



**IT4011**

**Database Administration and Storage Systems**

**Assignment – Oracle Database Administration**

IT20131074

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**Question 1** - Install the latest Oracle database version (19.X c or 21.X c) on the UNIX platform. Preferably on Linux.

Step 1 - The command ifconfig was used to get the IP address which is 192.168.122.1

```
[thisara@localhost ~]$ ifconfig
ens160: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.81.128 netmask 255.255.255.0 broadcast 192.168.81.255
    inet6 fe80::20c:29ff:fe19:1a78 prefixlen 64 scopeid 0x20<link>
    ether 00:0c:29:19:1a:78 txqueuelen 1000 (Ethernet)
    RX packets 2080487 bytes 2954253712 (2.7 GiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 401929 bytes 22795005 (21.7 MiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

virbr0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    inet 192.168.122.1 netmask 255.255.255.0 broadcast 192.168.122.255
    ether 52:54:00:5c:f8:7f txqueuelen 1000 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Step 2 - The hostname is taken using the hostname command

```
[thisara@localhost ~]$ hostname
localhost.Thisara
[thisara@localhost ~]$
[thisara@localhost ~]$
[thisara@localhost ~]$
[thisara@localhost ~]$
```

Step 3 - The content of the /etc/hosts file was updated by adding the IP address, hostname and the Oracle version. Type vi /etc/hosts

```
[thisara@localhost ~]$
[thisara@localhost ~]$ vi /etc/hosts
[thisara@localhost ~]$ su
Password:
[root@localhost thisara]#
127.0.0.1 localhost localhost.localdomain localhost4 localhost4.localdomain4
::1 localhost localhost.localdomain localhost6 localhost6.localdomain6
192.168.122.1 localhost.Thisara
~
~
~
```

Step 4 - List down the preinstalled Oracle 21c packages in the system using the yum list command.

```
[root@localhost thisara]#
[root@localhost thisara]# yum list oracle-database-preinstall-21c
Last metadata expiration check: 0:12:28 ago on Sun 24 Sep 2023 05:22:31 AM EDT.
Available Packages
oracle-database-preinstall-21c.src                    1.0-1.el8                ol8_appstream
oracle-database-preinstall-21c.x86_64                1.0-1.el8                ol8_appstream
[root@localhost thisara]#
```

Step 5 - The Oracle database package installation is performed using the yum install command.

```
[root@localhost thisara]#
[root@localhost thisara]# yum install -y oracle-database-preinstall-21c
Last metadata expiration check: 0:18:40 ago on Sun 24 Sep 2023 05:22:31 AM EDT.
Dependencies resolved.
=====
Package                               Arch    Version                               Repository    Size
=====
Installing:
oracle-database-preinstall-21c        x86_64  1.0-1.el8                            ol8_appstream 30 k
Installing dependencies:
compat-openssl10                       x86_64  1:1.0.2o-4.el8_6                    ol8_appstream 1.1 M
glibc-devel                           x86_64  2.28-225.0.2.el8                   ol8_baseos_latest 85 k
ksh                                    x86_64  20120801-257.0.1.el8               ol8_appstream 929 k
libnsl                                x86_64  2.28-225.0.2.el8                   ol8_baseos_latest 107 k
libxcrypt-devel                       x86_64  4.1.1-6.el8                         ol8_baseos_latest 25 k
lm_sensors-libs                       x86_64  3.4.0-23.20180522git70f7e08.el8    ol8_baseos_latest 59 k
make                                  x86_64  1:4.2.1-11.el8                     ol8_baseos_latest 498 k
sysstat                               x86_64  11.7.3-9.0.1.el8                   ol8_appstream 427 k
=====
Transaction Summary
=====
Install 9 Packages

Total download size: 3.2 M
Installed size: 9.4 M
Downloading Packages:
```

The installation can be verified as successful by the “Complete!” message displayed at the end.

```
Installing      : lm_sensors-libs-3.4.0-23.20180522git70f7e08.el8.x86_64        6/9
Running scriptlet: lm_sensors-libs-3.4.0-23.20180522git70f7e08.el8.x86_64        6/9
Installing      : sysstat-11.7.3-9.0.1.el8.x86_64                            7/9
Running scriptlet: sysstat-11.7.3-9.0.1.el8.x86_64                            7/9
Installing      : libnsl-2.28-225.0.2.el8.x86_64                             8/9
Installing      : oracle-database-preinstall-21c-1.0-1.el8.x86_64              9/9
Running scriptlet: oracle-database-preinstall-21c-1.0-1.el8.x86_64              9/9
Running scriptlet: oracle-database-preinstall-21c-1.0-1.el8.x86_64              9/9
Verifying       : glibc-devel-2.28-225.0.2.el8.x86_64                        1/9
Verifying       : libnsl-2.28-225.0.2.el8.x86_64                            2/9
Verifying       : libxcrypt-devel-4.1.1-6.el8.x86_64                        3/9
Verifying       : lm_sensors-libs-3.4.0-23.20180522git70f7e08.el8.x86_64      4/9
Verifying       : make-1:4.2.1-11.el8.x86_64                                5/9
Verifying       : compat-openssl10-1:1.0.2o-4.el8_6.x86_64                  6/9
Verifying       : ksh-20120801-257.0.1.el8.x86_64                          7/9
Verifying       : oracle-database-preinstall-21c-1.0-1.el8.x86_64            8/9
Verifying       : sysstat-11.7.3-9.0.1.el8.x86_64                          9/9

