit specified by the format.

Syntax:

Round (Date, [fmt])

If format is not specified by default date will be rounded to the nearest day.

Example:

SQL>Select round('4-sep-01','day') 迭 ounded_ from dual;

<u>Rounded</u>

02-SEP-01

The date formats are 'month' and 'year'.

If rounded with 'month' format it will round with nearest month.

If rounded with 'year' format it will round with nearest year.

6) Trunc (Truncate): This function returns the date, which is truncated to the unit specified by the format.

Syntax:

Trunc(Date,[fmt])

If format is not specified by default date will be truncated.

Example:

This will display first day of current week.

SQL>Select Trunc('4-sep-01','day') 典 runcated_ from dual;

<u>Truncated</u>

02- SEP-01

The date formats are 'month' and 'year '.

If rounded with 'month' format it will display first day of the current month.

If rounded with 'year' format it will display first day of the current year.

Conversion Functions:

Conversion functions convert a value from one data type to another. The conversion functions are classified into the following:

- ❖ To_Number()
- ❖ To_Char()
- ❖ To_Date()

1) To_Number: The to_number function allows the conversion of string containing numbers into the number data type on which arithmetic operations can be performed.

Example:

SQL>Select to_number('50') from dual;

<u>TO_NUMBER('50')</u>

50

2) To_Char: To_char function converts a value of number data type to a value of char data type, using the optional format string. It accepts a number (no) and a numeric format (fmt) in which the number has to appear. If 'fmt' is omitted, 'no' is converted to a char exactly long enough to hold significant digits.

Syntax:

To_char(no,[fmt])

Example:

SQL> select to_char(17145,'$099,999') 鼎 har_ from dual;

<u>Char</u>

$017,145

To_char converts a value of date datatype to character value. It accpets a date, as well as the format(fmt) in which the date has to appear. 'fmt' must be the date format. If 'fmt' is omitted, 'date' is converted to a character value in the default date format 電 d-mon-yy_.

Syntax:

To_char(Date,[fmt])

Example:

SQL>select to_char(hiredate, 'month dd yyyy') 滴 ireDate_ from emp_master

where salary = 10000;

<u>HireDate</u>

January 01 2000

September 16 2000

3) To_Date: The format is to_date(char [,fmt]). This converts char or varchar datatype to date datatype. Format model, fmt specifies the form of character. Consider the following example which returns date for the string ‘January 27 2000’.

Syntax:

To_date(char,[fmt])

Example:

SQL>select to_date(’27 January 2000’,’dd/mon/yy’) 泥 ate_ from dual;

Date

27- JAN-00

Practice queries using Aggregate functions, Group by, having and Order By Clause.

1. Write a query to Display the information present in the Cancellation and Reservation Tables

```
SQL> select * from Reservation UNION select * from Cancellation;
    PNR_NO     NO_OF_SEATS     ADDRESS          CONTACT_NO      STATUS
---------- -   ----------    --------------------    ---------- ---   --------------
        1         2            sdfgh             1234543          s
        1         3            msbtnk            123456789        s
        2         2            ldkp              234567891        s
        2         2            wertgfds          12212121         n
        3         4            dskng             345678912        n
        3        5            azxsdcvf          13243546         s
        4        2            ddfdsfsdfdsf      3456789          s
        4        5            abids             567891234        s
        5        2            allbd             891234567        s
        5        11           liopujth          43256787         s
        6        1            koti              231456781        s
    PNR_NO     NO_OF_SEATS      ADDRESS          CONTACT_NO     STATUS
----------          --         ---------         -------------------- ----------
        6        31           swebnht           453212345           s
        7        2            dbdhfdbhf         90876543            s
        7        3             jklhg            2345671             s
14 rows selected.
```

2. Find the distinct PNR_NO that are present

```
SQL> SELECT PNR_NO, COUNT(*) AS NoOccurances FROM Passenger GROUP BY
PNR_NO HAVING COUNT(*)>0;
                PNR_NO          NOOCCURANCES
              ----------          ------------
                  1                1
                  2                1
```

```
                    3                  1
                    4                  1
                    5                  1
                    6                  1
                    7                  1
7 rows selected.
```

3. Find the No of Seats booked for each PNR_NO using GROUP BY Clause.

```
SQL> select PNR_NO,sum(No_of_seats) from Reservation group by PNR_NO;
          PNR_NO      SUM(NO_OF_SEATS)
         ----------      ----------------
               1             3
               6             1
               2             2
               4             5
               5             2
               3             6
               7             3
     7 rows selected.
```

4. Find the number of seats booked in each class where the number of seats is greater than 1.

```
SQL> select class,sum(No_of_seats) from Reservation where class='a 'or class='b' or class=
'c' group by class having sum(No_of_seats)>1;
       CLASS      SUM(NO_OF_SEATS)
       ----          ---------------
       a               13
       b                7
       c                2
```

5. Find the total number of cancelled seats.

```
SQL> select sum(No_of_seats) from Cancellation;
            SUM(NO_OF_SEATS)
            ----------------
                     22
```

6. Creating and dropping views

Exp No: 8 **Date: _ _/_ _/ _ _**

AIM : Implement Joins

Joins

Sometimes we require to treat multiple tables as though they were a single entity. Then a single SQL sentence can manipulate data from all the tables. To achieve this, we have to join tables. The purpose of join is to combine the data spread across tables. A join is actually performed by the 'where' clause which combines the specified rows of tables.

Syntax for joining tables

select columns from table1, table2, ... where logical expression;

Basically there are three different types of joins:

- Simple Join
- Self Join
- Outer Join

Simple Join : This is the most frequently used join. It retrieves the rows from two tables having a common column and is further classified into equi-join and non-equi join. Equi join is based on equalit y and where clause uses comparison operator equal to (=) to perform a join. Non-equi join specifies therelationship between columns belonging to different tables by making use of relational operators(>,<,>=,<=, <>).

Example:

SQL> select * from order_master , order_detail where Order_master.order_no = order_detail.order_no;

This select statement will join the output of order_master and order_detail and display only those rows where order_master's order_no equals to order_detail's order_no. In the example the column name is prefixed by the table name because both the tables have the same column name i.e. order_no. Therefore to distinguish between them we use table names. If the column names are unique, then we need not prefix it with the table name.

Example:

SQL> select a.*, b.* from itemfile a, order_detail b where a.max_level< b.qty_ord

and a.itemcode = b.itemcode;

This select statement will retrieve rows from itemfile and order_detail where qty_ord of order_detail table is less than max_level of itemfile and Itemcode are common in both the table. Here a and b is indicating table aliases name. To prevent ambiguity in a query we include table names in the select statements. Table aliases are used to make multiple table queries shorter and more readable.

Self Join : In some situations, you may find it necessary to join a table to itself, as though you were joining two separate tables. This is referred to as a self-join. In a self-join, two rows from the same table combine to form a result row. To join a table to it self, two copies of the very ame table have to be opened in memory. Hence in the fromclause, the table name needs to be mentioned twice. Since the table names are same, the second table will overwrite the first table and in effect, result in only one table being in memory. This is because a table name is translated into specific memory location. To avoid this, each table to be opened under an alias. Now these table aliases will cause two identical tables to be opened in different memory locations. This will result in two identical tables to be physically present in the computer's memory.Display employees'salary with their manager's salary. (Use default emp table)

Example:

SQL> select a.ename, a.salary, b.ename, b.salary from emp a, emp b where a.mgr = b.empno;

This query will return employee name,salary with his manager's name and salary.

Outer Join : Outer join extends the result of simple join. An outer join returns all the rows returned by simple join as well as those rows from one table that do not match any row from the other table. This cannot be with a simple join. The outer join is represented by (+) sign.

Example:

SQL> select * from order_master a, order_detail b where a.order_no = b.order_no(+);

This select statement will return all the records from order_master and only matching records from order_detail. If (+) is not specified then it is simple join and it will retrieve only matching records from both tables.

Exp No: 9 **Date: _ _/_ _/ _ _**

AIM : Implement Sub Queries:

Subquery

A subquery is a form of an SQL statement that appears inside another SQL statement. It is also termed as nested query. The statement containing a subquery is called parent query statement. The parent statement uses the rows returned by the subquery. Subquery is always enclosed within parenthesis. Subquery will be evaluated first followed by the main query.

Example:

SQL> select * from order_master where order_no = (select order_no from order_detail where order_no = ‘O001’);

In this case subquery will execute first and the main query’s condition will work on subquery’s output.Now check the following select statement, what will the output.

Example:

SQL> select * from order_master where order_no = (select order_no from order_detail);

It will return an error, ‘single-row subquery returns more than one row’.

When subquery returns more than one row we have to use operators like any, all, in or not in.‘=any’ is equivalent to ‘in’ operator and ‘!=all’ is equivalent to not in.

Example:

SQL>Select * from order_master where order_no = any(select order_no from order_detail);

SQL> select * from order_master where order_no in(select order_no from order_detail);

Both select statements are equal. After using ‘any’ operator it display records from order_master where any order_no is equal to order_no from order_detail.

Example:

SQL> select * from order_detail where qty_ord =all(select qty_hand from itemfile where itemrate =250);

In above example the subquery will display area that holds the itemrate that is less than 250. The main query will display details about orders only if qty_ord is greater than all the values return by the subquery.

Exp No: 10 **Date: _ _/_ _/ _ _**

AIM : Implement Views:

Views

After a table is created and populated with data, it may become necessary to prevent all users from accessing all columns of a table, for data security reasons. This would mean creating several tables having the appropriate number of columns and assigning specific users to each table, as required. This will answer data security requirements very well but will give rise to a great deal of redundant data being resident in tables, in the database.To reduce redundant data to the minimum possible, Oracle allows the creation of an object called a View.

A View is mapped, to a SELECT sentence. The table on which the view is based is described in theFROM clause of the SELECT statement. The SELECT clause consists of a sub-set of the columns of the table. Thus a View, which is mapped to a table, will in effect have a sub-set of the actual columns of the table from which it is built. This technique offers a simple, effective way of hiding columns of a table.Some View's are used only for looking at table data. Other View's can be used to Insert, Update and Delete table data as well as View data. If a View is used to only look at table data and nothing else, the View is called a Read-Only view. A View that is used to Look at table data as well as Insert, Update and

Delete table data is called an Updateable View.

The reasons why views are created are:

- When Data security is required
- When Data redundancy is to be kept to the minimum while maintaining data securiry

Lets spend some time in learning how a View is Created

- ❖ Used for only viewing and/or manipulating table data

i.e. a read-only or updateable view

- ❖ Destroyed

Syntax:

Create View <View_Name> As Select statement;

Example:

SQL>Create View EmpView As Select * from Employee;

View created.

Once a view has been created, it can be queried exactly like a base table.

