1. As a DBA, discuss what you must plan before you create database?

Ans:

As a database administrator (DBA), there are several key considerations and planning steps to undertake before creating a database. Here's a detailed overview:

a. Define Requirements and Objectives:

- Understand the business requirements for the database. What is the purpose of the database? Who will use it? What data will it store?
- Identify performance, scalability, and availability requirements.
- Determine the expected growth rate of the data and the database usage patterns.
- Define objectives for security, backup, and disaster recovery.

b. Choose the Database Management System (DBMS):

- Select the appropriate DBMS based on the requirements, budget, and existing infrastructure.
- Evaluate factors such as scalability, performance, ease of administration, and compatibility with existing systems.
- Consider the features and licensing costs associated with different DBMS options.

c. Design the Database Schema:

- Identify the entities and relationships that need to be represented in the database.
- Normalize the data to eliminate redundancy and ensure data integrity.
- Design the tables, columns, primary keys, foreign keys, and indexes.
- Consider partitioning strategies for large tables to improve performance and manageability.

d. Plan Storage and Performance Optimization:

- Estimate the amount of storage required for the database and plan for growth.
- Choose the appropriate storage technology (e.g., HDD, SSD, SAN) based on performance and cost considerations.
- Configure tablespaces and data files to optimize performance and manageability.
- Implement partitioning, indexing, and caching strategies to improve query performance.
- Consider using compression and data archiving techniques to optimize storage utilization.

e. Define Security Policies:

- Identify the security requirements for the database, including authentication, authorization, and auditing.
- Implement user roles and privileges to control access to data and database objects.
- Configure network security settings to protect against unauthorized access.
- Encrypt sensitive data to prevent unauthorized disclosure.

f. Plan Backup and Recovery Strategies:

- Develop a backup strategy based on the Recovery Point Objective (RPO) and Recovery Time Objective (RTO) requirements.
- Choose appropriate backup methods (e.g., full, incremental, differential) and storage locations.

- Test backup and recovery procedures regularly to ensure reliability.
- Implement database mirroring, replication, or clustering for high availability and disaster recovery.

g. Consider High Availability and Disaster Recovery:

- Plan for high availability and fault tolerance to minimize downtime and data loss.
- Implement redundant hardware, network connections, and power supplies.
- Configure database mirroring, clustering, or replication for failover and disaster recovery.
- Establish offsite backups and data replication to protect against site-wide disasters.

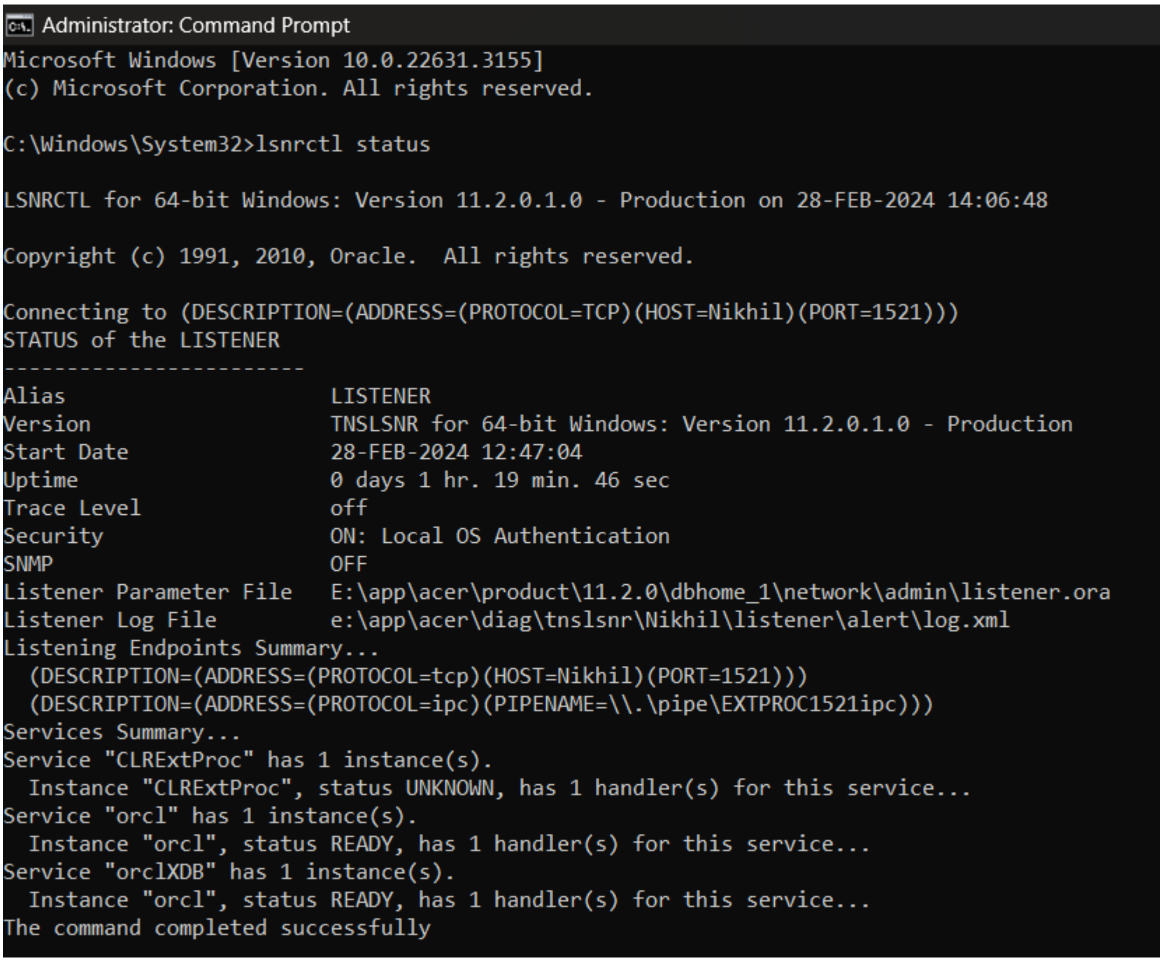
h. Document the Database Design and Configuration:

- Document the database schema, data dictionary, and database configuration settings.
- Create an inventory of database objects, including tables, indexes, views, and stored procedures.
- Document security policies, backup and recovery procedures, and high availability configurations.
- Maintain up-to-date documentation to facilitate troubleshooting, maintenance, and knowledge transfer.

By thoroughly planning and considering these factors before creating a database, a DBA can ensure that the database meets the organization's requirements for performance, availability, security, and data integrity. This proactive approach helps minimize risks and ensures the successful deployment and operation of the database system.