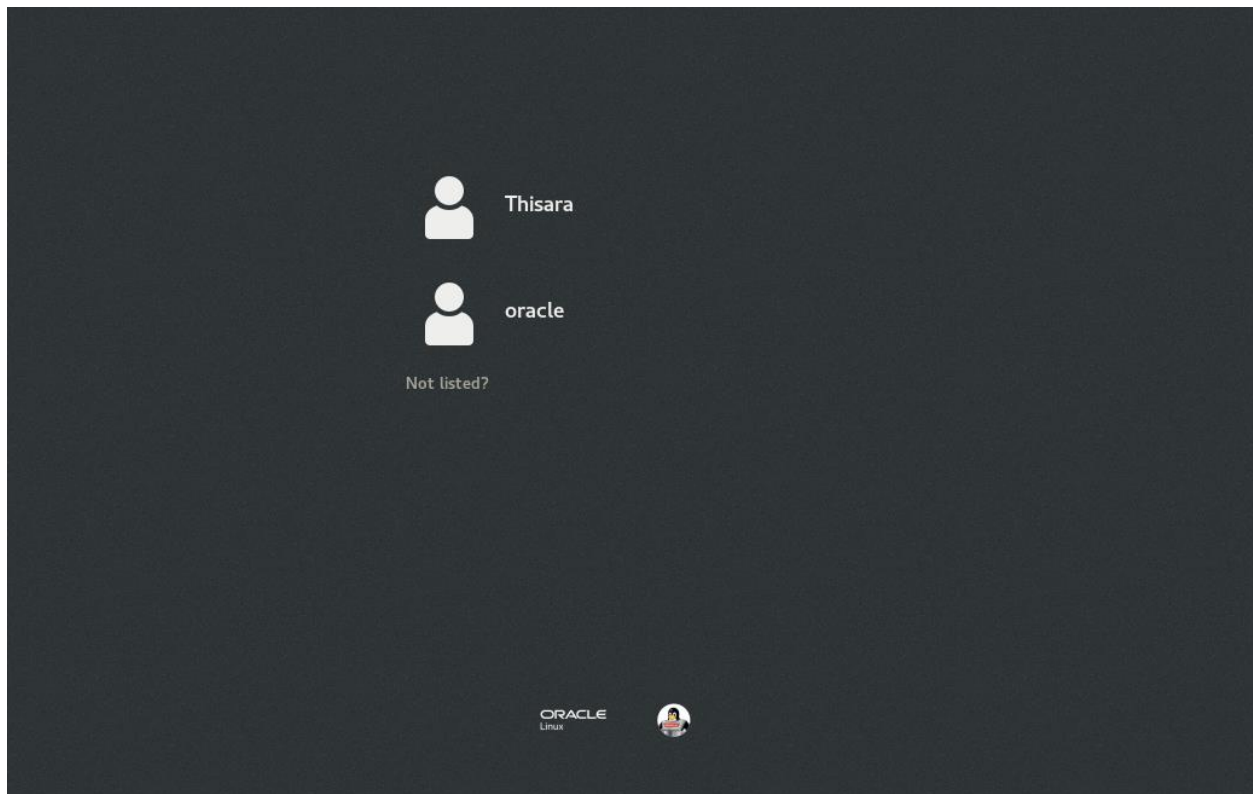
Installed:
compat-openssl10-1:1.0.2o-4.el8_6.x86_64      glibc-devel-2.28-225.0.2.el8.x86_64
ksh-20120801-257.0.1.el8.x86_64              libnsl-2.28-225.0.2.el8.x86_64
libxcrypt-devel-4.1.1-6.el8.x86_64           lm_sensors-libs-3.4.0-23.20180522git70f7e08.el8.x86_64
make-1:4.2.1-11.el8.x86_64                   oracle-database-preinstall-21c-1.0-1.el8.x86_64
sysstat-11.7.3-9.0.1.el8.x86_64

Complete!
[root@localhost thisara]#
```

Step 6 - As the next step a new user named Oracle is created and a password is assigned to the created user

```
[root@localhost thisara]#  
[root@localhost thisara]# passwd oracle  
Changing password for user oracle.  
New password:  
BAD PASSWORD: The password is shorter than 8 characters  
Retype new password:  
passwd: all authentication tokens updated successfully.  
[root@localhost thisara]#  
[root@localhost thisara]#
```

Two user accounts are created to log in with the creation of the oracle user account.



Step 7 - Next the content of the /etc/selinux/config file is modified by setting the attribute "SELINUX = permissive". Type vi /etc/selinux/config

```
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#   enforcing - SELinux security policy is enforced.
#   permissive - SELinux prints warnings instead of enforcing.
#   disabled - No SELinux policy is loaded.
SELINUX=permissive
#SELINUX=enforcing
# SELINUXTYPE= can take one of these three values:
#   targeted - Targeted processes are protected,
#   minimum - Modification of targeted policy. Only selected processes are protected.
#   mls - Multi Level Security protection.
SELINUXTYPE=targeted

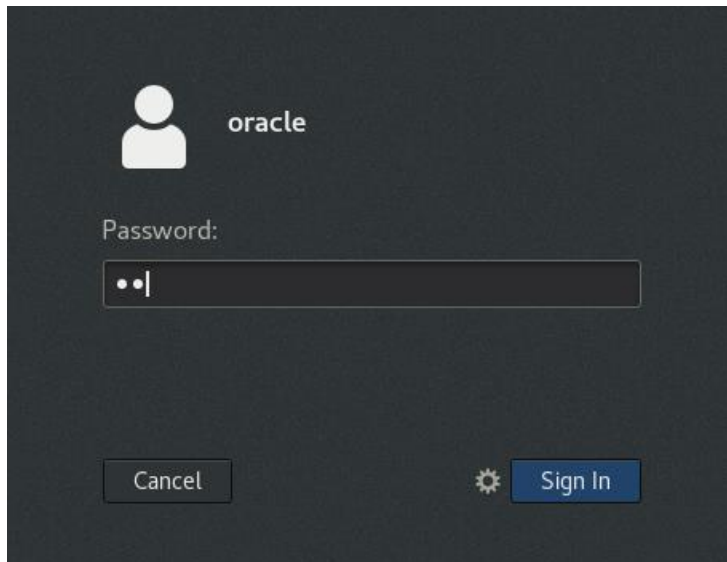
~
~
```

Step 8 -

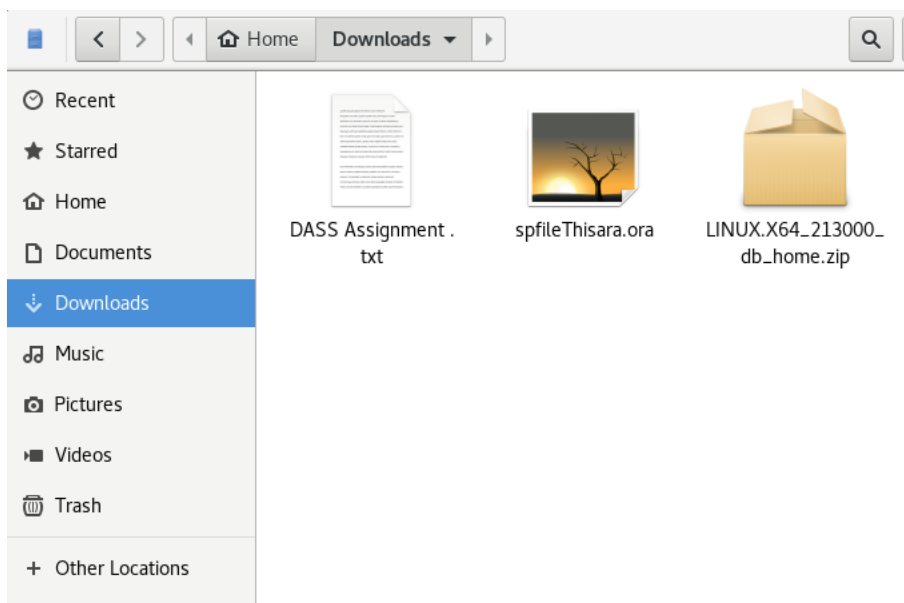
- create a directory structure, for an Oracle Database installation.
- chown is used to change the ownership of files and directories.
- chmod is used to change the permissions (read, write, execute) of files and directories.