Syntax:

Select columnname,columnname from <View_Name>;

Example:

SQL>Select Empno,Ename,Salary from EmpView where Deptno in(10,30);

```
EMPNO ENAME SALARY
1122        Allen      10000
1125        Tanmay      10000
2 rows selected.
```

Updateable Views:

Views can also be used for data manipulation (i.e. the user can perform the Insert, Update and Delete operations). Views on which data manipulation can be done are called Updateable Views. When you give an updateable view name in the Update, Insert or Delete SQL statement, modifications to data will be passed to the underlying table.

For a view to be updateable, it should meet the following criteria:

Views defined from Single Table:

If the user wants to INSERT records with the help of a view, then the PRIMARY KEY column/s and all the NOT NULL columns must be included in the view.The user can UPDATE, DELETE records with the help of a view even if the PRIMARY KEY column and NOT NULL column/s are excluded from the view definition.

Example:

Table Name: Employee

Column Name Data Type Size Attributes

Empno Number 3 Primary Key

Ename Varchar2 30 Not Null

Salary Number 8,2 Not Null

Deptno Number 3

Syntax for creating an Updateable View:

Create View Emp_vw As

Select Empno,Ename,Deptno from Employee;

View created.

When an INSERT operation is performed using the view:

SQL>Insert into Emp_vw values(1126,'Brijesh',20);

1 row created.

_ When an MODIFY operation is performed using the view:

SQL>Update Emp_vw set Deptno=30 where Empno=1125;

1 row updated.

_ When an DELETE operation is performed using the view:

SQL>Delete from Emp_vw where Empno=1122;

1 row deleted.

A view can be created from more than one table. For the purpose of creating the View these tables will be linked by a join condition specified in the where clause of the View's definition. The behavior of the View will vary for Insert, Update, Delete and Select table operations depending upon the following:

- Whether the tables were created using a Referencing clause
- Whether the tables were created without any Referencing clause and are actually standalone tables not related in any way.

View defined from Multiple tables (Which have no Referencing clause):

If a view is created from multiple tables, which were not created using a 'Referencing clause' (i.e. No logical linkage exists between the tables), then though the PRIMARY KEY column/s as well as the NOT NULL columns are included in the View definition the view's behavior will be as follows:

The INSERT, UPDATE or DELETE operation is not allowed. If attempted Oracle displays the followingerror message:

For insert/modify:

ORA-01779: cannot modify a column, which maps to a non-preserved table.

For delete:

ORA-01752: cannot delete from view without exactly one key-preservedtable.

View defined from Multiple tables (Which have been created with a Referencing clause):

If a view is created from multiple tables, which were created using a 'Referencing clause' (i.e. a logicallinkage exists between the tables), then though the PRIMARY KEY Column/s as well as the NOT NULL columns are included in the View definition the view's behavior will be as follows:

- ❖ An INSERT operation is not allowed.
- ❖ The DELETE or MODIFY operations do not affect the Master table.
- ❖ The view can be used to MODIFY the columns of the detail table included in the view.
- ❖ If a DELETE operation is executed on the view, the corresponding records from the detail table will be deleted.

Syntax for creating a Master/Detail View (Join View):

SQL>Create View EmpDept_Vw As

Select a.Empno,a.Ename,a.Salary,a.Deptno,b.Dname From Employee a,DeptDet b

Where a.Deptno=b.Deptno;

View created.

When an INSERT operation is performed using the view

SQL>Insert into EmpDept_Vw values(1127,'AbhayShah',10000,10,'Technical');

ORA-01776:cannot modify more than one base table through a join view When an MODIFY operation is performed using the view

SQL>Update EmpDept_Vw set salary=4300 where Empno=1125;

1 row updated.

When an DELETE operation is performed using the view

SQL>Delete From EmpDept_Vw where Empno=1123;

1 row deleted.

Common restrictions on updateable views:

The following condition holds true irrespective of the view being created from a single table or multiple tables.For the view to be updateable the view definition must not include:

- ❖ Aggregate functions.
- ❖ DISTINCT, GROUP BY or HAVING clause.
- ❖ Sub-queries.
- ❖ Constants, Strings or Value Expressions like Salary * 2.25.
- ❖ UNION, INTERSECT or MINUS clause.
- ❖ If a view is defined from another view, the second view should be updateable.

If the user tries to perform any of INSERT, UPDATE, DELETE operation, on a view which is created from a non-updateable view Oracle returns the following error message:

For insert/modify/delete:

ORA-01776:data manipulation operation not legal on this view

To Create Read-only View:

In this view, you cannot manipulate the records. Because of this view is created with read only.

SQL>Create View EmpRO As select * from Employee with Read Only;

View created.

To Create View With Check option:

In this view, you cannot change value of deptno column. Because of this view is created with checkoption.

SQL>Create View EmpCk As Select * from Employee Where Deptno=10 WithCheck Option;

View created.

Destroying a view:

The DROP VIEW command is used to remove a view from the database.

Syntax:

Drop View <View_Name>;

Example:

Remove the view Emp_Vw from the database.

```
SQL>Drop View Emp_Vw;

View dropped.
```

```
SQL> create view v1 as select * from Passenger full natural join Reservation;
View created.
```

a) INSERT

```
SQL> insert into male_pass values(&PNR_NO,&age);
Enter value for pnr_no: 12
Enter value for age: 22
old 1: insert into male_pass values(&PNR_NO,&age)
new 1: insert into male_pass values(12,22)
1 row created.
```

b) DROP VIEW

```
SQL> drop view male_pass;
        View dropped.
```

Exp No: 11 **Date: _ _/_ _/ _ _**

AIM : Implement Indexes:

Indexes

When the user fires a SELECT statement to search for a particular record, the Oracle engine must first locate the table on the hard disk. The Oracle engine reads system information and locates the starting location of a table's records on the current storage media. The Oracle engine then performs a sequential search to locate records that match user-defined criteria.

For example, to locate all the orders placed by client 'C00001' held in the sales_order table the Oracle engine must first locate the sales_order table and then perform a sequential search on the client_no column seeking a value equal too 'C00001'. The records in the sales_order table are stored in the order in which they are keyed in and thus to get all orders where client_no is equal to 'C00001' the Oracle engine must search the entire table column.Indexing a table is an 'access strategy', that is, a way to sort and search records in the table. Indexes are essential to improve the speed with which the record/s can be located and retrieved from a table.

An index is an ordered list of the contents of a column, (or a group of columns) of a table.

Indexing involves forming a two dimensional matrix completely independent of the table on which the index is being created.A column, which will hold sorted data, extracted from the table on which the index is being created.An address field that identifies the location of the record in the Oracle database. This address field is called Rowid.

When data is inserted in the table, the Oracle engine inserts the data value in the index. For every data value held in the index the Oracle engine inserts a unique rowid value. This is done for every data value inserted into the index, without exception. This rowid indicates exactly where the record is stored in the table.Hence once the appropriate index data values have been located, the Oracle engine locates an associated record in the table using the rowid found in the table.The records in the index are sorted in the ascending order of the index column/s.

If the SELECT statement has a where clause for the table column that is indexed, the Oracle engine will scan the index sequentially looking for a match of the search criteria rather than the table column itself. The sequential search is done using an ASCII compare routine to scan the columns of an index. Since the data is sorted on the indexed column/s, the sequential search ends as soon as the Oracle engine reads an index data value that does not meet the search criteria.

22245001111111

Example:

Select order_no,order_date,client_no From Sales_order Where client_no='C00001';

When the above select statement is executed, since an index is created on client_no column, the Oracle engine will scan the index to search for a specific data value i.e. client_no equal to 'C00001'. The Oracle engine will then perform a sequential search to retrieve records that match the search criteria i.e. client_no='C00001'. When 'C00002' is read, the Oracle engine stops further retrieval from the index. For the three records retrieved, the Oracle engine locates the address of the table records from the address of the table records from the ROWID field and retrieves records stored at the specified address.

Client_no	**ROWID**
C00001	00000240.0000.00004
C00001	00000240.0002.00004
C00001	00000241.0002.00004

The Rowid in the current example indicates that the record with client_no 'C00001' is located in data file0004. Two records are stored in block 00000240 with record number 0000 and 0002. The third record is stored in block 00000241 with record number 0002.Thus, data retrieval from a table by using an index is faster then data retrieval from the table whereindexes are not defined.

Duplicate/Unique Index:

Oracle allows the creation of two types of indexes. These are:

Indexes that allow duplicate values for the indexed columns i.e. Duplicate Index

Indexes that deny duplicate values for the indexed columns i.e. Unique Index

Creation of Index:

An index can be created on one or more columns. Based on the number of columns included in the index, an index can be:

simple Index Composite

Index **Creating Simple**

Index:

An index created on a single column of a table it is called Simple Index. The syntax for creating simple index that allows duplicate values is:

Syntax:

Create Index <Index Name> On <Table Name>(ColumnName);

Example:

Create a simple index on client_no column of the Client_master table

SQL>Create Index idx_client_no On Client_master (Client_no) ;

Index Created.

Creating Composite Index:

An index created on a more than one column it is called Composite Index. The syntax for creating a composite index that allows duplicate values is:

Syntax:

Create Index <Index Name> On <Table Name>(ColumnName, ColumnName);

Example:

Create a composite index on the sales_order tables on column order_no and product_no.

SQL>Create Index idx_sales_order On Sales_order (Order_no,product_no) ;

Index Created.

Note: The indexes in the above examples do not enforce uniqueness i.e. the columns included in the index can have duplicate values. To create unique index, the keyword

UNIQUE should be included in the Create

Index command.

Creation of Unique Index:

A unique index can also be created on one or more columns. If an index is created on a single column, it is called Simple Unique Index. The syntax for creating a simple unique index is:

Syntax:

Create Unique Index <Index Name> On <Table Name> (Column Name);

If an index is created on more than one column it is called Composite Unique Index. The syntax for creating a composite unique index is:

Syntax:

Create Unique Index <Index Name> On <Table Name> (ColumnName,ColumnName);

Example:

Create a unique index on client_no column of the client_master table.

SQL>Create Unique Index idx_client_no On Client_master (Client_no);

Index Created.

Note: When the user defines a primary key or a unique key constraint, the Oracle engine automatically

creates a unique index on the primary key or unique key column/s.

Dropping Indexes:

Indexes associated with the tables can be removed by using the DROP INDEX command.

Syntax:

Drop Index <Index Name>;

Example:

Remove index idx_client_no created for the table client_master.

SQL>Drop Index idx_client_no;

Index dropped.

Note: When a table, which has associated indexes (unique or non-unique) is dropped,

the Oracle engine automatically drops all the associated indexes as well.

Exp No: 12 **Date: _ _/_ _/ _ _**

Aim : Implementing Operations on relations using PL / SQL.