2.Assume you have installed Oracle database software in your own PC/laptop. After installing, state the following items in your report:

a. Show the listener status [With figure]

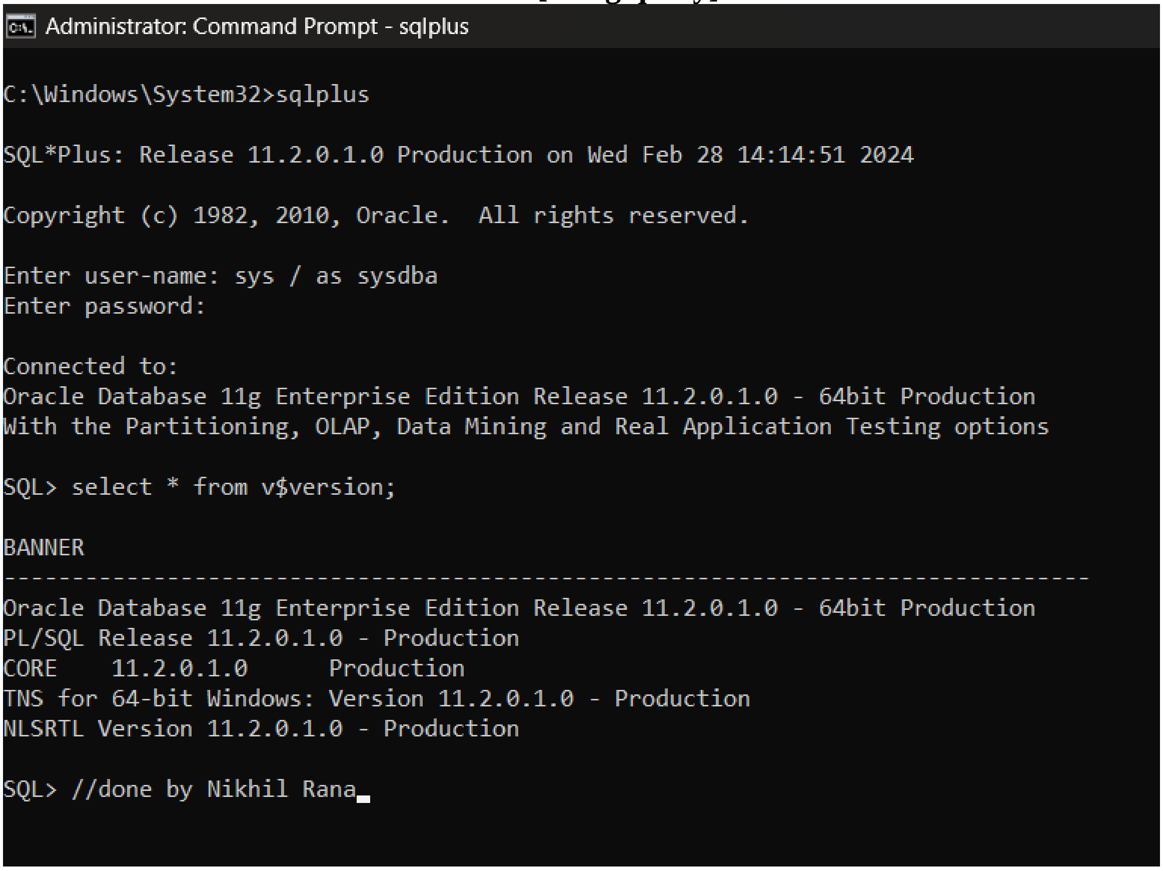


```
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.

C:\Windows\System32>lsnrctl status

LSNRCTL for 64-bit Windows: Version 11.2.0.1.0 - Production on 28-FEB-2024 14:06:48

Copyright (c) 1991, 2010, Oracle.  All rights reserved.

Connecting to (DESCRIPTION=(ADDRESS=(PROTOCOL=TCP)(HOST=Nikhil)(PORT=1521)))
STATUS of the LISTENER
------------------------
Alias                     LISTENER
Version                   TNSLSNR for 64-bit Windows: Version 11.2.0.1.0 - Production
Start Date                28-FEB-2024 12:47:04
Uptime                    0 days 1 hr. 19 min. 46 sec
Trace Level               off
Security                  ON: Local OS Authentication
SNMP                      OFF
Listener Parameter File   E:\app\acer\product\11.2.0\dbhome_1\network\admin\listener.ora
Listener Log File         e:\app\acer\diag\tnslsnr\Nikhil\listener\alert\log.xml
Listening Endpoints Summary...
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=Nikhil)(PORT=1521)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(PIPENAME=\\.\pipe\EXTPROC1521ipc)))
Services Summary...
Service "CLRExtProc" has 1 instance(s).
  Instance "CLRExtProc", status UNKNOWN, has 1 handler(s) for this service...
Service "orcl" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this service...
Service "orclXDB" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this service...
The command completed successfully
```

Query: lsnrctl status

The Oracle Listener is a background process that runs on the database server, listening for incoming connection requests from clients. It uses a configuration file (listener.ora) to define listening endpoints and manage the registration of database services. The listener directs client requests to the appropriate database service through service handlers. Dynamic service registration allows database instances to register with the listener automatically. Monitoring and maintaining the listener's proper configuration are crucial for effective client-server communication in an Oracle Database environment.
The above command displays the status of an Oracle database listener, which is a process that handles incoming connection requests from clients. It indicates that the listener is active and capable of accepting connections. The output provides details such as listener name, version, start time, available services, and technical information about its status. Overall, it confirms that the Oracle Database software is running and the listener is operational.

b. The Oracle software release /edition [using query]