```
[root@localhost thisara]# ls
Desktop Documents Downloads Music Pictures Public Templates Videos
[root@localhost thisara]# cd ..
[root@localhost home]# ls
oracle thisara
[root@localhost home]# cd ..
[root@localhost /]# ls
bin boot dev etc home lib lib64 media mnt opt proc root run sbin srv sys tmp usr var
[root@localhost /]# mkdir -p /u01/app/oracle/product/21.0.0/dbhome_1
[root@localhost /]# ls
bin boot dev etc home lib lib64 media mnt opt proc root run sbin srv sys tmp u01 usr var
[root@localhost /]# mkdir -p /u02/oradata
[root@localhost /]# ls
bin boot dev etc home lib lib64 media mnt opt proc root run sbin srv sys tmp u01 u02 usr var
[root@localhost /]# chown -R oracle:oinstall /u01 /u02
[root@localhost /]# chmod -R 775 /u01 /u02
```

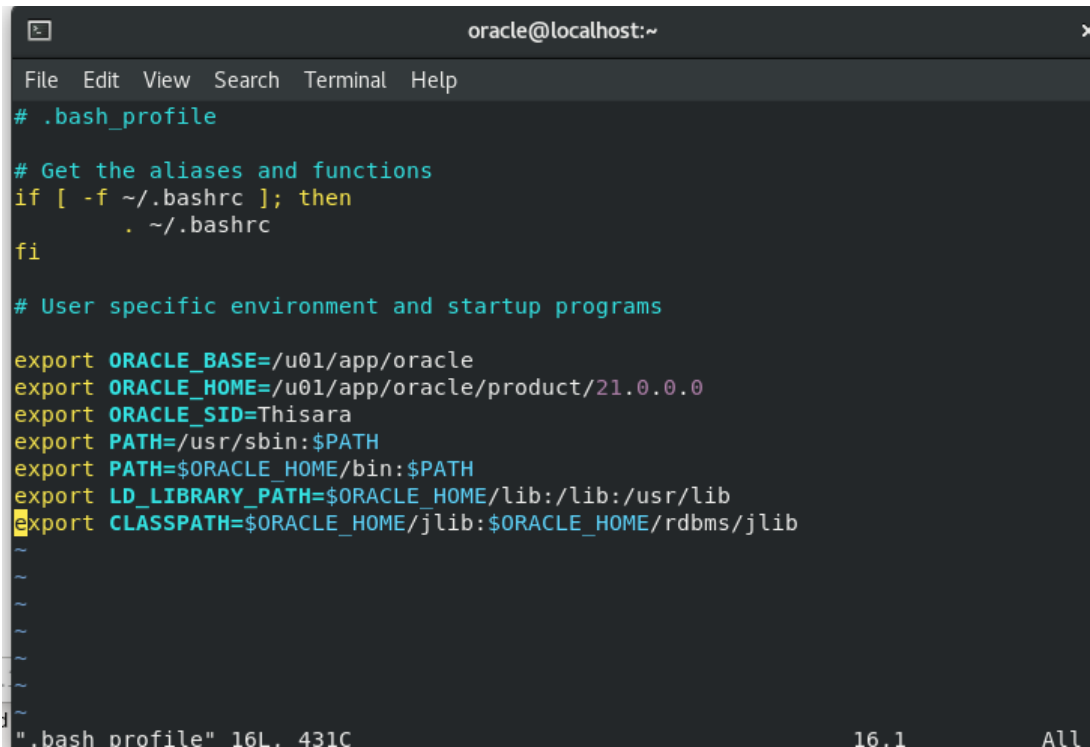
Step 9 - As the next step sign out from the root user account and log in to the created Oracle account.



The downloaded Oracle database 21c package downloaded.

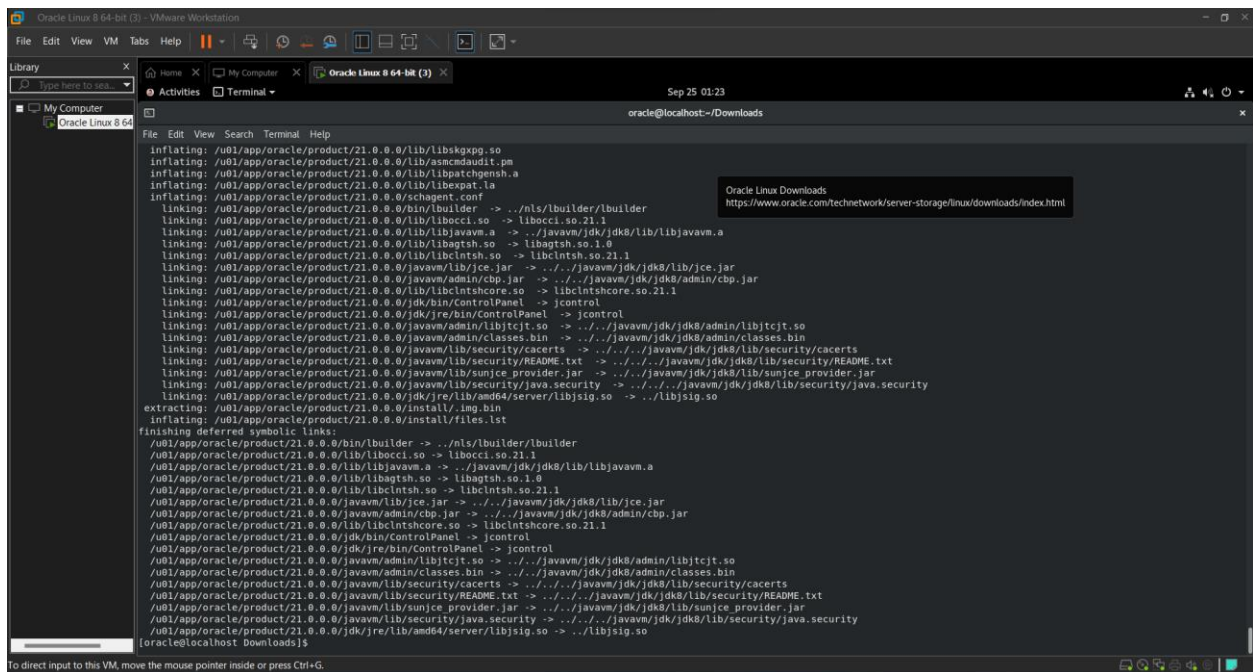


Step 10 – type “vi .bash\_profile” and edit the profile as below.

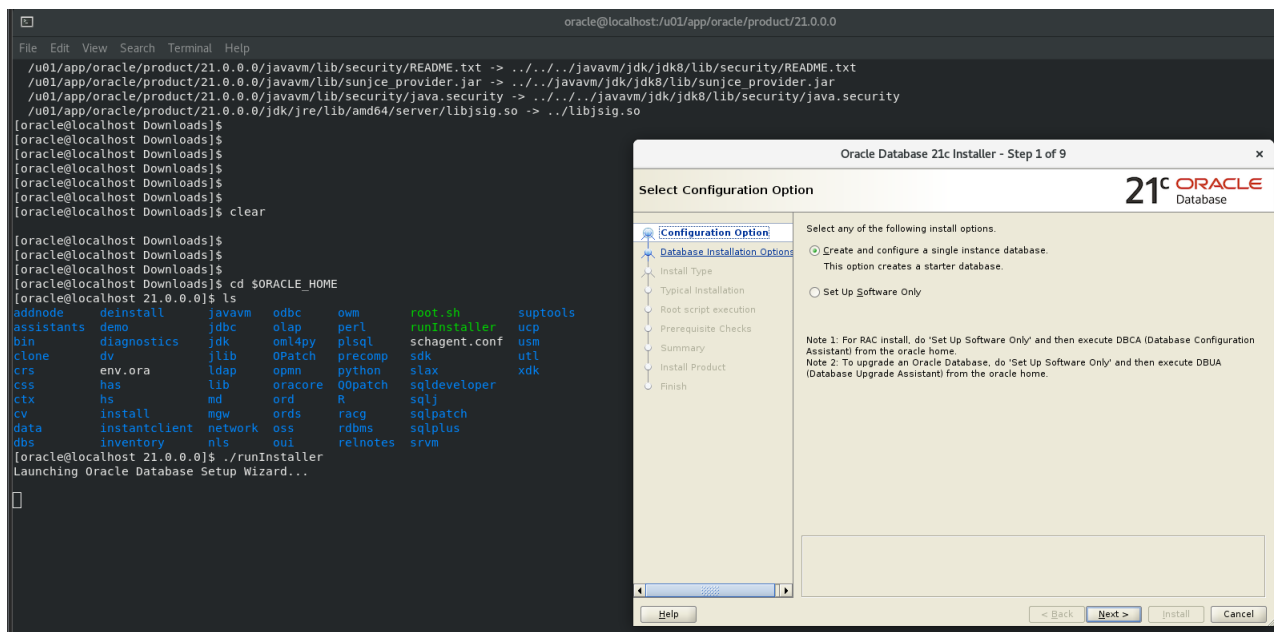
A screenshot of a terminal window titled "oracle@localhost:~". The terminal shows the contents of the .bash\_profile file. The file starts with a comment "# .bash\_profile", followed by a comment "# Get the aliases and functions" and an if statement "if [ -f ~/.bashrc ]; then" with an indented ". ~/.bashrc" and a "fi" statement. Then, a comment "# User specific environment and startup programs" is followed by several export statements: "export ORACLE\_BASE=/u01/app/oracle", "export ORACLE\_HOME=/u01/app/oracle/product/21.0.0.0", "export ORACLE\_SID=Thisara", "export PATH=/usr/sbin:\$PATH", "export PATH=\$ORACLE\_HOME/bin:\$PATH", "export LD\_LIBRARY\_PATH=\$ORACLE\_HOME/lib:/lib:/usr/lib", and "export CLASSPATH=\$ORACLE\_HOME/jlib:\$ORACLE\_HOME/rdbms/jlib". The terminal shows several tilde (~) characters below the last export statement. At the bottom, a status bar shows ".bash\_profile" 16L, 431C, 16.1, and All.

Step 11 – go to Downloads folder and Run unzip command here.

A screenshot of a terminal window showing the execution of the unzip command. The prompt is "[oracle@localhost Downloads]\$". The first command is "ls", which lists "LINUX.X64\_213000\_db\_home.zip" in red text. The second command is "unzip LINUX.X64\_213000\_db\_home.zip -d \$ORACLE\_HOME", with a cursor at the end of the line.



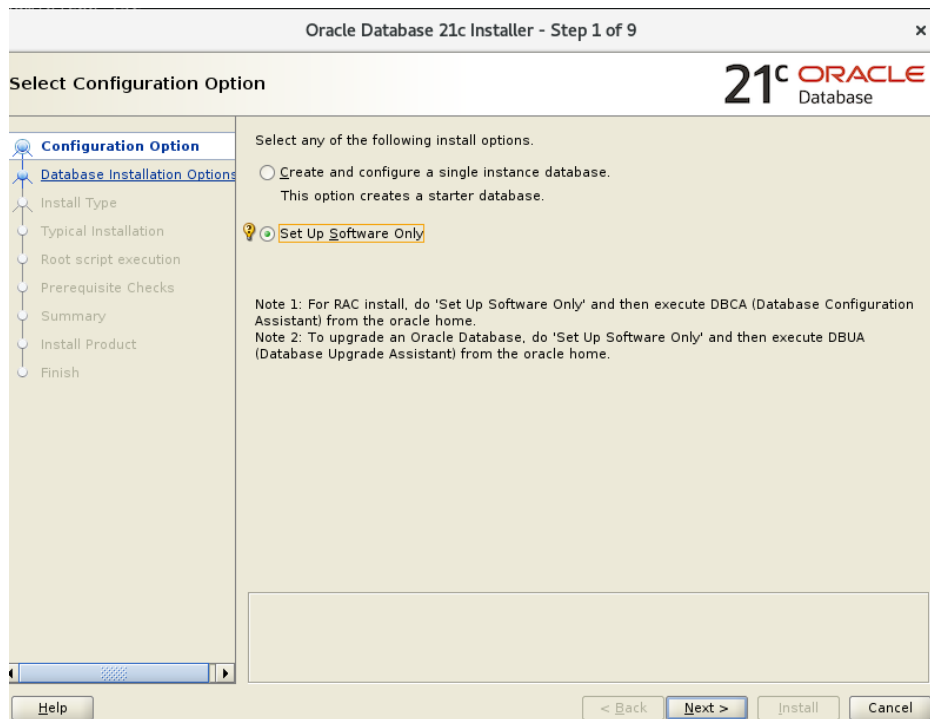
## Step 12 - Launch the database setup using ./runInstaller command



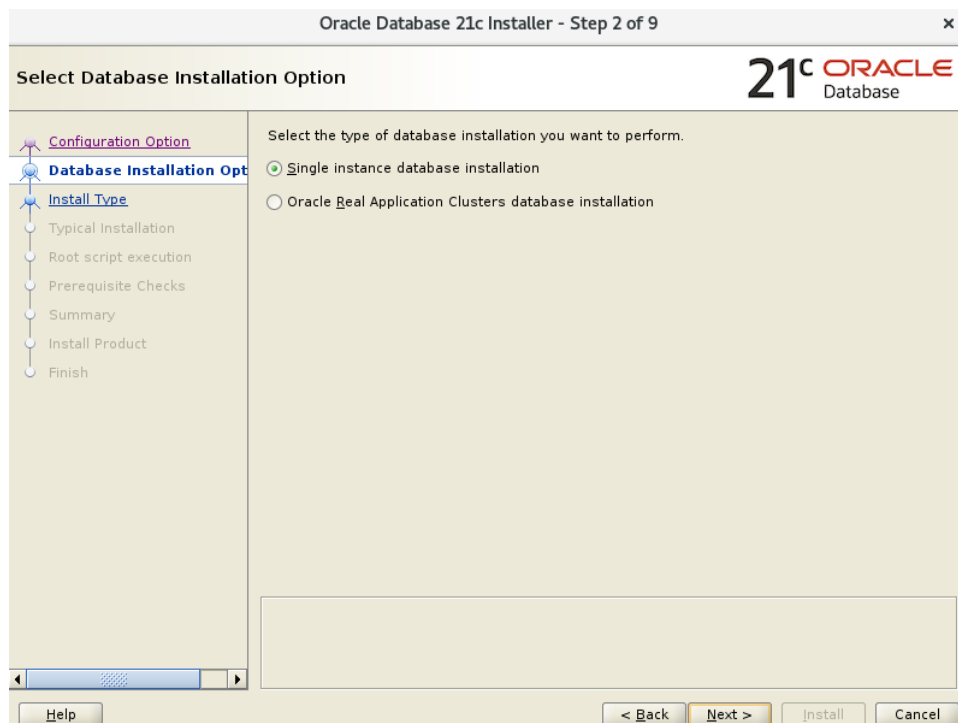
## Step 13 - Setup the oracle database The database setup will be launched after a few seconds. The database setup displays several steps to set up the database.

- Select 'Set Up Software Only' option in the configuration option step.

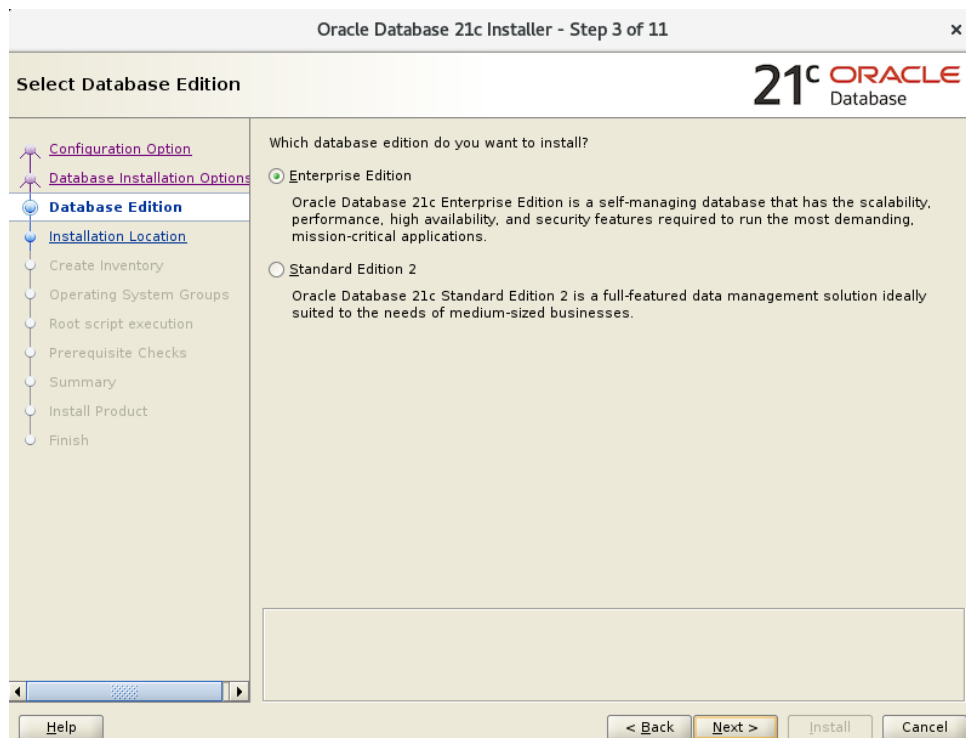