Basics of PL/SQL

About PL/SQL

PL/SQL is a Oracle's Procedural Language (PL) extension to Structured Query Language (SQL), that Oracle developed as an extension to standard SQL in order to provide a way to execute proce- dural logic on the database. PL/SQL provides a mechanism for developers to add a procedural component at the server level. It has been enhanced to the point where developers now have access to all the features of a full-featured procedural language at the server level. It also forms the basis for programming in Oracle's continually evolving set of client/server development tools, most nota- bly Developer/2000.

Use of PL/SQL

You can use PL/SQL to perform processing on the server rather than the client. You can use PL/SQL to encapsulate business rules and other complicated logic. It provides for modularity and ab- straction. Finally, it provides you with a level of platform independence. Oracle is implemented on many platforms, but PL/SQL is the same on all of them. It makes no difference whether you are running Personal Oracle on a laptop or Oracle 8 Server on Windows NT In a nutshell, With PL/SQL you have the power to make your applications more robust, more effi- cient, and most secure

Advantages of PL/SQL

PL/SQL is a block-structured language offered by Oracle to facilitate the use of the Oracle RDBMS.It has the following properties and features that can be used to aid in application development:PL/SQL is completely portable, high performance transaction processing, which offers the follow- ing advantages.

• Without PL/SQL, Oracle must process SQL statements one at a time. With PL/SQL, an entire block of statements can process in a single command line statement. This reduces the time taken to communicate the application and the Oracle server. PL/SQL blocks are portable to any operating system or platform.

• PL/SQL allows us to use of all SQL data manipulation commands, transactions control commands, SQL functions (except group functions), operators and pseudo columns.

• Any DDL Statements are not allowed in PL/SQL Block.

• PL/SQL supports all the SQL data types and as well as it has its own.

These features make PL/SQL a powerful SQL processing language. Using PL/SQL has several major advantages over using standard SQL statements (in addition to allowing the use of stored procedures and functions). Among these are ease of use, portability, and higher performance.

PL/SQL Block

PL/SQL code is grouped into structures called blocks. A Block contains three sections, as de- scribed below.

```
declare
 <declaration of variables, constants, function, procedure,
cursor etc.>;
begin
   <executable statement(s)>;
exception
   <exception handling>;
end;
/
```

Within a PL/SQL block, the first section is the Declaration section. Using Declaration section, you can define variables and cursors that the block will use. The declaration section starts with the keyword declare and ends when the Executable commands section starts. (as indicated by the keyword begin). The executable commands section is followed b y exception handling section; the **exception keyword signals the start of the exception**

handling section. The PL/SQL block is termi- nated by the end keyword.

In PL/SQL Block only the executable section is required, the declarative and exception handling sections are optional.

A Simple Block

Example

```
Begin
Insert  into  emp(empno,ename)  values(100,'Shruti');
Insert  into  emp(empno,ename)  values(101,'Yesha');
End;
/
```

/ forward slash executes the PL/SQL block.

When the PL/SQL block is executed it will inserted two rows in emp table.

dbms_output.put_line()

dbms_output.put_line() is used to displays the value of variable or any message on the next line of the console. You might wonder, that, though the block is successfully completed with dbms_output.put_line() it is not showing any output. For that we have to check out that the serveroutput is on or not? If not, write the following line on the SQL prompt, and execute the block again, now you get the output on the console.

```
SQL>Set Serveroutput On
```

R It is not necessary to write the above statement for the execution of each and every ***block. This statement is written only once per session***

You can omit line word from dbms_output.put_line().

dbms_output.put()is used to displays the value of variable or any message on the same line on the console.

Example

```
Begin
dbms_output.put_line('Starting of PL/SQL');
dbms_output.put_line('Welcome to')
dbms_output.put('AZURE');
End;
```

/

When the above PL/SQL block is executed, you will receive the following response from Oracle.

SQL> PL/SQL Procedure successfully completed.

Starting of PL/SQL

Welcome to AZURE

R before executing above block make sure that Serveroutput must be on.

Datatypes

PL/SQL datatypes can be classified into two types.

• Scalar datatypes

• Composite datatypes

All SQL data types like number, char, varchar2, raw, long raw, lob, date and ANSI Standard data type such as boolean, binary_integer and number are categorized as a scalar datatype.

Boolean

Boolean data types can be used to store the values TRUE, FALSE or NULL.

Binary_Integer

Binary_integer is used to store signed integers. The range of binary_integer value is 7 231 i.e. the range of binary_integer is –2147483647 to 21474483647

Number

It is same as SQL number data types. In addition to this it includes ANSI standard types which includes following datatypes

- ❖ Dec / Decimal
- ❖ Int / Integer
- ❖ Real

Identifiers

Identifiers are names, which the programmer used within the program. They can refer to one of the following.

• Variable

• Constant

Some data are predetermined before a block is used, and its value remains unchanged during the execution of block, these are constant. Other data may change or be assigned values, as the block executed is known as variable.

Variables

Communication with the database takes place via variables in the PL/SQL block. Variables are memory locations, which can store data values. As the program runs, the contents of variables can and do change. Information from the database can be assigned to a variable, or the contents of a variable can be inserted into the database. These variables are declared in the declarative sections of the block. Every variable has a specific t ype as well, which describes what kind of information can be stored in it.

Variables are declared in the declarative section of the block.

The general syntax for declaring a variable is

variable_name type [:= value/expression];

where variable_name is the name of the identifier, type is the any valid data type and value is the value of the variable.

For example, the following are the legal variable declarations:

salary number(5);

Declares variable called salary to store maximum 5-digit number.

Assigning values to a variable

We can assign a value to the variable using followings.

- Assignment operator (:=)
- Default keyword
- By fetching method

Declare variable name to store maximum 10 characters and assign AZURE value through assign- ment operator

name varchar2(10):='AZURE';

Declared variable called salary to store maximum 5-digit number and assign value 3999 to it using default keyword.

Salary number(5) default 3999;

Store an employee name in nm variable whose employee number is 2 using fetching method.

Select ename into nm from emp where empno = 2;

Constants

We can declare variable as a constant and use them in executable part. One cannot change the value of constant throughout the program.

variable_name CONSTANT type := value/expression;

where variable_name is the name of the identifier, type is the any valid data type and value is the value of the variable.

For example,

pi constant number(9,7):=3.1415926;

Here value of variable pi can't be change throughout the program execution.

Example

Insert value into dept table using variables.

```
Declare
    v_deptno number :=  10;
    v_dname varchar2(10) := 'sales';
    v_loc varchar2(10) := 'bombay';
Begin
    insert into dept values(v_deptno, v_dname, v_loc);
End;
/
```

Example

To get the area of the circle provided the radius is given.

```
Declare
  pi constant NUMBER(9,7) := 3.1415926;
  radius INTEGER(5);
area  NUMBER(13,2);
Begin
  radius := 3;
  area := pi * power(radius,2);
  dbms_output.put_line('Area of the circle is ',area);
```

End;

/

In the above example, Declaration section having constant identifier (the value of which can not be reinitialized) named pi, which stores a constant value 3.1415926 and another two variables of type Integer and Number respectively. In Executable Section, radius is initialize with value 3 and then area is initialize with the calculated result according to the mathematical formula for finding area of the Circle.

Example

To get the name and salary of specified employee.

Declare

nm varchar2(20);

sal number(9,2);

Begin

Select ename,salary into nm, sal from emp where empno=2;

dbms_output.put_line('Name : ' || nm);

dbms_output.put_line('Salary : ' || sal);

End;

/

In the above example we have use concatenation operator (||). Concatenation operator attaches two or more strings together.

'hello '||'world' gives you 'hello world' output.

Comments in PL/SQL Block

As we know from very beginning of programming, Comment improves readability and makes your program more understandable. The PL/SQL engine ignores them at the compilation and execution time.

There are two kinds of comments:

Single-line comments

It is starts with two dashes and continues until the end of the line.

Example

Begin — — declaration section is ignored

Insert into emp(ename, empno) values('Tejas',1234);

End;

/

Multiline comments

It is starts with /* delimiter and end with the */ delimiter. This is the same style of comments used in the C language.

Example

Begin /* declaration section and exception

section is also neglected*/

Insert into emp(ename, empno) values('Tanmay',1234);

End;

/

R One can utilize multiline comments in Single line.

Example

To get the name and salary of specified employee.

Declare

nm varchar2(20);

sal number(9,2);

Begin

/* Get employee name and Salary */

Select ename,salary into nm, sal from emp where empno=2;

/* Display Employee name and Salry */

dbms_output.put_line('Name   : ' || nm);

dbms_output.put_line('Salary : ' || sal);

End;

/

%type Attribute

In many cases, variable will be used to manipulate data stored in a database table. In such case, the variable should have the same type as the table column.

For example, the ename column of emp table has type varchar2(20). Based on this, we have to declare a variable as follows as discussed in above program.

nm varchar2(20);

This is fine, but what happens if the definition of ename column is changed? Say the table is altered and ename now has type varchar2(25). Any PL/SQL code that uses this column would have to be changed, as shown here: nm varchar2(25);

If you have a large amount of PL/SQL code based on ename column of emp table, this can be a time consuming and error prone process. Rather than hardcode the type of a variable in this way, you can use the %type attribute.

This attribute is used to declare a variable's data type as being equivalent to the specified column's datatype. So, you need not know the exact data type and size of a database column.

For example:

nm emp.ename%type;

By using %type, nm will have whatever t ype and size the ename column of the emp table has. If the database definition changes, the datatype in PL/SQL block is also changed according to changes made in database.

Example

To get the name and salary of specified employee using %type attribute.

```
Declare
nm emp.ename%type;
sal emp.salary%type;
Begin
Select ename,salary into nm, sal from emp where empno=2;
dbms_output.put_line('Name    : ' || nm);
dbms_output.put_line('Salary : ' || sal);
End;
/
```

%rowtype Attribute

%type attribute is used to declare a variable's data type as being equivalent to the

specified column's datatype , while %rowtype attribute is used to declare composite variable that is equivalent to a row in the specified table. The composite variable is consist of the column names and datatypes in the referenced table i.e. in the declaration of %rowtype attribute with variable, variable inherits column and its datatype information for all the columns of a table.

For example:

```
   erec emp%rowtype;
```

By using %rowtype, erec will have all the columns with it of emp table.

To, access value of the particular column is done as follows.

```
erec.ename;
```

Where, erec is a composite variable, while ename is a column of emp table.

Example

To get the name and salary of specified employee using %type attribute.

```
Declare
emprec emp%rowtype;
Begin
Select * into emprec from emp where empno=10;
dbms_output.put_line('Name    : ' || emprec.ename);
dbms_output.put_line('Salary : ' || emprec.salary);
End;
/
```

%rowtype attribute specially used with Cursor, which will be discussed later.