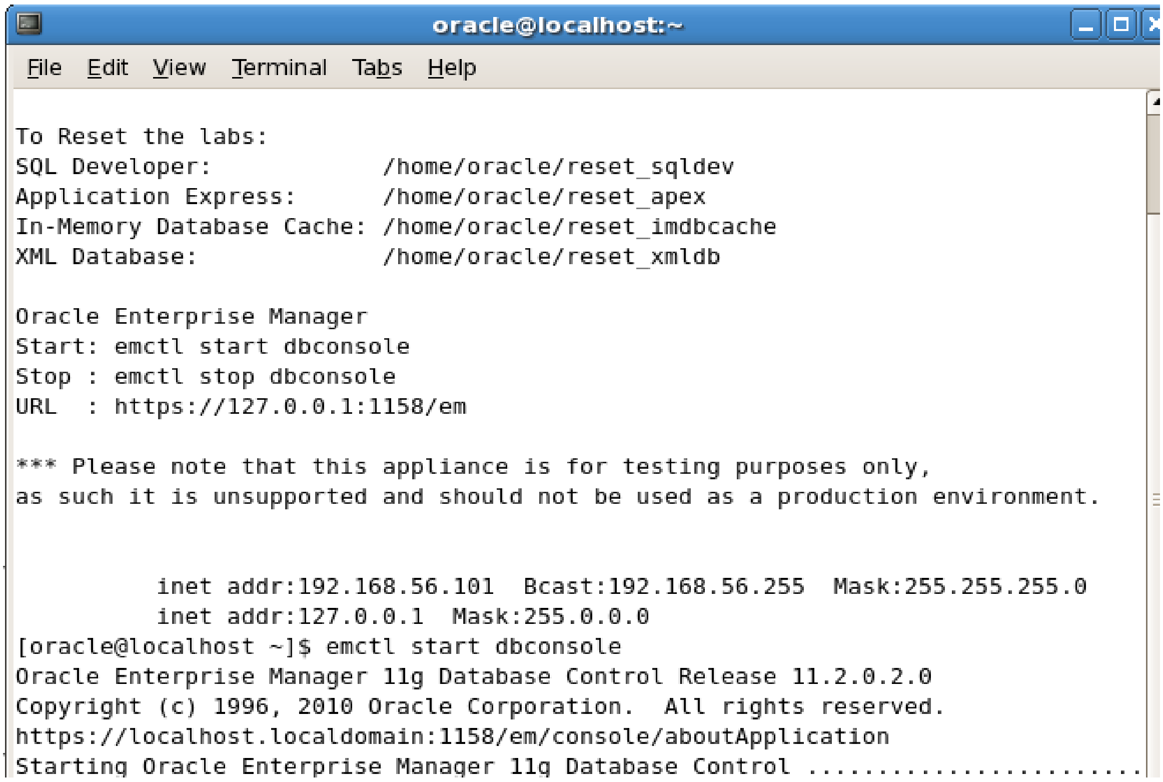
```
C:\Windows\System32>sqlplus

SQL*Plus: Release 11.2.0.1.0 Production on Wed Feb 28 14:14:51 2024

Copyright (c) 1982, 2010, Oracle.  All rights reserved.

Enter user-name: sys / as sysdba
Enter password:

Connected to:
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - 64bit Production
With the Partitioning, OLAP, Data Mining and Real Application Testing options

SQL> select * from v$version;

BANNER
--------------------------------------------------------------------------------
Oracle Database 11g Enterprise Edition Release 11.2.0.1.0 - 64bit Production
PL/SQL Release 11.2.0.1.0 - Production
CORE    11.2.0.1.0      Production
TNS for 64-bit Windows: Version 11.2.0.1.0 - Production
NLSRTL Version 11.2.0.1.0 - Production

SQL> //done by Nikhil Rana
```

The terminal window displays the process of connecting to an Oracle database using SQL*Plus, a command-line tool.

1. **Command Prompt:** The user is on a Windows machine as indicated by "C:\Windows\System32>".
2. **SQL*Plus Launch:** "sqlplus" command launches SQL*Plus.
3. **Version Info:** Shows SQL*Plus version and Oracle copyright notice.
4. **Login:** User inputs username ("**sys/**") and password (hidden) with administrative privileges ("**as sysdba**").
5. **Successful Connection:** "Connected to:" confirms successful connection to the Oracle database.
6. **Database Information**: Query result (**select * from v$version;**) displays database details: name, version, PL/SQL version, core version, TNS version, and NLSRTL version.

3. How will you start and stop dbconsole process? [Figure is must]

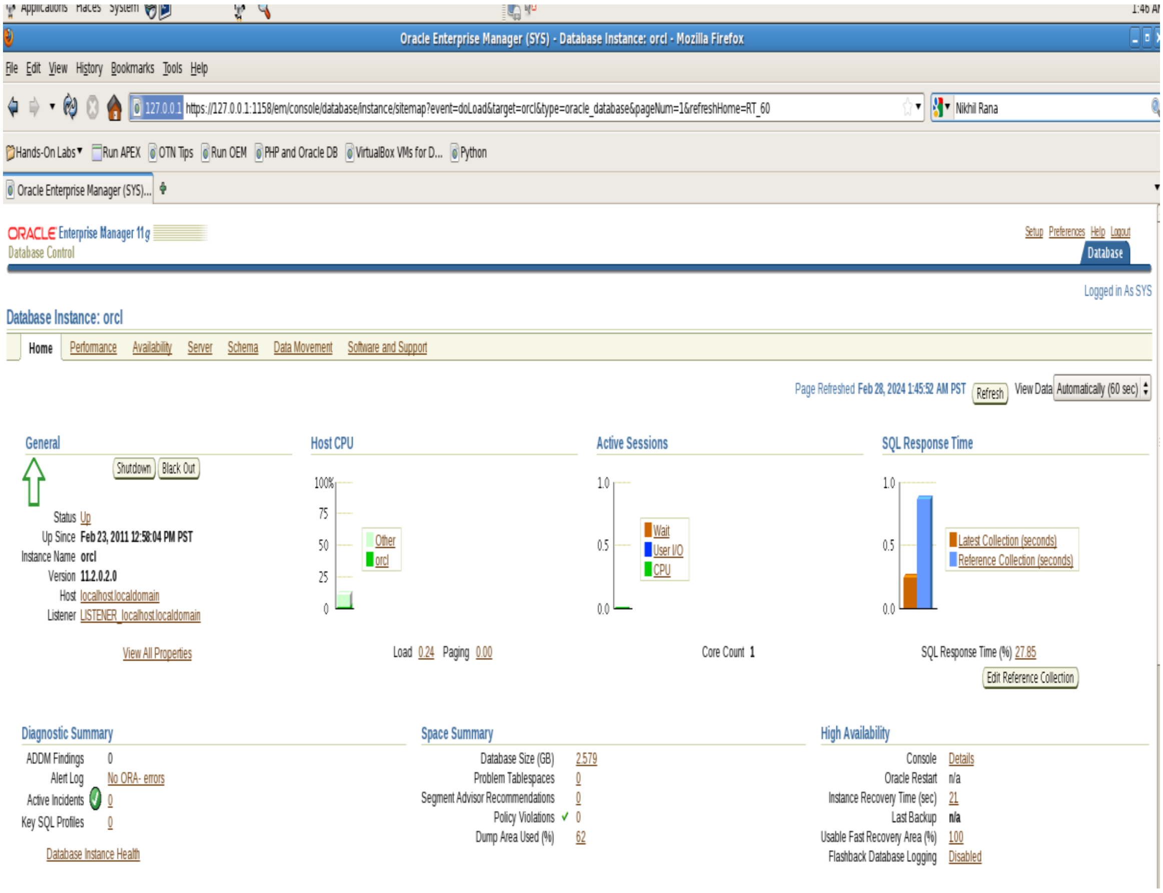
Query: **emctl start dbconsole**



```
To Reset the labs:
SQL Developer:             /home/oracle/reset_sqldev
Application Express:       /home/oracle/reset_apex
In-Memory Database Cache:  /home/oracle/reset_imdbcache
XML Database:              /home/oracle/reset_xmldb

Oracle Enterprise Manager
Start: emctl start dbconsole
Stop : emctl stop dbconsole
URL  : https://127.0.0.1:1158/em

*** Please note that this appliance is for testing purposes only,
as such it is unsupported and should not be used as a production environment.


          inet addr:192.168.56.101  Bcast:192.168.56.255  Mask:255.255.255.0
          inet addr:127.0.0.1  Mask:255.0.0.0
[oracle@localhost ~]$ emctl start dbconsole
Oracle Enterprise Manager 11g Database Control Release 11.2.0.2.0
Copyright (c) 1996, 2010 Oracle Corporation.  All rights reserved.
https://localhost.localdomain:1158/em/console/aboutApplication
Starting Oracle Enterprise Manager 11g Database Control .......................
```

- **Database Control Startup**: The database management console is starting, with a provided URL for access.