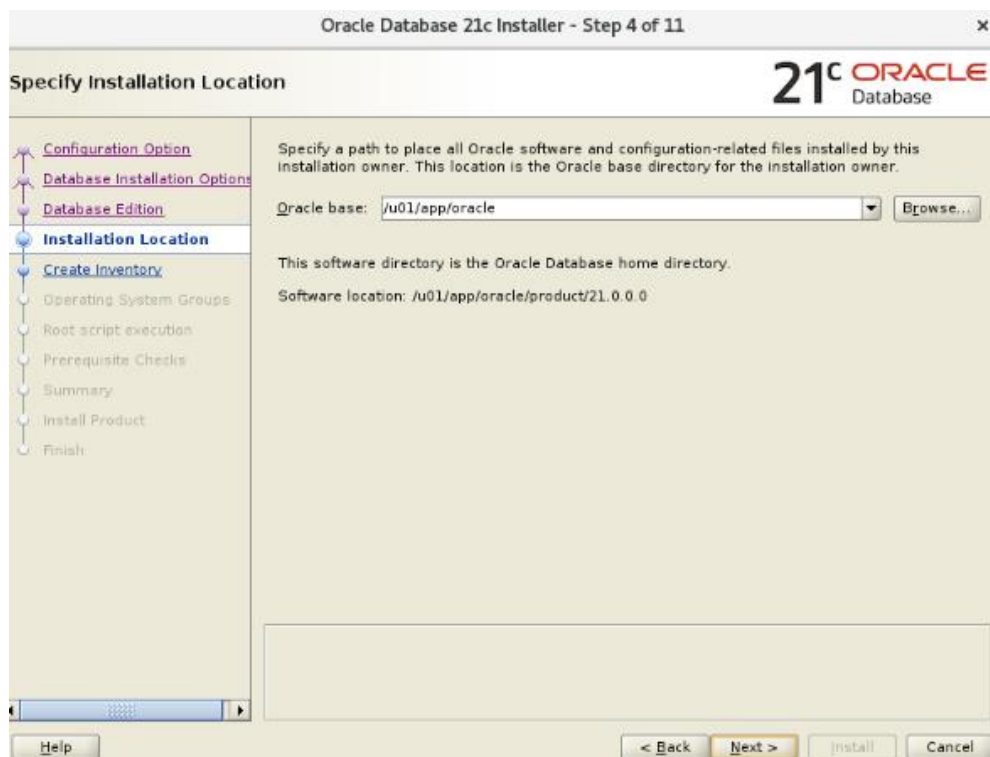
- Select 'Single Instance database installation' option



- Select the 'Enterprise Edition' as the Database edition.



- Set the path of the Oracle base.



- Set the path of the Inventory Directory.

Oracle Database 21c Installer - Step 5 of 11

### Create Inventory

**21c ORACLE Database**

You are starting your first installation on this host. Specify a directory for installation metadata files (for example, install log files). This directory is called the "inventory directory". The installer automatically sets up subdirectories for each product to contain inventory data. The subdirectory for each product typically requires 150 kilobytes of disk space.

Inventory Directory:

Specify an operating system group whose members have write permission to the inventory directory (orainventory).

orainventory Group Name:

- Select the corresponding Operating system groups from the drop-down options.

Oracle Database 21c Installer - Step 6 of 11

### Privileged Operating System groups

**21c ORACLE Database**

SYS privileges are required to create a database using operating system (OS) authentication. Membership in OS Groups grants the corresponding SYS privilege, eg. membership in OSDBA grants the SYSDBA privilege.

Database Administrator (OSDBA) group:

Database Operator (OSOPER) group (Optional):

Database Backup and Recovery (OSBACKUPDBA) group:

Data Guard administrative (OSDGDBA) group:

Encryption Key Management administrative (OSKMDBA) group:

Real Application Cluster administrative (OSRACDBA) group:

- Tick the 'Automatically run configuration scripts' option and enter the root user password.

Oracle Database 21c Installer - Step 7 of 11

### Root script execution configuration

**21c ORACLE Database**

During the software configuration, certain operations have to be performed as "root" user. You can choose to have the installer perform these operations automatically by specifying inputs for one of the options below. The input specified will also be used by the installer to perform additional prerequisite checks.

☒ **Automatically run configuration scripts**

☐ Use "root" user credential

Password :

☐ Use sudo

Program path :

User name :

Password :

- A summary page will be displayed of the set configurations.

Oracle Database 21c Installer - Step 9 of 11

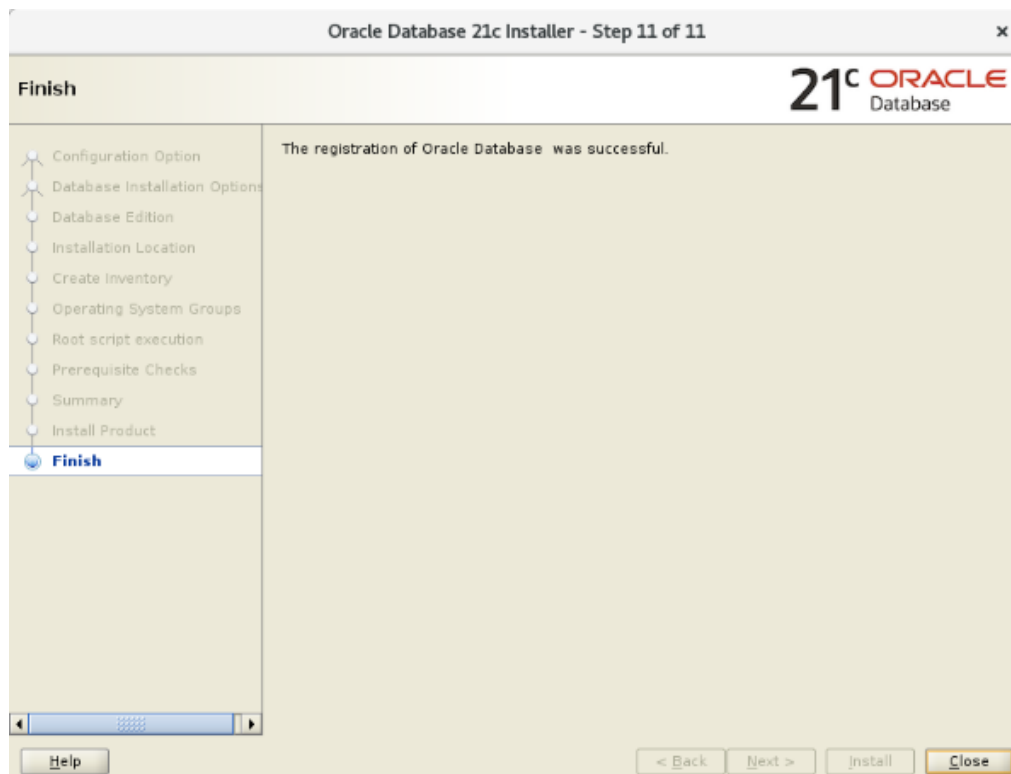
### Summary

**21c ORACLE Database**

**Oracle Database 21c Installer**

- Global settings**
  - Database edition: Enterprise Edition (Set Up Software Only) [\[Edit\]](#)
  - Oracle base: /u01/app/oracle [\[Edit\]](#)
  - Software location: /u01/app/oracle/product/21.0.0.0
  - Privileged Operating System groups: dba (OSDBA), oinstall (OSOPER), backupdba (OSBA)
  - Root script execution configuration: Manual configuration [\[Edit\]](#)
- Inventory information**