PL/SQL Control Structures

Control structure is the most important in PL/SQL to change the logical flow of statements within PL/SQL Block. PL/SQL has a variety of control structures that allow you to control the behavior of the block as it runs. These structures include conditional statements and iterative controls i.e. PL/SQL supports basic programming control structures.

- Sequence
- Selection / Condition
- Iteration

These structures combined with variables, gives PL/SQL its power and flexibility.

R dbms_standard package provides a language facility to interact with Oracle.

Selection Control

Within PL/SQL block, Selection control is used when the execution of a particular set of statement is based on a specific condition. Sequence of statements can be executed based on some condition using the if statement. There are various form of if statement.

If-then form

The simple form of the if statement is the if-then statement as follows.

```
IF <boolean_expression> THEN
statements;
END IF;
```

Where boolean_expression is any expression that evaluates to a Boolean value.

Example

Accept Number from a User and display Hello message if the entered number is Positive.

```
Declare
num number;
Begin
num := &num; if num > 0 then
dbms_output.put_line('Hello');
end if;
end;
/
```

Example

Display Salary of a specified employee increasing by 500 if its salary is more than 3000.

```
Declare
sal number(9,2);
num emp.empno%type;
Begin
num := &num;
```

```
Select salary into sal from emp where empno=num;
If sal > 3000 then
sal := sal + 500;
end if;
dbms_output.put_line('Salary : ' || sal);
End;
/
```

Above block will display salary of specific employee (as per entered employee number) by increas- ing 500 if its salary is greater than 3000 otherwise it will display salary as it is.

If-then-else form

So far we have discussed the simplest form of the if statement, which gives us a choice of executing a statement of block or skipping them. If-then-else form allows us to execute either or blocks depend on condition using if-then-else form as follows.

IF <boolean_expression> THEN

True block statements;

ELSE

False block statements;

END IF;

True block statements are executed only if the condition is satisfied otherwise the else portion will be executed.

Example

Accept number from a user and find out whether it is Odd or Even.

```
Declare
num number;
Begin
num := &num;
if mod(num,2) = 0 then
dbms_output.put_line(no,'is even');
else
dbms_output.put_line(no,'is  Odd');
```

```
end if;
End;
/
```

Example

Accept employee number from a user and increase its salary depends on the current salary as follows.

Salary Increment

>= 5000 12.5%;

<5000 11%

```
Declare
sal number(9,2);
num emp.empno%type;
pf number(9,2);
Begin
num := &num;
Select salary into sal from emp where empno=num;
If sal >= 5000 then
    update emp set salary = salary+(salary*0.125)where empno=num;
else
  update emp set salary = salary + (salary*0.11) where empno=num;
end if;
End;
/
```

If-then-elsif form

This form is used to select one of multiple alternatives.

IF <boolean_expression1> THEN

statements;

ELSIf <boolean_expression2> THEN

statements;

ELSIf <boolean_expression2> THEN

statements;

____

____

END IF;

Example

```
Declare
sal emp.sal%type;
eno emp.empno%t ype;
Begin
    Eno := &eno;
    Select salary into sal from emp where empno=eno;
    if sal > 10000  then
  dbms_output.put_line('Salary is more than 10000');
    elsif sal >= 7000 then
  dbms_output.put_line('salary is between 7000 to 10000');
    else
       dbms_output.put_line('Salary is less than 7000');
   end if;
End;
/
```

Iterative Control / Loops

PL/SQL provides a facility for executing statements repeatedly, via loops. In PL/SQL we have three loops as follows to execute statements repetitively.

• Simple loop

• While loop

• For loop

Simple loop

The most basic kind of loops, simple loop have this Syntax:

LOOP

Sequence_of_statements;

END LOOP;

Sequence_of_statements will be executed infinitely, since this loop has no stopping condition. We can exit this loop via EXIT statement. General form of exit statement is as follows.

EXIT [WHEN condition];

Example

```
Declare
I number(2):=0;
Begin
Loop
        dbms_output.put_line(I);
        I:=I+1;
        Exit when (I>10);
End loop;
End;
/
```

WHILE Loop

WHILE <condition>

LOOP

Sequence_of_statements;

END LOOP;

Before each iteration of the loop, condition is evaluated. If it evaluates to TRUE, *sequence_of_statements is executed. If condition evaluates to FALSE or NULL, the loop is fin-* ished and control resumes after the END LOOP statement.

The only difference between simple loop and while loop is simple execute first and then it will check condition, so simple loop execute at least once and in while loop first it will check condition and then execute.

Example

```
Declare
I number(2):=0;
Begin
While I > 50
loop
        dbms_output.put_line(i);
I:=I+5;
End Loop;
End;
/
```

FOR Loop

The number of iterations for simple loops and while loops is not known in advance; it depends on the condition. FOR loops, on the other hand, have a defined number of iterations.

```
FOR loop_counter IN [REVERSE] LowerBound..UpperBound
LOOP
      Sequence_of_statements;
End LOOP;
```

Where loop_counter is the implicitly declared index variable, lowerbound and upperbound specify the number of iterations, and sequence_of_Statements is the contents of the loop.

Example

```
Declare
   no number := 5;
Begin
   For I in 1..10 loop
 dbms_output.put_line(no||' * '||I||' = '||no*I);
   End loop;
End;
/
```

Reverse keyword

If the REVERSE keyword is present in the FOR loop, then the loop index will iterate from the high value to the low value. Notice that the syntax is the same; the low value is still referenced first.

Example

```
Begin
For I in REVERSE 1..5 LOOP
        dbms_output.put_line(I);
End LOOP;
End;
/
```

Goto Statment

The goto statement allows us to branch to a label unconditionally. The label, which is enclosed within double angular brackets, must precede an executable SQL or a PL/SQL block. When ex- ecuted, the goto statement transfers control to the labeled statement or a block.

Example

```
Declare
no number:=1;
Begin
While no<=10 loop
   dbms_output.put_line(no);
   no := no+1;
   If no = 5 then
            goto lbl;
        End if;
End loop;
<<lbl>>
dbms_output.put_line(‘Number Printing from lable ‘||no);
End;
```

/

In above example, when no is equal to 5 control transfer to label lbl and execute whatever men- tioned after label and stop execution of for loop.

Exception Handling

Exception

One of the features of PL/SQL is the exception handling mechanism. By using exceptions and exception handlers, you can make your PL/SQL programs robust and able to deal with both unex- pected and expected errors during execution. What kind of errors can occur in a PL/SQL program? Errors can be classified into run-time error and compile-time error.

Exceptions are designed for run-time error handling. Errors that occur during the compilation time are detected by PL/SQL engine and reported back to the user. The program cannot handle this, since this had yet to run. Exceptions and exception handlers are how the program responds to run- time errors. When an error occurs, an exception is raised. When this happens, control is passed to the exception handler, which is the separate section of the PL/SQL Block. This separates the error handling from the rest of the block, which makes the logic of the program easier to understand. In PL/SQL, the user can anticipate and trap for certain runtime errors. there are two types of exceptions:

- ❖ Predefined Exceptions
- ❖ User-defined Exceptions

R Exceptions can be internally defined by Oracle or by the user.

Pre-defined Exceptions

The Pre-defined exception is raised implicitly (automatically) when PL/SQL block or any of its statement violets Oracle rule. Those errors, which are frequently occur, are assign as a predefined exception by Oracle.

Then General form Exception Handling is :

Declare

...

Begin

...

Exception

When Exception_1 then

<Statement(s)>;

When Exception_2 then

<Statement(s)>;

...

End;

/

In this syntax, Exception_1 and Exception_2 are the names of the predefined exceptions.

State- *ments are the valid code that will be executed if the exception name is satisfied.*

The Oracle server defines several errors with standard names. Although every Oracle error has a number, the errors must be referenced by name. PL/SQL has predefined some common Oracle errors and exceptions. Some of these predefined exception names are ***Sr. Exception Description***

1 No_Data_Found SELECT returned no rows

2 Too_many_rows SELECT into statement returned more than one row.

3 Invalid_cursor This exception is raised when we violet cursor operation.

For example, when we try to close a cursor, which is not opened.

4 Value_error Arithmetic, Conversion, Truncation or Constraint Error occurred. i.e.

Attempt to insert a value with larger precision.

5 Invalid_Number Conversion of a character to a number is failed.

6 Zero_divide Attempted to divide by zero.

7 Dup_val_on_Index Attempted to insert a duplicate value into a column that has a unique index.

8 Cursor_already_open Attempted to open a cursor that was previously opened.

9 Not_logged_on A database call was made without being logged into Oracle.

10 Transaction_backed_out Usually raised when a remote portion of a transaction is rolled back

11 Login_denied Login to Oracle failed because of invalid username and password.

12 Program_error Raised if PL/SQL encounters an internal problem.

13 Storage_error Raised if PL/SQL runs out of memory or if memory is corrupted.

14 Timeout_on_resource Timeout occurred while Oracle was waiting for a resource.

15 Others This is a catchall. If the error was not trapped in the previous

exception traps, this statement will trap the error.

Oracle declares predefined exceptions globally in the package standard. Therefore, you do not need to declare them yourself.

Example

Write a PL/SQL Block to accept employee name from a user if it is exist display its salary otherwise display appropriate message using exception handling.

```
Declare
erec emp%rowtype;
nm emp.ename%type;
Begin
nm:=&nm;
SELECT * into erec from emp where ename=nm;
dbms_output.put_line(‘Employee Salary : ‘ || erec.salary);
Exception
When No_Data_Found then
dbms_output.put_line(‘Entred name is not found’);
When Others then
Null;
End;
/
```

Example

Write a PL/SQL Block to display the salary of that employee whose age is 45 year otherwise dis- play appropriate message using exception handling.

```
Declare
erec emp%rowtype;
yr number;
Begin
yr := &yr;
```

```
SELECT *into erec from emp Where round((SYSDATE-BDATE)/365),0)= 45;
dbms_output.put_line(‘Employee Salary : ‘ || erec.salary);
Exception
When No_Data_Found then
dbms_output.put_line(‘No Employee with 45 years age’);
When Too_many_rows then
dbms_output.put_line(‘More than one Employee with 45 years age’);
When Others then Null;
End;
/
```

Example

Write a PL/SQL Block to insert add one row in employee table with employee number and name.Display appropriate message using exception handling on duplication entry of employee number.

```
Declare
eno emp.empno%type;
nm  emp.ename%type;
Begin
eno := &eno;
nm := ‘&nm’;
insert into emp(empno,ename) values(eno,nm);
Exception
When Dup_val_on_index then
dbms_output.put_line(‘Employee Number already Exist’);
When Others then
Null;
End;
/
```

As you saw in the earlier examples of exception-handling blocks, the other exception was used as a catchall exception handler. Others is normally used when the exact nature of the exception isn't important, when the exception is unnamed, or even when it's unpredictable

User-Defined Exception

Unlike internal exceptions, user-defined exceptions should be explicitly specified. The user-defined exception must be declared in the declaration part of the PL/SQL Block and it can explicitly raised with the RAISE Statement. Declaration of user-defined cursor declares a name for user_defined error that the PL/SQL code block recognizes. The raise exceptions procedure should only be used when Oracle does not raise its own exception or when processing is undesirable or impossible to complete

Steps for trapping a user-defined error include the following:

1) Declare the name for the user-defined exception within the declaration section of the block.