The image below displays a screenshot of an Oracle Enterprise Manager console. This is a web-based interface for managing and monitoring Oracle databases. Here's a breakdown of important areas:


Applications Places System
Oracle Enterprise Manager (SYS) - Database Instance: orcl - Mozilla Firefox
File Edit View History Bookmarks Tools Help
https://127.0.0.1:1158/em/console/database/instance/sitemap?event=doLoad&target=orcl&type=oracle_database&pageNum=1&refreshHome=RT_60
Nikhil Rana
Hands-On Labs Run APEX OTN Tips Run OEM PHP and Oracle DB VirtualBox VMs for D... Python
Oracle Enterprise Manager (SYS)...
ORACLE Enterprise Manager 11g
Database Control
Setup Preferences Help Logout
Database
Logged in As SYS
Home Performance Availability Server Schema Data Movement Software and Support
Refresh
Shutdown Black Out
Host CPU
100% 75 50 25 0
Other
orcl
Active Sessions
1.0 0.5 0.0
Wait
User I/O
CPU
SQL Response Time
1.0 0.5 0.0
Latest Collection (seconds)
Reference Collection (seconds)
Edit Reference Collection
View All Properties
Database Instance Health

Database Instance: orcl

Page Refreshed Feb 28, 2024 1:45:52 AM PST View Data Automatically (60 sec)

General

Status Up
Up Since Feb 23, 2011 12:58:04 PM PST
Instance Name orcl
Version 11.2.0.2.0
Host localhost.localdomain
Listener LISTENER_localhost.localdomain

Load 0.24 Paging 0.00

Core Count 1

SQL Response Time (%) 27.85

Diagnostic Summary

ADDM Findings	0
Alert Log	No ORA- errors
Active Incidents	✓ 0
Key SQL Profiles	0

Space Summary

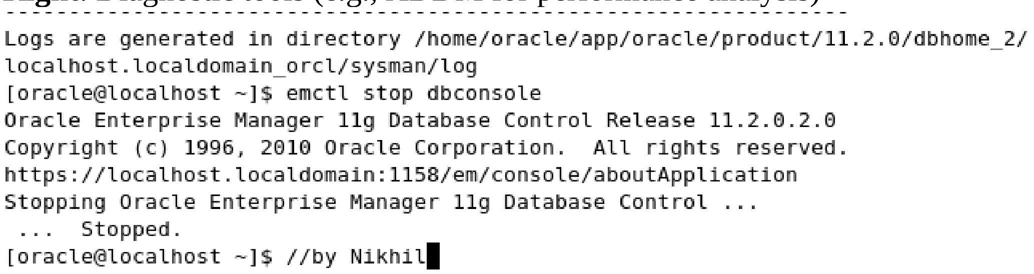
Database Size (GB)	2.579
Problem Tablespaces	0
Segment Advisor Recommendations	0
Policy Violations	✓ 0
Dump Area Used (%)	62

High Availability

Console	Details
Oracle Restart	n/a
Instance Recovery Time (sec)	21
Last Backup	n/a
Usable Fast Recovery Area (%)	100
Flashback Database Logging	Disabled

Top Navigation: Provides access to major sections of the Enterprise Manager:
Home: Dashboard for the database instance.
Performance: Monitoring tools (e.g., load, wait events, blocking sessions).
Availability: Managing high availability, backups.
Schema: Managing database objects (tables, views, etc.).
More options: (Server, Data Movement, Software and Support)

Central Area: Displays details about the selected database instance (orcl), including:
Status: Up
Up Since: Date and time
Host: Server where the database resides
Version: Oracle database version
Listener: Network listener status and configuration
Side Panels: Provide quick summaries and shortcuts:
Left: Key metrics, alerts, recent problems in the database
Right: Diagnostic tools (e.g., ADDM for performance analysis)


```
------------------------------------------------------------------------------------
Logs are generated in directory /home/oracle/app/oracle/product/11.2.0/dbhome_2/
localhost.localdomain_orcl/sysman/log
[oracle@localhost ~]$ emctl stop dbconsole
Oracle Enterprise Manager 11g Database Control Release 11.2.0.2.0
Copyright (c) 1996, 2010 Oracle Corporation.  All rights reserved.
https://localhost.localdomain:1158/em/console/aboutApplication
Stopping Oracle Enterprise Manager 11g Database Control ...
 ...  Stopped.
[oracle@localhost ~]$ //by Nikhil
```

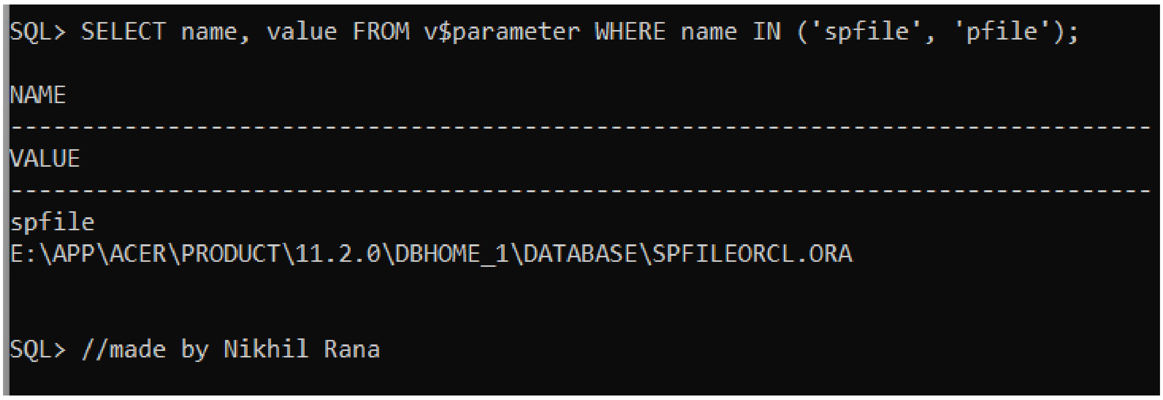
This shows stopping the Oracle Enterprise Manager 11g Database Control
Query: **emctl stop dbconsole**

4. How will you know the location of the spfile and pfile? [Snapshot required]. Create pfile from spfile and spfile from pfile. [query needed along with snapshot]

Check if the database is using SPFILE or PFILE

SQL> SHOW PARAMETER spfile;