  - Inventory location: /u01/app/oralInventory [\[Edit\]](#)
  - oralInventory group: oinstall [\[Edit\]](#)

- The completion of the oracle database setup.



**Question 2** - Create CDB in non-archive log mode named using DBCA and create a PDB called PDBDASS.

Step 1 - Change the path to ./bin and start the database configuration using ./dbca command

Step 2 – Setup Database Configurations

- Select the 'Create a database option'

Database Configuration Assistant - Create a database - Step 2 of 14

### Select Database Creation Mode

**21<sup>c</sup> ORACLE Database**

- Database Operation
- Creation Mode**
- Deployment Type
- Database Identification
- Storage Option
- Fast Recovery Option
- Database Options
- Configuration Options
- Management Options
- User Credentials
- Creation Option
- Summary
- Progress Page
- Finish

☐ Typical configuration

Global database name:

Storage type:

Database files location:

Fast Recovery Area (FRA):

Database character set:

Administrative password:

Confirm password:

☒ Create as Container database

Pluggable database name:

☒ Advanced configuration

- Select advanced configuration.

Database Configuration Assistant - Create a database - Step 2 of 14

### Select Database Creation Mode

**21<sup>c</sup> ORACLE Database**

- Database Operation
- Creation Mode**
- Deployment Type
- Database Identification
- Storage Option
- Fast Recovery Option
- Database Options
- Configuration Options
- Management Options
- User Credentials
- Creation Option
- Summary
- Progress Page
- Finish

☐ Typical configuration

Global database name:

Storage type:

Database files location:

Fast Recovery Area (FRA):

Database character set:

Administrative password:

Confirm password:

☒ Create as Container database

Pluggable database name:

☒ Advanced configuration

- Deployment type.

Database Configuration Assistant - Create a database - Step 3 of 14

## Select Database Deployment Type

Select the type of database you want to create.

Database type:

Database Management Policy:

Select a template for your database.

Templates that include datafiles contain pre-created databases. They allow you to create a new database quickly. Use templates without datafiles only when necessary, such as when you need to change attributes like block size that cannot be altered after database creation.

	Template name	Include datafiles	Details
<input checked="" type="radio"/>	General Purpose or Transaction Processing	Yes	<a href="#">View details</a>
<input type="radio"/>	Custom Database	No	<a href="#">View details</a>
<input type="radio"/>	Data Warehouse	Yes	<a href="#">View details</a>

Template location: /u01/app/oracle/product/21.0.0.0/assistants/dbca/templates

- Database identification.  
change the Global database name into “Thisara” and change PDB name into “PDBDASS”.