2) Raise the exception explicitly within the executable portion of the block using the RAISE State- ment.

3) Reference the declared exception with an error-handling routine.

Example

```
Declare
    Invalid_Pay Exception;
    Pay Number := &Pay;
Begin
If Pay Not Between 2000 and 5000 Then
RAISE Invalid_Pay;
End If;
Exception
When Invalid_Pay Then
  dbms_Output.Put_Line('Salary should be between 2000 and 5000');
End;
/
```

Example

Accept employee number and salary from a user and store it into the table if salary is greater than zero otherwise display appropriate message using user-defined exception.

La

```
Declare
    sal emp.salary%t ype;
    eno emp.empno%type;
    sal_error exception;
Begin
    eno := &eno;
    sal :=  &sal;
    if sal=0  then
        raise sal_error;
    else
    update emp set salary = sal where empno=eno;
    end if;
Exception
    when sal_error then
        dbms_output.put_line(‘Salary must be >0’);
End; /
```

Exp No: 13 **Date: _ _/_ _/ _ _**

Aim : Writing triggers

Database Triggers:

Trigger defines an action the database should take when some database-related event occurs. Trig- gers may be used to supplement declarative referential integrity, to enforce complex business rules, or to audit changes to data. The code within a trigger, called a trigger body, is made up of PL/SQL blocks. It's like a stored procedure that is fired when an insert, update or delete command is issued against associated table.

The execution of triggers is transparent to the user. Triggers are executed by the database when specific types of data manipulation commands are performed on specific tables. Such commands may include insert, update, and delete. Updates of specific columns may also be used as triggering events.Because of their flexibility, triggers may supplement referential integrity; they should not be used toreplace it. When enforcing the business rules in an application, you should first rely on the declara- tive referential integrity available with Oracle; use triggers to enforce rules that cannot be coded through referential integrity.In other words, a trigger is a PL/SQL block that is associated with a table, stored in a database and executed in response to a specific data manipulation event. Triggers can be executed, or fired, in response to the following events:

- A row is inserted into a table
- A row in a table is updated
- A row in a table is deleted

R It is not possible to define a trigger to fire when a row is selected.

A database trigger has three parts namely a trigger statement, a trigger body and a trigger restric- Tion Trigger statement specifies the DML statements like insert , update, delete and it fires the trigger body. It also specifies the table to which the trigger associated.Trigger body is a PL/SQL bock that is executed when a triggering statement is issued.Restrictions on a trigger can be achieved using the WHEN clause as shown in the syntax for creat-ing triggers. They can be included in the definition of a row trigger, wherein, the condition in the WHEN clause is evaluated for each row that is effected by the trigger.A trigger is a database object, like a table or an index. When you define a trigger, it becomes a part of the database and is always executed when the event for which it is defined occurs. It doesn't matter if the event is triggered by someone typing in a SQL statement using SQL* Plus, running a Client/Server program that updates the database, or running a utility like Oracle's SQL Loader in order to bulk-load data. Because of this, triggers serves as a choke point, allowing you to perform critical data validation or computations in response to database changes, no matter what the source.

Types of Triggers

A trigger 's type is defined by the type of triggering transaction and by the level at which the trigger is executed. In the following sections, you will see descriptions of these classifications, along with relevant restrictions.

Row-Level Triggers

Row-level triggers execute once for each row in a transaction. Row-level triggers are the most common type of trigger; they are often used in data auditing applications. Row-level triggers are also useful for keeping distributed data in sync. Row-level triggers are created using the for each row clause in the create trigger command.

Statement-Level Triggers

Statement-level triggers execute once for each transaction. For example, if a single transaction inserted 500 rows into a table, then a statement-level trigger on that table would only be executed once. Statement-level triggers therefore are not often used for data-related activities; they are nor- mally used to enforce additional security measures on the types of transactions that may be per- formed on a table.Statement-level triggers are the default type of trigger created via the create trigger command.

BEFORE and AFTER Triggers

Because triggers are executed by events, they may be set to occur immediately before or after those events. Since the events that execute triggers include database transactions, trigger can be executed immediately before or after insert, update and delete. For database-level events, addi- tional restrictions apply; you cannot trigger an event to occur before a logon or startup takes place.

Within the trigger, you can reference the old and new values invoked by the transaction. The access required for the old and new data may determine which type of trigger you need.

徹 ld_ refers to the data, as it existed prior to the transaction; updates and deletes usually reference old values. **New_ values are the data values that the transaction creates (such** as the columns in an inserted record).

If you need to set a column value in an inserted row via your trigger, then you need to use a BE- FORE INSERT trigger to access the 渡 ew_ values. Using an AFTER INSERT trigger would not allow you to set the inserted value, since the row will already have been inserted into the table. AFTER row-level triggers are frequently used in auditing applications, since they do not fire until the row has been modified. The row's successful modification implies that it has passed the referen- tial integrity constraints defined for that table.Together with commonly used four types, it gives a total of 12 possible trigger types, which are listed in the following Table. Note that the SELECT statement is the only data manipulation state-ment for which no triggers can be defined.

• Before update row
• Before update statement
• Before insert row
• Before insert statement
• Before delete row
• Before delete statement
• After update row
• After update statement
• After insert row
• After insert statement

• After delete row

• After delete statement

Also note that one trigger can be defined to fire for more than one SQL statement.

INSTEAD OF Triggers

You can use INSTEAD OF triggers to tell Oracle what to do instead of performing the actions that invoked the trigger. For example, you could use an INSTEAD OF trigger on a view to redirect inserts into table or to update multiple tables that are part of a view. You can use INSTEAD OF triggers on either object views or relational views. For example, if a view involves a join of two tables, your ability to use the update command on records in the view is limited. However, if you use an INSTEAD OF trigger, you can tell Oracle how to update, delete, or insert records in the view's underlying tables when a user attempts to change values via the view. The code in the INSTEAD OF trigger is executed in place of the update, delete,or insert command you enter.

Uses of Triggers

The possible uses for database triggers are varied and are limited only by your imagination.

Some common uses are listed below:• Enforcing business rules

• Maintaining referential integrity

• Enforcing security

• Maintaining a historical log of changes

• Generating column values, including primary key values

• Replicating data

Syntax:

Create [or replace] trigger [user.]trigger_name{ before | after | instead of }

{ **delete | insert | update [of column [, column]** · **}**

on [user.]{ Table | View }

for each { row | statement }

[when (condition)]

PL/SQL Block

Clearly, there is a great deal of flexibility in the design of a trigger. The before and after keywords indicate whether the trigger should be executed before or after the triggering transaction. If the instead of clause is used, the trigger's code will be executed instead of **the** event that caused the trigger to be invoked. The delete, insert, and update keywords (the last of which may include a column list) indicate the type of data manipulation that will constitute a trigger event. When the for each row clause is used, the trigger will be a row-level trigger; otherwise, it will be a statement-level trigger. The when clause is used to further restrict when the trigger is executed. The restrictions enforced in the when clause may include checks of old and new data values. For example, suppose we want to monitor any adjustments to Salary column value that are greater than 10 percent. The following row-level BEFORE UPDATE trigger will be executed only if the new value of the salary column is more than 10 percent greater than its old value and add transac- tion details in audit table. This example also illustrates the use of the new keyword, which refers to the new value of the column, and the old keyword, which refers to the original value of the column.

Example

```
Create or replace trigger emp_salary_update_row
before update on emp
for each row
when (:New.Amount / :Old.Amount > 1.1)
usr varchar2(20);
Begin
Select user into usr from dual;
Insert into EMP_AUDIT values (:Old.salary, :New.salary, :Old.eno,
usr, to_char(sysdate,'HH:MI'),sysdate);
Commit;
End;
/
```

Trigger created.

Breaking the above created trigger command makes it easier to understand. Let's do it:

Create or replace trigger emp_salary_update_row the emp_salary_update_row is the trigger name, which indicates table name and it acts upon and the type of trigger. One can define trigger with any valid name. before update on emp above statement indicates that this trigger applies to the Emp table and it will executed before update transactions have been committed to the database. for each row Because of above statement, the trigger will apply to each row in the transaction. If this clause is not used, then the trigger will execute at the statement level. The When clause adds further criteria to the triggering condition. The triggering event not only must be an update of the Ledger table, but also must reflect an increase of over 10 percent in the value of the Amount column when (New.Amount / Old.Amount > 1.1)

The PL/SQL code shown in the following listing is the trigger body. The commands shown here are to be executed for every update of the emp table that passes the when condition. For this to suc- ceed, the EMP_AUDIT table must exist, and the owner must have been granted privileges on that table. This example inserts the old values from the emp record into EMP_AUDIT table before the employee record is updated in emp table. Structure of EMP_AUDIT table is as per follows.

EMP_AUDIT eno

number(5) old_salary

number(9,2) new_salary

number(9,2) user

varchar2(20) tr_time

varchar2(10) tr_date

date

```
Begin
Select user into usr from dual;
Insert into EMP_AUDIT values (:Old.eno, :Old.salary,
 :New.salary, usr, to_char(sysdate,'HH:MI'),sysdate);
commit;
End;
/
```

Above trigger makes the log of the emp table in the EMP_AUDIT table and maintains the track of updation in the table, the user name, Transaction Date, Transaction Time, All the old and new values of columns.R When referencing the New and Old keywords in the PL/SQL block, they are preceded by the colons(:)

Using :Old and :New Values in Row Level Triggers

When Row level trigger fires once per row processed by the triggering statement. Inside the trigger, you can access the row that is currently being processed. This is done through keywords :new and :old. Following describes what values are set to :Old and :New with the given triggering statement.

Triggering Statement

INSERT

: Old Undefined – all fields are NULL

: New Values that will be inserted when the statement is complete

UPDATE

: Old Original values for the row before the update

: New New values that will be updated when the statement is complete

DELETE

: Old Original values before the row is deleted

: New Undefined – all fields are NULL

They are valid only within row level triggers and not in statement level triggers. :Old values are not available if the triggering statement is INSERT and :new values are not available if the triggering statement is DELETE. Each column is referenced by using the expression :Old.ColumnName or :New.ColumnName. if a column is not updated by the triggering update statement then :old and :new values remain the same.