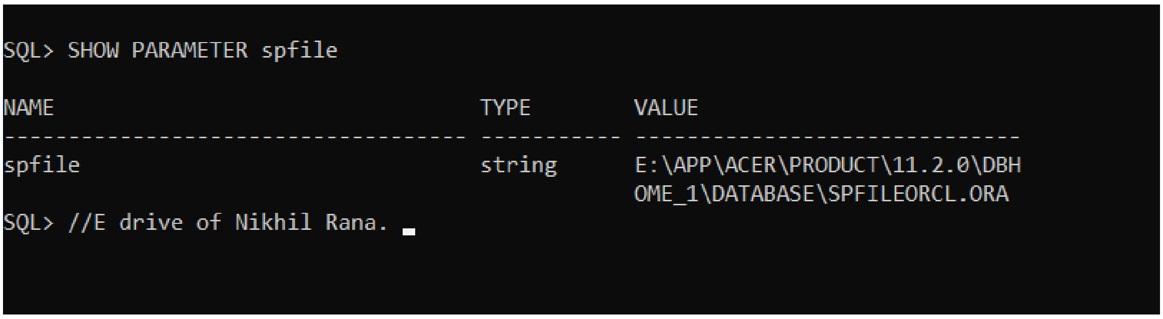
If the database is using SPFILE then there will be the name along with the location in the VALUE column. But if the database is using PFILE, then there will be nothing in this column.



```
SQL> SELECT name, value FROM v$parameter WHERE name IN ('spfile', 'pfile');

NAME
--------------------------------------------------------------------------------
VALUE
--------------------------------------------------------------------------------
spfile
E:\APP\ACER\PRODUCT\11.2.0\DBHOME_1\DATABASE\SPFILEORCL.ORA


SQL> //made by Nikhil Rana
```

- **SELECT statement:** The user is running a query to get information about database settings.
- **Output:**
  - The names of settings ('spfile', 'pfile')
  - The value (location) of the primary configuration file (spfile)

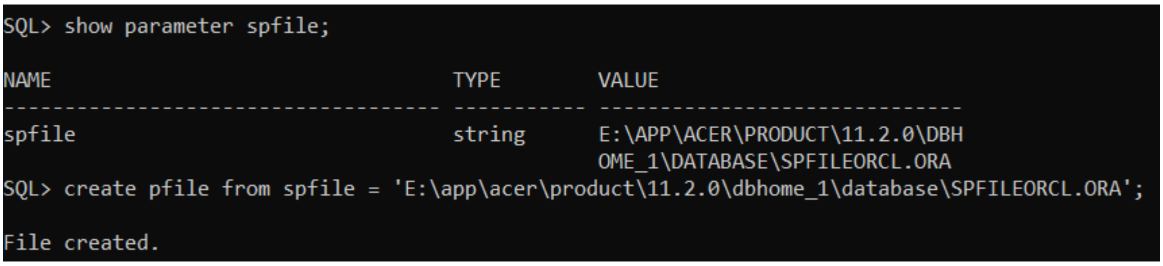
In short, the user is checking the location of important Oracle database configuration files.



```
SQL> SHOW PARAMETER spfile

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
spfile                               string      E:\APP\ACER\PRODUCT\11.2.0\DBH
                                                 OME_1\DATABASE\SPFILEORCL.ORA
SQL> //E drive of Nikhil Rana.
```

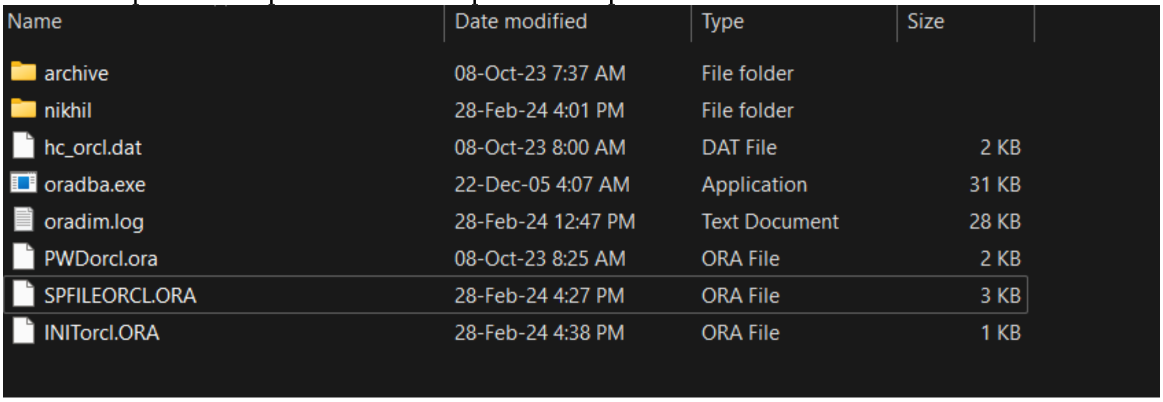
This shows parameter spfile and create pfile from spfile

Create pfile from spfile



```
SQL> show parameter spfile;

NAME                                 TYPE        VALUE
------------------------------------ ----------- ------------------------------
spfile                               string      E:\APP\ACER\PRODUCT\11.2.0\DBH
                                                 OME_1\DATABASE\SPFILEORCL.ORA
SQL> create pfile from spfile = 'E:\app\acer\product\11.2.0\dbhome_1\database\SPFILEORCL.ORA';

File created.
```

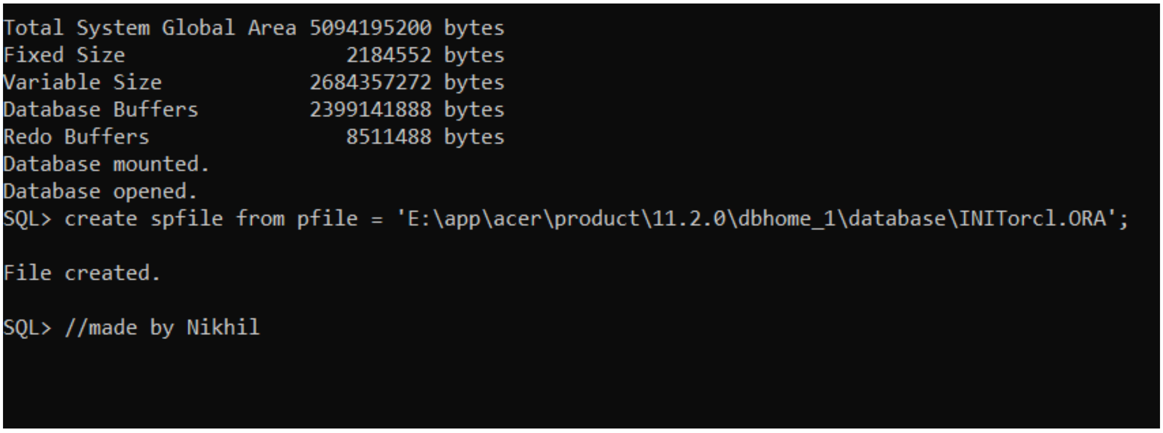
This show parameter spfile and created pfile from spfile.