Database Configuration Assistant - Create a database - Step 4 of 14

## Specify Database Identification Details

Provide a unique database identifier information. An Oracle database is uniquely identified by a Global database name, typically of the form "name.domain".

Global database name:

SID:

Service name:

☒ Create as Container database

A Container database can be used for consolidating multiple databases into a single database, and it enables database virtualization. A Container database (CDB) can have zero or more pluggable databases (PDB).

☒ Use Local Undo tablespace for PDBs

☐ Create an empty Container database

☒ Create a Container database with one or more PDBs

Number of PDBs:

PDB name:

- Storage option.

Database Configuration Assistant - Create 'Thisara' database - Step 5 of 14

### Select Database Storage Option

**21c ORACLE Database**

Database Operation  
Creation Mode  
Deployment Type  
Database Identification  
**Storage Option**  
Fast Recovery Option  
Database Options  
Configuration Options  
Management Options  
User Credentials  
Creation Option  
Summary  
Progress Page  
Finish

☒ Use template file for database storage attributes  
Storage type and location for database files will be picked up from the specified template (General Purpose or Transaction Processing).

☐ Use following for the database storage attributes  
All the database files will be put at the specified location below. You can customize the name and location of each datafile in the subsequent screen.

Database files storage type: File System

Database files location: {ORACLE\_BASE}/oradata/{DB\_UNIQUE\_NAME} Browse...

Oracle Managed files option will enable Oracle to automatically generate the names of the datafiles for simplified database management.

☐ Use Oracle-Managed Files (OMF) Multiplex redo logs and control files...

File location variables...

Help < Back Next > Finish Cancel

- Fast recovery option.  
Select specify fast recovery area.

Database Configuration Assistant - Create 'Thisara' database - Step 6 of 14

### Select Fast Recovery Option

**21c ORACLE Database**

Database Operation  
Creation Mode  
Deployment Type  
Database Identification  
Storage Option  
**Fast Recovery Option**  
Database Options  
Configuration Options  
Management Options  
User Credentials  
Creation Option  
Summary  
Progress Page  
Finish

Choose the recovery options for the database.

☒ Specify Fast Recovery Area

Recovery files storage type: File System

Fast Recovery Area: {ORACLE\_BASE}/fast\_recovery\_area/{DB\_UNIQUE\_NAME} Browse...

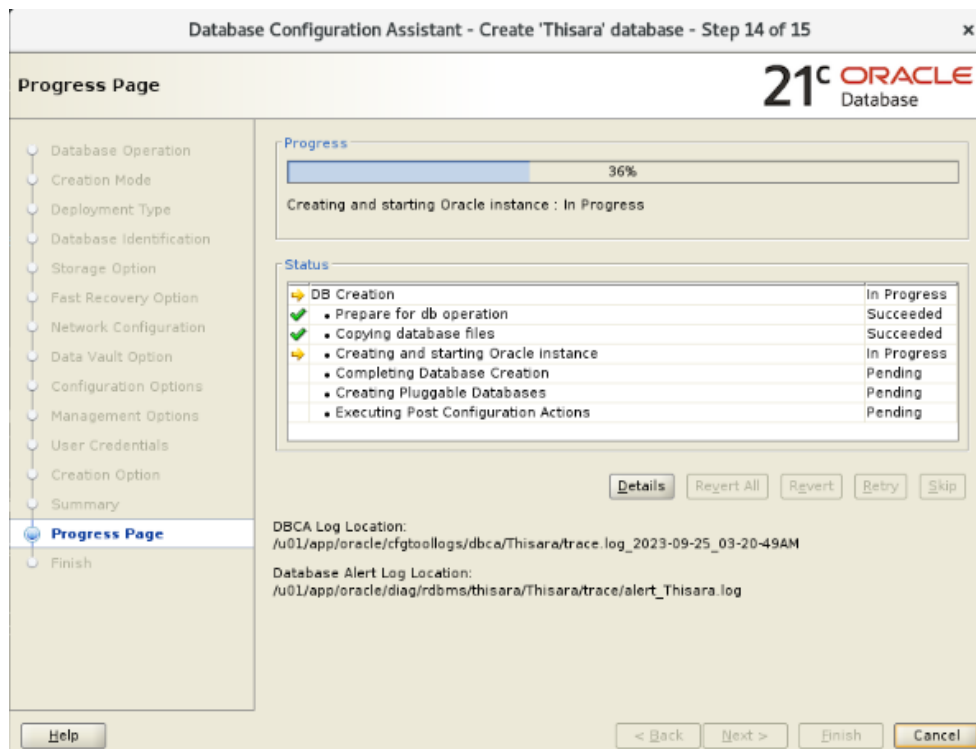
Fast Recovery Area size: 13896 MB

☐ Enable archiving Edit archive mode parameters...

Help < Back Next > Finish Cancel



- Progress page.



- Type sqlplus / as sysdba to use Oracle database.
- Successfully Connected to Oracle database 21c.