An Example of a Trigger with :New

Suppose for a moment that you wanted to be sure that all department names were stored using uppercase letters. Perhaps you are doing this to facilitate searching on that field.

Following example

shows one way to do this with a trigger.

Example

Create or replace trigger upperdname before insert or update on

dept for each row

Begin

:new.dname := upper(:new.dname);

End;

/

Trigger created.

Example

Following trigger does not allow the user to delete any row from a Try table.

Create Or Replace Trigger delete_rest_trig Before Delete On Try

Begin

Raise_Application_Error(-20011,’UNABLE TO DELETE’);

End;

/

In the above example, a new Term is used i.e. Raise_Application_Error()

Let’s discuss it in details:

Customizing Error Conditions

Oracle provides a procedure named raise_application_error that allows programmers to issue user- defined error messages.

Syntax :

Raise_Application_Error(Error_number, Message);

Where Error_number is a negative integer in the range –20000 to –20999. and Message Is a string up to 2048 bytes in length An application can call 迭 aise_Application_Error_ only from an executing stored subprogram like stored procedures and functions, database triggers. Typically 迭 aise_Application_Error_ is used in database triggers. 迭

aise_Application_Error_ ends the subprogram, rolls back any database changes it made, and returns a user-defined error number and message to the application Within a single trigger, you may establish different error conditions. For each of the error conditions you define, you may select an error message that appears when the error occurs. The error num bers and messages that are displayed to the user are set via the Raise_Application_Error proce - dure, which may be called from within any trigger. Following example shows a statement-level BEFORE UPDATE or INSERT trigger on the Emptable. When a user attempts to Insert, modify or delete a row in the Emp table, this trigger is executed and checks two system conditions; that the day of the week is neither Saturday nor Sun-day, and that the Oracle username is other than user 'ADMIN'.

Example

```
Create or replace trigger emp_rest before insert or update or delete on Emp
Declare
    Weekend_Error Exception;
    Invalid_User Exception;
Begin
    If to_char(SysDate, 'DY') in ('sat','sun') then
        Raise Weekend_Error;
    End if;
    If upper(User) != 'ADMIN' then
        Raise Invalid_User;
    End if;
Exception
When Weekend_Error then Raise_Application_Error(-20001,'No Insertion or
Updation on Weekends');
When Invalid_User then
Raise_Application_Error(-20002,'Insertion, Updation or
deletion only allowed to Admin Users');
End;
/
Trigger created.
```

Study following code and find out use of following Trigger

```
Create or replace trigger check_date_time before insert or update
or delete on dept
```

```
Begin
If to_number(to_char(sysdate,’hh24'))>not in(10,18) or
to_char(sysdate, ‘dy’) not in (‘sun’, ‘sat’) then
raise_application_error(-20001,’no manipulations allowed in
table in non-office working hours’);
End if;
End;
```

Firing Triggers selectively using Trigger Predicates Problem

We have a lot of tables in the database. Instead of writing three different triggers for INSERT, UPDATE, and DELETE operations, we want to write one trigger for each table in the system, and that trigger should handle any DML operations on that table individually. We need to know how to create such triggers and in the trigger body how to recognize the type of DML operation that caused the trigger to fire. How to fire triggers selectively using trigger predicates?

Solution

You can write a single trigger to handle multiple DML operations on a table. For instance, an INSERT,DELETE or UPDATE statement can fire the same trigger with the user of the ON IN- SERT OR DELETE OR UPDATE OF clause while creating the trigger. The trigger body can use the conditional predicates INSERTING,DELETING, AND UPDATING to execute specific blocks of code, depending upon the triggering statement.

Example

```
Create or replace trigger find_tran before insert or update or
delete on dept for each row
Begin
If Inserting then
   raise_application_error(-20001,’Insertion Restricted’);
elsif updating then
   raise_application_error(-20002,’Updation Restricted’);
elsif deleting then
   raise_application_error(-20003,’Deletion Restricted’);
```

```
end if;

End;

/
```

Examples:

Create of insert trigger, delete trigger and update trigger.

1. To write a TRIGGER to ensure that Bus table does not contain duplicate of null values in Bus_No column.

```
a)   CREATE OR RELPLACE TRIGGER trig1 before insert on Bus for each row

DECLARE a number;

BEGIN

        if(:new.Bus_No is Null) then

                raise_application_error(-20001,'error:: Bus_No cannot be null');

                else

                select count(*) into a from Bus where Bus_No =:new. Bus_No;

                if(a=1) then

                    raise_application_error(-20002,'error:: cannot have duplicate Bus_No ');

                end if;

        end if;

END;
```

RESULT:

```
SQL> @trigger

Trigger created.

SQL> select * from Bus;

BUS_NO      SOURCE              DESTINATION

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

110                  hyd            ban

221                  hyd            chn

412                  hyd            mum

501                  hyd            kol

SQL> insert into Bus values(&Bus_No,'&source','&destination');
```

```
Enter value for Bus_No: null
Enter value for source: Chen
Enter value for destination: hyd
old 1: insert into Bus values(&Bus_No, '&source', '&destination')
new 1: insert into Bus values(null,Chen','hyd')
insert into Bus values(null,’Chen','hyd')
*
ERROR at line 1:
ORA-20001: error::Bus_No cannot be null
35
ORA-06512: at "SYSTEM.TRIG1", line 5
ORA-04088: error during execution of trigger 'SYSTEM.TRIG1'
SQL> /
Enter value for Bus_No: 110
Enter value for source:KOL
Enter value for destination: hyd
old 1: insert into Bus values(&Bus_No, '&source', '&destination')
new 1: insert into Bus values(110,KOL','hyd')
insert into Bus values(110,’KOL','hyd')
*
ERROR at line 1:
ORA-20002: error:: cannot have duplicate Bus_No
ORA-06512: at "SYSTEM.TRIG1", line 9
ORA-04088: error during execution of trigger 'SYSTEM.TRIG1'
```

b) Create Trigger updchek before update on Ticket

```
For Each Row
Begin
    If New.Ticket_No>60 Then
        Set New.Ticket_No=Ticket_No;
    Else
          Set New.Ticket_No=0;
        End If
End.
SQL> @trigger
Trigger created.
```

c) CREATE OR RELPLACE TRIGGER trig1 before insert on Passenger for each row

```
DECLARE a number;
BEGIN
        if(:new.PNR_NO is Null) then
                raise_application_error(-20001,'error:: PNR_NO cannot be null');
                else
                select count(*) into a from Passenger where PNR_NO =:new. PNR_NO;
                if(a=1) then
                    raise_application_error(-20002,'error:: cannot have duplicate PNR_NO ');
                end if;
        end if;
END;
SQL> @trigger
Trigger created.
```

Exp No: 14 **Date: _ _/_ _/ _ _**

AIM : Implement Cursors:

Cursors:

In SQL when you submit a query, it returns number of rows depends on query. It may be zero or may be hundreds. While in PL/SQL if your select statement returns multiple rows then oracle must return Too_many_rows error message (Exception). In Such circumstances it is necessary to manipulate multiple rows through PL/SQL Block without raising Exception. The resource that Oracle provides to accomplish this job is the Cursor. PL/SQL cursors provide a way for your program to select multiple rows of data from the database and then to process each row individually. Specifically, a cursor is a name assigned b y Oracle to every SQL statement processed. This is done in order to provide Oracle a means to direct and control all phases of the SQL processing

Two kinds of cursor are used by Oracle: Implicit and Explicit. PL/SQL implicitly declares a cursor for every SQL statement. Implicit cursors are declared by Oracle for each UPDATE, DELETE, and INSERT SQL command. Explicit cursors are declared and used by the user to process multiple rows returned by a SELECT statement. Explicitly defined cursors are constructs that enable the user to name an area of memory to hold a specific statement for access at a later time.

Explicit Cursor

User define cursor are known as Explicit cursor. Explicit cursor is one in which the cursor explicitly assigned to the select statement. Processing of explicit cursor involves four steps.

1) Declare the cursor

2) Open the cursor

3) Fetch data from cursor

4) Close the cursor

Declaring the cursor

The first step is to declare cursor in order for PL/SQL to reference the returned data. This must be done in the declaration portion of your PL/SQL block. Declaring a cursor accomplishes two goals:

- It names the cursor
- It associates a query with a cursor

The name you assign to a cursor is an undeclared identifier, not a PL/SQL variable. You cannot assign values to a cursor name or use it in an expression. This name is used in the PL/SQL block to reference the cursor query.

Cursor <cursor_name> is <select statement>;

Where, cursor_name is the name you assign to the cursor. SELECT statement is the query that returns row to the cursor active set. In the following example, the cursor named cur_emp is defined with a SELECT statement that queries the employee table.

cursor cur_emp is select * from emp where ename like 'A%';

The only constraint that can limit the number of cursors is the availability of memory to manage the cursors.

Opening the Cursor

Opening the cursor activates the query and identifies the active set. When the OPEN command is executed, the cursor identifies only the rows that satisfy the query used with cursor definition. The rows are not actually retrieved until the cursor fetch is issued. OPEN also initializes the cursor pointer to just before the first row of the active set. S yntax to opening a cursor is :

Open <cursor_name>;

In this syntax, cursor_name is the name of the cursor that you have previously defined.

R After a cursor is opened, until the moment you close it, all fetched data in the active set will remain static This means that the cursor will ignore all SQL DML commands (INSERT, UPDATE, DELETE and SELECT) performed on that data after the cursor was opened. Hence, you should open the cursor only when you need it.

Fetching Data from the Cursor

Getting data form the Activ Set is accomplished with FETCH command. The FETCH command retrieves the rows from the active set one row at a time. The FETCH command is usually used in conjunction with some type of iterative process. The first FETCH statement sorts the active set as necessary. In the iterative process, the cursor advances to the next row in the active set each time the FETCH command is executed. The FETCH command is the only means to navigate through the active set. Syntax for Fetching Data from the Cursor is :

Fetch <cursor_name> into <record_list>;

In this syntax, cursor_name is the name of the previously defined cursor from which you are now retrieving rows-one at a time. record_list is a list of variables that will receive the columns from the active set. The FETCH command places the results of the active set into these variables. The record_list or Variable list is the structure that receives the data of fetched row. For each column value retrieved by the cursors' query must have corresponding variable in the INTO list. Additionally, their datatypes must be compatible.

If you want to revisit a previously fetched row, you must close and reopen the cursor and then fetch each row in turn. If you want to change the active set, you must assign new values to the input variables in the cursor query and reopen the cursor. This re-creates the active set with the results of the revised query statement.