Name	Date modified	Type	Size
archive	08-Oct-23 7:37 AM	File folder	
nikhil	28-Feb-24 4:01 PM	File folder	
hc_orcl.dat	08-Oct-23 8:00 AM	DAT File	2 KB
oradba.exe	22-Dec-05 4:07 AM	Application	31 KB
oradim.log	28-Feb-24 12:47 PM	Text Document	28 KB
PWDorcl.ora	08-Oct-23 8:25 AM	ORA File	2 KB
SPFILEORCL.ORA	28-Feb-24 4:27 PM	ORA File	3 KB
INITorcl.ORA	28-Feb-24 4:38 PM	ORA File	1 KB

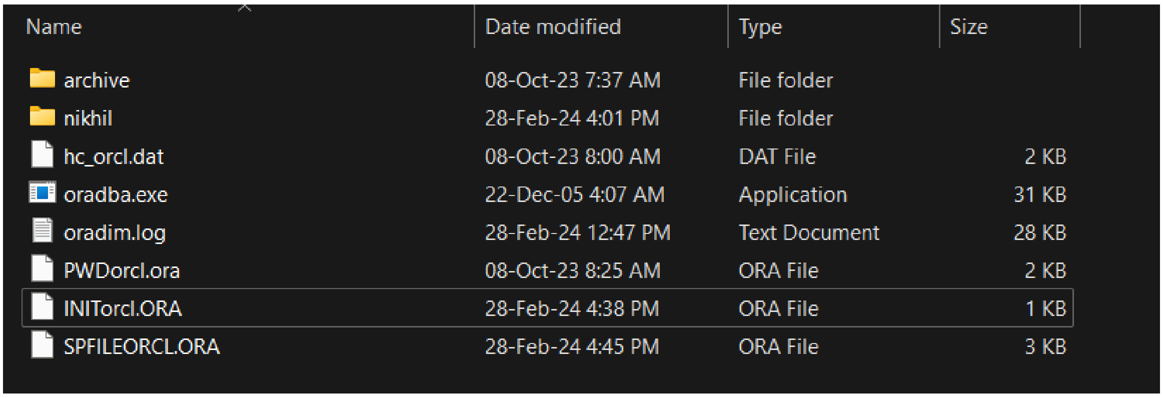
This is location of pfile amd spfile

Create spfile from pfile



```
Total System Global Area 5094195200 bytes
Fixed Size                  2184552 bytes
Variable Size            2684357272 bytes
Database Buffers         2399141888 bytes
Redo Buffers                8511488 bytes
Database mounted.
Database opened.
SQL> create spfile from pfile = 'E:\app\acer\product\11.2.0\dbhome_1\database\INITorcl.ORA';

File created.

SQL> //made by Nikhil
```

New spfile created from pfile



Name	Date modified	Type	Size
archive	08-Oct-23 7:37 AM	File folder	
nikhil	28-Feb-24 4:01 PM	File folder	
hc_orcl.dat	08-Oct-23 8:00 AM	DAT File	2 KB
oradba.exe	22-Dec-05 4:07 AM	Application	31 KB
oradim.log	28-Feb-24 12:47 PM	Text Document	28 KB
PWDorcl.ora	08-Oct-23 8:25 AM	ORA File	2 KB
INITorcl.ORA	28-Feb-24 4:38 PM	ORA File	1 KB
SPFILEORCL.ORA	28-Feb-24 4:45 PM	ORA File	3 KB

5. Show the location of the physical file where the data is stored. [Query + Snapshot]

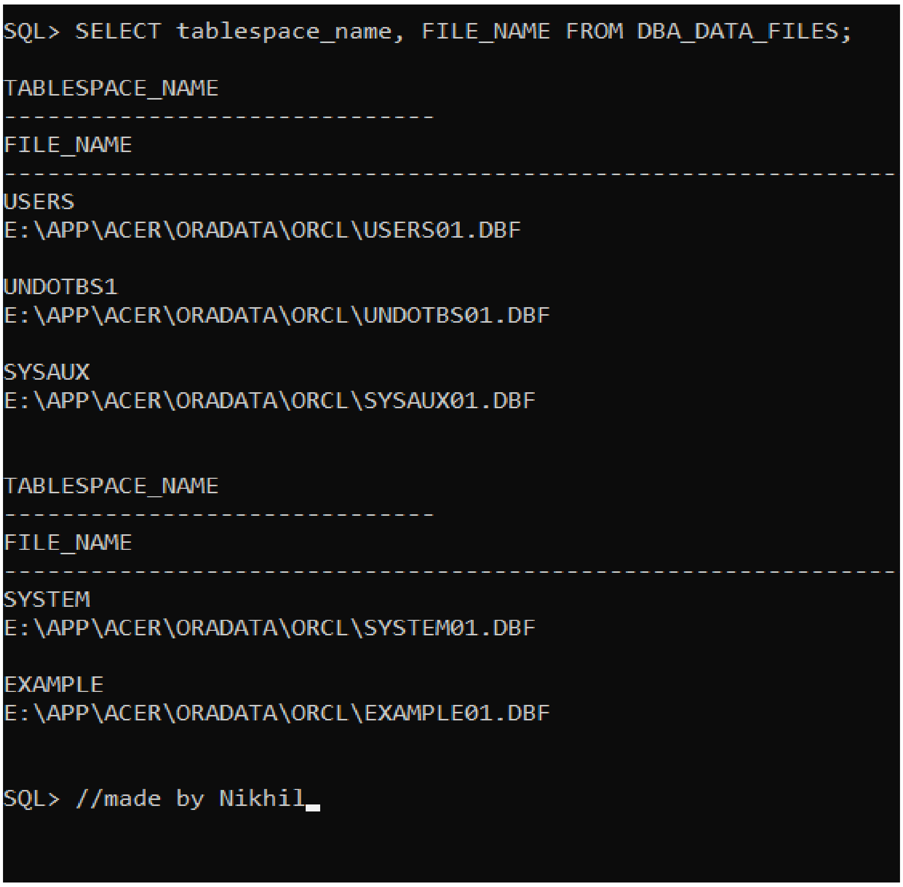
In an Oracle Database, there are several types of physical files associated with database storage and configuration. Here are some key types of physical files, along with example queries to find their locations:

Datafiles:
Datafiles store the actual data of the database.
SELECT FILE_NAME FROM DBA_DATA_FILES;

Control Files:
Control files contain metadata about the database, such as database name, data file names, and log file names.
SELECT NAME FROM V$CONTROLFILE;

Redo Log Files:
Redo log files record changes made to the database for recovery purposes.
SELECT MEMBER FROM V$LOGFILE;

Initialization Parameter File (SPFILE or PFILE):
The initialization parameter file contains configuration settings for the database instance.
SELECT VALUE FROM V$SYSTEM_PARAMETER WHERE NAME = 'spfile';