```

oracle@localhost:u01/app/oracle/product/21.0.0.0
File Edit View Search Terminal Help
bin      diagnostics  jdk      oml4py  plsql    schagent.conf  usm
clone    dv              jlib     OPatch  precomp  sdk            utl
crs       env.ora        ldap     opmn    python   slax           xdk
css       has            lib      oracore 00patch  sqldeveloper
ctx       hs             md       ord     R         sqlj
cv        install        mgw      ords    racg     sqlpatch
data     instantclient network oss      rdbms    sqlplus
dbs      inventory      nls      oui     relnotes  srvnm

[oracle@localhost 21.0.0.0]$ ./runInstaller
Launching Oracle Database Setup Wizard...

The response file for this session can be found at:
/u01/app/oracle/product/21.0.0.0/install/response/db_2023-09-25_01-27-29AM.rsp

You can find the log of this install session at:
/tmp/InstallActions2023-09-25_01-27-29AM/installActions2023-09-25_01-27-29AM.log
Moved the install session logs to:
/u01/app/oraInventory/logs/InstallActions2023-09-25_01-27-29AM
[oracle@localhost 21.0.0.0]$ dbca
[oracle@localhost 21.0.0.0]$ sqlplus / as sysdba

SQL*Plus: Release 21.0.0.0.0 - Production on Mon Sep 25 04:36:02 2023
Version 21.3.0.0.0

Copyright (c) 1982, 2021, Oracle. All rights reserved.