Closing the Cursor

The CLOSE statement closes or deactivates the previously opened cursor and makes the active set undefined. Oracle will implicitly close a cursor when the user's program or session is termi- nated. After closing the cursor, you cannot perform any operation on it or you will receive and invalid_cursor exception. Syntax for closing a cursor:

Close <cursor_name>;

where, cursor_name is the name of the previously opened cursor

Example

Declare

```
cursor cur_emp is select ename,Salary from emp;
nm emp.ename%type;
sal emp.salary%type;
Begin
open cur_emp;
fetch cur_emp into nm,sal;
dbms_output.put_line(‘Name    : ‘ || nm);
dbms_output.put_line(‘Salary : ‘ || sal);
close cur_emp;
End;
/
```

Above cursor will store all the records of emp table into active set but display only first employee details. Because no iterative control is used with fetch statement.

To display all the employee details you should aware little about Cursor Attribute.

Explicit Cursor Attributes

Each cursor, whether it is explicitly or implicitly defined, carries with it attributes that provide useful data of the cursor. The four cursor attributes are %isopen, %rowcount, %found and %notfound. These attributes can be used in any PL/SQL statement. Cursor attributes cannot be used against closed cursors, an invalid_cursor exception will be raised if you attempt this.

The %isopen Attribute

The %isopen attribute indicates whether the cursor is open. If the named cursor is open, then this attribute equates to true; otherwise, it will be false. The following example uses the %isopen at- tribute to open a cursor if it is not already open:

Example

```
Declare
cursor c1 is select * from emp;
Begin
open c1;
if c1%isopen then
```

```
        dbms_output.put_line('cursor already open');
else
        open c1;
end if;
close c1;
End;
/
```

The %notfound Attribute

The %notfound attribute is useful in telling you whether a cursor has any rows left in it to be fetched. The %notfound Attribute equates to true when last fetch statement return no row (there are no more rows remaining in Active Set), while it equates to false if last fetch statement retuns row. Prior to the first fetch, this attribute will equate to null. An error will be returned if you evalu- ate %notfound on a cursor that is not opened.

Following example illustrates use of %notfound attribute.

Example

```
Declare
cursor cur_emp is select * from emp where ename like 'A%';
emp_rec emp%rowtype;
Begin
open cur_emp;
loop
fetch cur_emp into emp_rec; exit when
cur_emp%notfound; dbms_output.put_line('Name :
' || emp_rec.ename); dbms_output.put_line('Age : '
|| round((sysdate- emp_rec.bdate)/30, 0);
end loop;
close cur_emp;
End;
/
```

Above PL/SQL block of cursor will store all the records of employee into active set whose name start with A and display their name with the age.

The %found Attribute:

The %found attribute equates to true if the last FETCH statement returns row. Therefore, the %found attribute is a logical opposite of the %notfound attribute. The %found attribute equates to false when no rows are fetched. Like the %notfound, this attribute also equates to null prior to the first fetch.

The following example illustrates practical use of %found attribute

Example

```
Declare
cursor cur_emp is select ename,salary from emp;
nm emp.ename%type;
sal emp.salary%type;
Begin
open cur_emp;
loop
fetch cur_emp into nm,sal; if
cur_emp%found then
dbms_output.put_line('Name    : '|| nm);
dbms_output.put_line('Salary : '|| sal);
else
 exit; end
if; end
loop;
close cur_emp;
End;
/
```

The %rowCount Attribute:

The %rowCount attribute returns the number of rows fetched so far for the cursor. Prior to the first fetch, %rowcount is zero. There are many practical applications of the %rowcount attribute. The following example will perform a commit after the first 250 employees' salaries are processed.

Example

```
Declare
cursor c1 is select * from emp where salary > 4000;
emp_rec emp%rowtype;
Begin
open c1;
loop
fetch c1 into emp_rec;
exit when c1%rowcount > 5;
dbms_output.put_line(emp_rec.ename);
end loop;
close c1;
End;
/
```

Above PL/SQL block of cursor will display only first five records whose salary is greater than 4000.

Automated Explicit Cursors (Cursor For Loop)

The previous section illustrated the basic mechanism of declaring and using cursors. In many pro- gramming situations, there is more than one way to code your logic. This also applies to PL/SQL cursors; there are opportunities to streamline or simplify the coding and usage of them. An alternate way to open, fetch and close the cursor Oracle furnishes another approach to place the cursor within a FOR Loop. This is known as a CURSOR FOR loop. A CURSOR FOR loop will implicitly.

- Declare the Loop Index
- Open the Cursor
- Fetch the next row from the cursor for each loop iteration
- Close the cursor when all rows are processed or when the loop exits

The Syntax for cursor for loop :

For <record_list> in <cursor_name>

Loop

Statements;

End loop;

CURSOR FOR loops are ideal when you want all the records returned by the cursor. With CUR- SOR FOR loops, you should not declare the record that controls the loop.

Example

```
Declare
cursor emp_cursor is select * from emp where deptno in (10,30);
emp_rec emp%rowtype;
Begin
for emp_rec in emp_cursor
loop
 update emp set salary = salary + (salary * 0.10) where
empno = emp_rec.empno;
end loop;
End;
/
```

Aim: To write a Cursor to display the list of Male and Female Passengers.

Analyst.

```
DECLARE
cursor c(jb varchar2) is select Name from Passenger where Sex=m;
pr Passenger.Sex%type;
BEGIN
open c('m');
dbms_RESULT.put_line(' Name of Male Passenger are:');
loop
fetch c into pr;
exit when c%notfound;
```

```
dbms_RESULT.put_line(pr);
end loop;
close c;
open c('f');
dbms_RESULT.put_line(' Name of female Passengers are:');
loop
fetch c into em;
exit when c%notfound;
dbms_RESULT.put_line(em);
end loop;
close c;
END;
```

RESULT:

```
Name of Male Passenger are:
SACHIN
rahul
rafi
salim
riyaz
Name of female Passengers are:
swetha
neha
PL/SQL procedure successfully completed.
```

b) To write a Cursor to display List of Passengers from Passenger Table.

```
DECLARE
cursor c is select PNR_NO, Name, Age, Sex from Passenger  ;
i Passenger.PNR_NO%type;
j Passenger.Name%type;
k Passenger.Age%type;
```

```
l Passenger.Sex%type;
BEGIN
open c;
dbms_RESULT.put_line('PNR_NO, Name, Age, Sex of Passengers are:= ');
loop
fetch c into  i, j, k, l;
exit when c%notfound;
dbms_RESULT.put_line(i||' '||j||' '||k||' '||l);
end loop;
close c;
END;
```

RESULT:

```
SQL>@Passenger
        PNR_NO       NAME                    AGE SEX
     ----------       -------------------- ---------- ----------
            1            SACHIN                12      m
            2            rahul                 43      m
            3            swetha                24       f
            4            rafi                  22      m
PL/SQL procedure successfully completed.
```

Exp No: 15 **Date: _ _/_ _/ _ _**

AIM : Implement SubPrograms in PL/SQL.

SUBPROGRAMS:

So, far we have seen PL/SQL Block (Anonymous Block) which are executed by interactively enter- ing the block at the SQL prompt or by writing the PL/SQL statements in a user_named file and executing the block at SQL prompt using @ command. The block needed to compile at every time it is run and only the user who created the block can use the block. Any PL/SQL block consists of some hundreds statements, in such cases it is necessary to break the entire block into smaller modules depending on your requirements. So, your block became more easy to understand and efficient to perform operation and maintenance. Stored procedures / Sub- programs are such kind of named PL/SQL Block. Basically it is Sophisticated Business rules and application logic.

Stored subprogram are compiled at time of creation and stored in the database itself. The source code is also stored in the database. Any user with necessary privileges can use the stored subpro- gram.

Procedures and Functions are subprograms having group of SQL, PL/SQL and Java–enables

Statements you to move code that enforce the business rules from your application to database. It takes a set of parameters given to them by the calling program and perform a set of actions. The only real difference between a procedure and a function is that a function will include a single return value. Both functions and procedures can modify and return data passed to them as a param- eter.

A procedure or function that has been stored in the library cache is referred to as a stored proce- dure or a stored function. A stored procedure or stored function has the following characteristics:

• It has a name: This is the name by which the stored procedure or function is called and referenced.

• It takes parameters: These are the values sent to the stored procedure or function from the application.

• It returns values: A stored procedure or function can return one or more values based on the purpose of the procedure or function.

Procedures

A procedure is a one kind of subprogram, which is designed and created to perform a specific operation on data in your database. A procedure takes zero or more input parameters and returns **125** zero or more output parameters.

The syntax of a creation of procedure is as follows:

Syntax:

```
CREATE OR REPLACE PROCEDURE procedure_name
[(argument1 [IN/OUT/IN OUT] datatype,
argument2 [IN/OUT/IN OUT] datatype,_)] IS
[<local variable declarations>]

BEGIN
Executable Statements
[EXCEPTION
   Optional Exception Handler(s)
]
END;
```

The procedure is made up of two parts: the declaration and the body of the procedure. The declara- tion begins with the keyword PROCEDURE and ends with the last parameter declaration. The body begins with the keyword IS and ends with the keyword END. The procedure body is further divided into three parts : declarative, executable and exception part same as PL/SQL blcok. The declaration section is used to assign name and define parameter list, which variables are passed to the procedure and which values are returned from the procedure back to the calling program.

Parameters can be define in following format

Argument [parameter mode] datatype

There are three types of parameters mode: IN, OUT and IN OUT

IN Mode

• Default parameter mode.

• Used to pass values to the procedure.

• Formal parameter can be a constant, literal, initialized variable or expression.

• Used for reading purpose

OUT Mode

• Used to return values to the caller.

• Formal parameter cannot be used in an expression, but should be assigned a value.

• Used for writing purpose

126 OUT Mode

• Used to pass values to the procedure as well as return values to the caller

• Formal parameter acts like an initialized variable and should be assigned a value.

• Used for both reading and writing purpose

R In a procedure declaration, it is illegal to constrain char and varchar parameter with

length and number parameter with precision and scale.

The body of the procedure is where the real work is done. The body is made up of the

PL/SQL statements that perform the desired task.

The EXCEPTION Section

In both procedures and functions, you can add optional exception handlers. These exception han- dlers allow you to return additional information based on certain conditions (such as no data found or some user-specified condition). By using exception handlers and allowing the stored procedure to notify you of some special conditions, you can minimize the amount of return-value checking that must be done in the application code. Because the work to determine that no data has been selected has already been done b y the RDBMS engine, you can save on resources if you take advantage of this information.

Example

Create a procedure, which receives a number and display whether it is odd or even.

```
Create or replace procedure oddeven (num in number) is
a number(3);
Begin
    a := mod(num,2);
    If a = 0 then
    dbms_output.put_line( num ||' is even number');
    Else
    dbms_output.put_line( num ||' is odd number');
    End if;
End;
/
Procedure created.
```

127

Execution of procedure

Procedure is executed from a SQL prompt as per follows and One can execute procedure from caller program also.