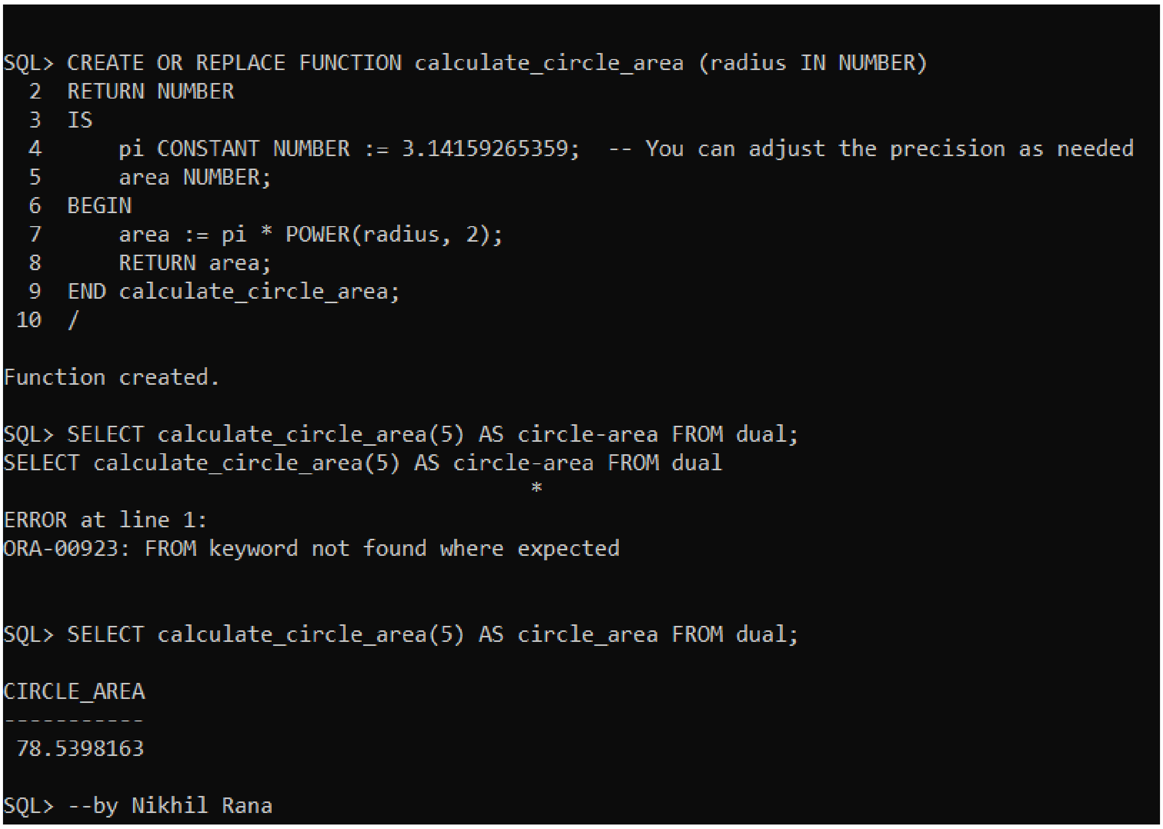
```
SQL> SELECT tablespace_name, FILE_NAME FROM DBA_DATA_FILES;

TABLESPACE_NAME
------------------------------
FILE_NAME
--------------------------------------------------------------
USERS
E:\APP\ACER\ORADATA\ORCL\USERS01.DBF

UNDOTBS1
E:\APP\ACER\ORADATA\ORCL\UNDOTBS01.DBF

SYSAUX
E:\APP\ACER\ORADATA\ORCL\SYSAUX01.DBF


TABLESPACE_NAME
------------------------------
FILE_NAME
--------------------------------------------------------------
SYSTEM
E:\APP\ACER\ORADATA\ORCL\SYSTEM01.DBF

EXAMPLE
E:\APP\ACER\ORADATA\ORCL\EXAMPLE01.DBF


SQL> //made by Nikhil
```

- TABLESPACE_NAME: The logical storage containers within the Oracle database where data is stored.
- FILE_NAME: The physical filename and path on the server associated with a tablespace.

The purpose of this query used in Oracle db administration to view how data is physically stored.

6. Write PL/SQL procedure/ function to determine the area of the circle. Area = Pi * r^2

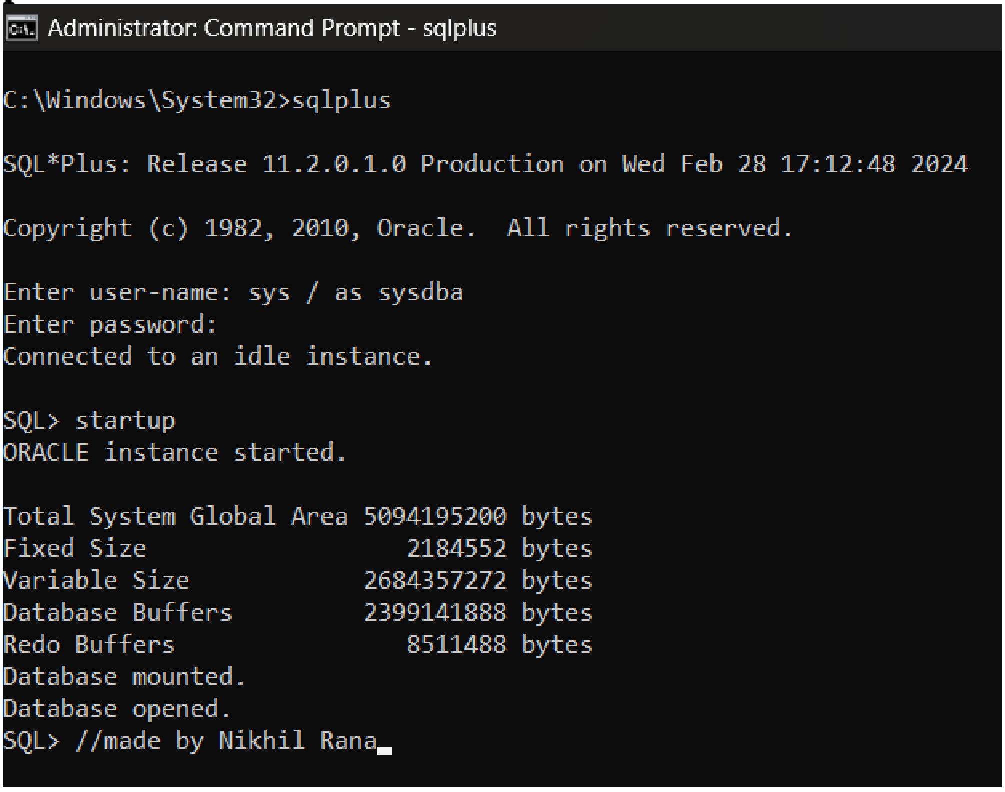
PL/SQL (Procedural Language/Structured Query Language) is Oracle's extension to SQL, enabling the creation of procedural code for tasks like data manipulation and error handling. It includes features such as blocks, variables, control structures, stored procedures, functions, triggers, and exception handling. PL/SQL seamlessly integrates with SQL, providing a powerful tool for building database applications with enhanced organization, reusability, and maintainability. It is widely used in Oracle Database environments.



```
SQL> CREATE OR REPLACE FUNCTION calculate_circle_area (radius IN NUMBER)
  2  RETURN NUMBER
  3  IS
  4      pi CONSTANT NUMBER := 3.14159265359;  -- You can adjust the precision as needed
  5      area NUMBER;
  6  BEGIN
  7      area := pi * POWER(radius, 2);
  8      RETURN area;
  9  END calculate_circle_area;
 10  /

Function created.

SQL> SELECT calculate_circle_area(5) AS circle-area FROM dual;
SELECT calculate_circle_area(5) AS circle-area FROM dual
                                         *
ERROR at line 1:
ORA-00923: FROM keyword not found where expected


SQL> SELECT calculate_circle_area(5) AS circle_area FROM dual;

CIRCLE_AREA
-----------
 78.5398163

SQL> --by Nikhil Rana
```