SQL > execute/exec procedure_name(parameter list)

For example above created procedure is executed as follows

```
SQL> Exec example1(7)
7 is odd number
```

Example

Make a procedure, which will accept a number and return it's Square.

```
Create or replace procedure square_no(num in number,ans out number)
Is
Begin
```

```
    ans:=num*num;
End;
/
Procedure created.
```

To execute above procedure we make one block, which is known as a Caller Block

```
Declare
ret number(10);
no number(5) := &no;
Begin
square_no (no, ret);
dbms_output.put_line('Square of '||no||' is : '|| ret);
End;
/
```

Output

```
Enter value for no: 10
old 3: no number(5) := &no;
new 3: no number(5) := 10;
Square of 10 is : 100
```

128

Procedures Related to Table

Example

Pass employee no and name and store into employee table.

```
Create or replace procedure emp_add (eno emp.empno%type, enm
emp.ename%type)
Is
Begin
Insert into emp(empno,ename) values(eno,enm);
Exception
When Dup_val_on_index then
dbms_output.put_line('Employee Number already Exist');
```

```
End;
/
```

To run above procedure

```
SQL> exec emp_add(1013,'DAXESH');
```

Example

Create a Procedure, which receives employee number and display employee name, Designation and salary.

```
Create or replace procedure empdata(eno in number)
Is
 enm varchar2(20);
jb  varchar2(20);
sal number(10,2);
Begin
Select ename, job, salary into enm, jb, sal from emp where
empno= eno;
dbms_output.put_line('employee  name        : '|| enm);
dbms_output.put_line('employee designation: '|| jb);
dbms_output.put_line('employee  salary      : '|| sal);
End;
/
Procedure created.
```

Output

```
SQL>exec empdata(1051)
129 employee name        : RISHI
employee designation: ANALYST
employee salary      : 5000
```

Example

Write a PL/SQL block, which will use a user-defined procedure, which accept employee number and return employee name and department name in a out parameter.

```
Create or replace procedure emp_data(eno number, enm out varchar2, dnm out varchar2)
```

```
Is
Begin
select ename, dname into enm, dnm from emp, dept where emp.deptno
= dept.deptno and empno = eno;
End;
/
Procedure created
```

Block To execute procedure

```
Declare
employee varchar2(30);
department varchar2(20);
eno number(4);
Begin
eno :=&employeenumber; emp_data(eno, employee,
department); dbms_output.put_line(‘Employee Number
‘||eno); dbms_output.put_line(‘Employee Name ‘||emplo
yee); dbms_output.put_line(‘Department Name
‘||department); End;
/
```

Output

```
Enter value for employeenumber: 1011
old 6: eno :=&EmployeeNumber;
new 6: eno :=1011;
Employee Number 1011
Employee Name TEJAS
Department Name RESEARCH
```

130

Example

Create a procedure, which receives department number and get total Salary of that

Department.

```
Create or replace procedure dept_total(dno in numbe, total out  number)
Is
Begin
Select sum(salary) into total from emp where deptno= dno;
dbms_output.put_line('Total salary of Department '|| dno  ||
' is ' || total);
End;
/
Procedure created.
```

Block To execute procedure

```
Declare
dn number(5) := &no;
tot number; Begin
dept_total(dn,tot);
End;
/
```

Output

```
Enter value for dn: 10
old 2: dn number(5) := &dn;
new 2: dn number(5) := 10;
Total salary of Department 10 is 235300
```

Example

Write procedure to accept Department number and display Name, Designation and Age of each employee belonging to such Department.

```
Create or replace procedure dept_list(dno number)
Is
 cursor c1 is select * from emp where deptno = dno;
erec emp%rowtype;
```

```
Begin
For erec in c1
loop
131dbms_output.put_line('Emp. Name : ' || erec.ename);
dbms_output.put_line('Designation : '|| erec.desg);
dbms_output.put_line('Age : '|| round((sysdate-erec.bdate)/
    365,0);
dbms_output.put_line('=============================');
End loop;
End;
/
Procedure created.
```

Output

```
SQL>exec dept_list(20);
Emp. Name : AANSHI
Designation : ANALYST
Age : 21
========================
Emp. Name : TEJAS
Designation : MANAGER
Age : 27
========================
Emp. Name : DAXESH
Designation : MANAGER
Age : 24
========================
```

Example

Create a procedure, which will accept Deptno and Display no of employee under different grade.

```
Create or replace procedure empcount(dno in number)
```

```
Is
Cursor c1 is select grade, count(*) from emp where deptno = dno group by grade;
grd varchar2(3);
noofemp number(3);
Begin
Open c1;
dbms_output.put_line('Grade    '||'No of employee');
  Loop
 Fetch c1 into vgrade,  noofemp;
```

132 Exit when c1%notfound;

```
dbms_output.put_line(grd||'        '||noofemp);
End loop;
  Close c1;
End;
/
Procedure created.
```

Output

```
SQL>exec empcount(30);
Grade  No of employee
A1
B2
C2
D1
```

Exp No: 16 **Date: _ _/_ _/ _ _**

AIM : Implement Functions of PL/SQL.

Functions:

A function, like a procedure, is a set of PL/SQL statements that form a subprogram. The subpro- gram is designed and created to perform a specific operation on data. A function takes zero or more input parameters and returns just one output value. If more than one output value is required, a procedure should be used. The syntax of a function is as follows:

Syntax

```
CREATE OR REPLACE Function function_name
[(argument1 [IN/OUT/IN OUT] datatype,
  argument2 [IN/OUT/IN OUT] datatype,_)] RETURN datatype IS
[<local variable declarations>]
BEGIN
PL/SQL Statements
[EXCEPTION
Optional Exception Handler(s)]
END [function_name];
/
```

As with a procedure, a function is made up of two parts: the declaration and the body. The declara- tion begins with the keyword Function and ends with RETURN statement. The body begins with the keyword IS and ends with the keyword END.

The difference between a procedure and a function is the return value. A function has the return declaration as well as a RETURN function within the body of that function that returns a value. This RETURN function is used to pass a return value to the calling program.

133

R If you do not intend to return a value to the calling program, or you want to return more than one value, use a procedure.

How Procedures and Functions Operate

Procedures and functions use the same basic syntax in the program body with the exception of the RETURN keyword, which can only be used by functions. The body itself is made up of PL/SQL blocks that perform the desired function and return the desired data to the calling program. The goal of the body of the procedure is both to minimize the amount of data to be transmitted across the network (to and from the calling program) and to perform the PL/SQL statements in the most effi- cient manner possible.

Example

Create a function to get cube of passed number

```
Create or replace function cube(no number) return number
Is
 ans number(4);
Begin
    ans := no * no * no;
    return ans;
End;
/
```

Function created.

Output

```
SQL> select cube(5) from dual;
CUBE(5)
———-
125
```

Example

Write a Function to find out maximum salary for the passed designation.

```
Create or replace function maxjob(des  varchar2)  return number  Is
maxsal number(7,2);
Begin
select max(sal) into maxsal from emp where job = des;
return maxsal;
End;
/
```

134 Function created.

Output

```
SQL> SELECT MAXJOB('ANALYST') FROM DUAL;
MAXJOB('ANALYST')
—————————-
        6725
```

Example

Create a Function to find out existence of employee whose name is passed as a parameter

```
Create or replace function empchk(enm varchar2) return boolean Is
erec emp%rowtype;
Begin
select * into erec from emp where ename = enm;
return true;
Exception
When no_data_found then
return false;
When too_manu_rows then
Return true;
End;
/
```

Function created.

Block To execute procedure (Caller Program)

```
Declare
nm emp.ename%type;
b Boolean;
Begin
nm := &employeename
b :=empchk(nm);
if b = true then
dbms_output.put_line('Employee Exist');
else
dbms_output.put_line('Employee not exist');
end if;
End;
/
```

135

Example

Write a Function to find out Total salary for the passed department Name.

```
Create or replace function totsalary(dnm varchar2) return number
Is
 totsal emp.sal%type;
Begin
select sum(sal) into totsal from emp,dept where dept.deptno
= emp.deptno and dname = dnm;
return totsal;
End;
/
```

Function created.

Block To execute procedure

```
Declare
tot number;
dnm dept.dname%type := &departmentname;
```

```
Begin
tot = totalsalary(dnm);
dbms_output.put_line(‘Total Salary of ‘|| dnm || ‘ is ‘ ||
tot);
End;
/
```

Example

Write a Function to find out No Of Employee who joined between dates passed.

```
Create or replace function noofemp(date1 date,date2 date) return
number
Is
 noofemp number(7);
Begin
select count(*) into noofemp from emp where hiredate between
date1 and date2;
return noofemp;
End;
/
Function created.
```

136

Output

```
SQL> select noofemp(’20-dec-80',’20-dec-81') from dual;
NOOFEMP(’20-DEC-80',’20-DEC-81')
----------------------------------
                              11
```

Example

Write a function to check whether passed number is Odd or Even.

```
Create or replace function oddeven(no number) return varchar2 is
Begin
If mod(no,2)=0 then
```

```
return
Else
 return no || ' is odd';
End if;
End;
/
Function created.
```

Output

```
SQL>Select oddeven(10) from dual;
ODDEVEN(10)
-----------
10 is Even
SQL> select oddeven(11) from dual;
ODDEVEN(11)
-----------
11 is Odd
```

Example

Write a Function to find out total annual income for the employee, who's number we passed.

```
Create or replace function ann_income(eno number) return number
Is total number(9,2);
Begin
137Select (salary + nvl(comm,0))*12 into total from emp where
empno = eno;
return total;
End;
/
Function created.
```

Output

```
SQL> select ann_income(1010) from dual;
ANN_SAL(1010)
```

```
-------------
      60000
```

Example

Create a function, which receives three arguments, first two as a number and third as a arithmetic operator and return proper answer, In case of invalid operator display appropriate message.

```
Create or replace function calc(a number, b number,  c char, x boolean) return number is
d number; invalid_opt exception;
Begin
    If c ='+' then
        d := a + b;
    Elsif c='-' then
        d :=  a-b;
    Elsif c='/' then
        d :=  a/b;
    Elsif c='*' then
        d := a*b;
    Else
         Raise invaid_opt;
    End if;
  x:=true;
    Return d;
Exception
    When value_error then
dbms_output.put_line('cannot perform calculation');
x:=false;
return 0;
    When invalid_opt then
x:=false;
```

```
return 0;
End;
/
```

Block To execute procedure

```
Declare
n1 number;
n2 number;
ans number;
op varchar2;
valid Boolean;
Begin
n1  :=  &firstnumber;
n2 := &secondnumber;
op :=  &operator
ans = (n1,n2,op,valid);
if valid then
dbms_output.put_line(n1 op n2 || ‘ is ‘ || ans);
end if;
End;
/
```