The above screenshot command is used to calculate area of circle

7. Write the steps of starting the Oracle Database with a clear picture.

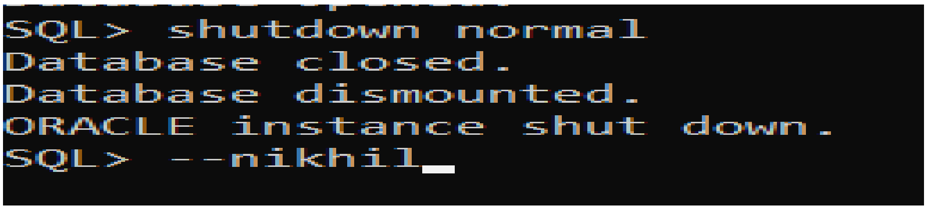


```
C:\Windows\System32>sqlplus

SQL*Plus: Release 11.2.0.1.0 Production on Wed Feb 28 17:12:48 2024

Copyright (c) 1982, 2010, Oracle.  All rights reserved.

Enter user-name: sys / as sysdba
Enter password:
Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area 5094195200 bytes
Fixed Size                  2184552 bytes
Variable Size            2684357272 bytes
Database Buffers         2399141888 bytes
Redo Buffers                8511488 bytes
Database mounted.
Database opened.
SQL> //made by Nikhil Rana_
```

This is a command to start up the oracle database

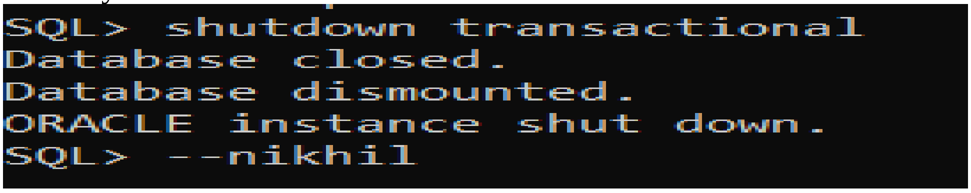
8. Write the steps of different shutdown modes in Oracle Database with a clear picture.

SHUTDOWN NORMAL: It Initiate a normal shutdown



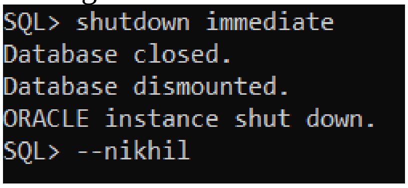
```
SQL> shutdown normal
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> --nikhil_
```

SHUTDOWN TRANSACTIONAL: Allows ongoing transactions to complete but rolls back any uncommitted data.



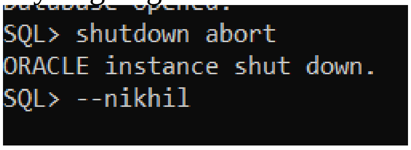
```
SQL> shutdown transactional
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> --nikhil
```

SHUTDOWN IMMEDIATE: Terminates the database instance immediately, potentially leading to data loss.



```
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> --nikhil
```

SHUTDOWN ABORT: It immediately stops all database processes without completing any ongoing transactions.



```
Database opened.
SQL> shutdown abort
ORACLE instance shut down.
SQL> --nikhil
```

9. Identify the SIX (6) categories of failure that normally occur in database environment. Discuss/propose solutions to overcome the failure.

Ans:
In a database environment, various types of failures can occur, each posing different challenges and requiring specific strategies for prevention and recovery. Here are six categories of failures commonly encountered in a database environment, along with proposed solutions to overcome them:

Hardware Failures:
Description: Hardware failures such as disk crashes, power outages, or network failures can lead to data loss or corruption.
Solution:

- Implement hardware redundancy and fault-tolerant configurations (e.g., RAID arrays, redundant power supplies).
- Regularly monitor hardware health and performance to detect potential issues early.
- Implement backup and disaster recovery solutions to ensure data integrity and availability in case of hardware failures.

Software Failures:
Description: Software failures can occur due to bugs, software crashes, or compatibility issues, leading to application downtime or data corruption.
Solution:

- Keep software up-to-date with patches and updates to address known vulnerabilities and bugs.
- Implement testing and quality assurance processes to identify and mitigate software issues before deployment.
- Maintain backups and disaster recovery plans to restore data and services quickly in case of software failures.

Human Errors:
Description: Human errors such as accidental deletion of data, misconfiguration, or improper use of database tools can lead to data loss or corruption.
Solution:

- Provide comprehensive training and documentation to educate users and database administrators on best practices and procedures.
- Implement access controls and permissions to restrict unauthorized actions and mitigate the risk of human errors.
- Regularly review and audit database activities to identify and address potential security vulnerabilities and compliance issues.

Security Breaches:
Description: Security breaches such as unauthorized access, data breaches, or malware attacks can compromise the confidentiality, integrity, and availability of data.
Solution:

- Implement robust security measures such as firewalls, encryption, and intrusion detection systems to protect against unauthorized access and data breaches.
- Regularly audit and review access controls, user permissions, and security configurations to identify and address vulnerabilities.
- Develop and enforce security policies and procedures to promote a culture of security awareness among users and administrators.

Data Corruption:
Description: Data corruption can occur due to disk errors, software bugs, or incomplete transactions, leading to inconsistencies or loss of data integrity.
Solution:

- Implement data validation and integrity checks to detect and repair corrupt data automatically.
- Regularly back up data and maintain multiple copies to ensure redundancy and facilitate recovery in case of data corruption.
- Monitor database performance and health indicators to identify potential issues and address them proactively.

Natural Disasters:
Description: Natural disasters such as earthquakes, floods, or fires can cause physical damage to data centers and infrastructure, leading to prolonged downtime or data loss.
Solution:

- Implement geographically distributed data centers and disaster recovery sites to ensure business continuity and data availability in the event of a natural disaster.
- Regularly test and update disaster recovery plans to ensure they are effective and up-to-date.
- Store backups and critical data in secure, off-site locations to protect against physical damage to on-premises infrastructure.
- By addressing these six categories of failures with proactive measures and robust contingency plans, organizations can mitigate risks and ensure the reliability, availability, and integrity of their database environments. Regular monitoring, testing, and continuous improvement are essential for maintaining resilience and readiness to respond to potential failures effectively.