Connected to:
Oracle Database 21c Enterprise Edition Release 21.0.0.0.0 - Production
Version 21.3.0.0.0

SQL>

```

**Question 3** - Answer the following questions.

- (a) The database you created in question number 2 above uses a binary-type parameter file. When a parameter file is corrupted or missing how can you recover it and start the database?

Demonstrate your answer using your database.

```
[oracle@localhost 21.0.0.0]$ rman

Recovery Manager: Release 21.0.0.0.0 - Production on Mon Sep 25 04:44:45 2023
Version 21.3.0.0.0

Copyright (c) 1982, 2021, Oracle and/or its affiliates. All rights reserved.

RMAN> startup mount;

RMAN-00571: =====
RMAN-00569: ===== ERROR MESSAGE STACK FOLLOWS =====
RMAN-00571: =====
RMAN-03002: failure of startup command at 09/25/2023 04:46:17
RMAN-06171: not connected to target database

RMAN> connect target Thisara

target database Password:
connected to target database (not started)

RMAN> startup mount;

Oracle instance started
database mounted

Total System Global Area      1526725760 bytes

Fixed Size                     9686144 bytes
Variable Size                  956301312 bytes
Database Buffers               553648128 bytes
Redo Buffers                    7090176 bytes

RMAN>
```

```
RMAN> alter database archivelog;

Statement processed
```

```

RMAN> backup database plus archivelog;

Starting backup at 25-SEP-23
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=262 device type=DISK
specification does not match any archived log in the repository
backup cancelled because there are no files to backup
Finished backup at 25-SEP-23

Starting backup at 25-SEP-23
using channel ORA_DISK_1
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00001 name=/u01/app/oracle/oradata/THISARA/system01.dbf
input datafile file number=00003 name=/u01/app/oracle/oradata/THISARA/sysaux01.dbf
input datafile file number=00004 name=/u01/app/oracle/oradata/THISARA/undotbs01.dbf
input datafile file number=00007 name=/u01/app/oracle/oradata/THISARA/users01.dbf
channel ORA_DISK_1: starting piece 1 at 25-SEP-23
channel ORA_DISK_1: finished piece 1 at 25-SEP-23
piece handle=/home/oracle/THISARA/backupset/2023_09_25/o1_mf_nnndf_TAG20230925T045406_lk1k8pqw_.bkp tag=TAG20230925T045406 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:35
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00010 name=/u01/app/oracle/oradata/THISARA/PDBDASS/sysaux01.dbf
input datafile file number=00009 name=/u01/app/oracle/oradata/THISARA/PDBDASS/system01.dbf
input datafile file number=00011 name=/u01/app/oracle/oradata/THISARA/PDBDASS/undotbs01.dbf
input datafile file number=00012 name=/u01/app/oracle/oradata/THISARA/PDBDASS/users01.dbf
channel ORA_DISK_1: starting piece 1 at 25-SEP-23
channel ORA_DISK_1: finished piece 1 at 25-SEP-23
piece handle=/home/oracle/THISARA/0623B8A8FCE40F6E063017AA8C0151B/backupset/2023_09_25/o1_mf_nnndf_TAG20230925T045406_lk1k9sww_.bkp tag=TAG20230925T045406 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:15
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00008 name=/u01/app/oracle/oradata/THISARA/pdbseed/sysaux01.dbf
channel ORA_DISK_1: starting piece 1 at 25-SEP-23
channel ORA_DISK_1: finished piece 1 at 25-SEP-23
piece handle=/home/oracle/THISARA/0623A2278A1C3C37E063017AA8C0299B/backupset/2023_09_25/o1_mf_nnndf_TAG20230925T045406_lk1kbrlz_.bkp tag=TAG20230925T045406 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:15
Finished backup at 25-SEP-23

Starting backup at 25-SEP-23
using channel ORA_DISK_1
specification does not match any archived log in the repository
backup cancelled because there are no files to backup
Finished backup at 25-SEP-23

Starting Control File and SPFILE Autobackup at 25-SEP-23
piece handle=/home/oracle/THISARA/autobackup/2023_09_25/o1_mf_s_1148445869_lk1kbrlz_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 25-SEP-23

RMAN>

```

```

input datafile file number=00005 name=/u01/app/oracle/oradata/THISARA/pdbseed/system01.dbf
input datafile file number=00008 name=/u01/app/oracle/oradata/THISARA/pdbseed/undotbs01.dbf
channel ORA_DISK_1: starting piece 1 at 25-SEP-23
channel ORA_DISK_1: finished piece 1 at 25-SEP-23
piece handle=/home/oracle/THISARA/0623A2278A1C3C37E063017AA8C0299B/backupset/2023_09_25/o1_mf_nnndf_TAG20230925T045406_lk1kbrlz_.bkp tag=TAG20230925T045406 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:15
Finished backup at 25-SEP-23

Starting backup at 25-SEP-23
using channel ORA_DISK_1
specification does not match any archived log in the repository
backup cancelled because there are no files to backup
Finished backup at 25-SEP-23

Starting Control File and SPFILE Autobackup at 25-SEP-23
piece handle=/home/oracle/THISARA/autobackup/2023_09_25/o1_mf_s_1148445869_lk1kbrlz_.bkp comment=NONE
Finished Control File and SPFILE Autobackup at 25-SEP-23

RMAN>

```

```

RMAN> shutdown immediate

database dismounted
Oracle instance shut down

RMAN> exit

Recovery Manager complete.
[oracle@localhost 21.0.0.0]$

```

- Manually delete spfileThisara.ora
- This file is in the “u01/app/oracle/dbs”.

```
[oracle@localhost 21.0.0.0]$ rman
```

```
Recovery Manager: Release 21.0.0.0.0 - Production on Mon Sep 25 05:06:34 2023  
Version 21.3.0.0.0
```

```
Copyright (c) 1982, 2021, Oracle and/or its affiliates. All rights reserved.
```

```
RMAN> connect target Thisara
```

```
target database Password:  
connected to target database (not started)
```

```
RMAN> startup nomount;
```

```
startup failed: ORA-01078: failure in processing system parameters  
ORA-01565: error in identifying file '/u01/app/oracle/dbs/spfileThisara.ora'  
ORA-27037: unable to obtain file status  
Linux-x86_64 Error: 2: No such file or directory  
Additional information: 7
```

```
starting Oracle instance without parameter file for retrieval of spfile  
Oracle instance started
```

```
Total System Global Area      1073740480 bytes
```

```
Fixed Size                      9693888 bytes  
Variable Size                   276824064 bytes  
Database Buffers                780140544 bytes  
Redo Buffers                    7081984 bytes
```

```
RMAN> set DBID 230773994
```

```
executing command: SET DBID
```

```
RMAN> restore SPFILE from '/home/oracle/THISARA/autobackup/2023_09_25/o1_mf_s_1148445869_lk1kbrlz_.bkp';
```

```
Starting restore at 25-SEP-23  
using target database control file instead of recovery catalog  
allocated channel: ORA_DISK_1  
channel ORA_DISK_1: SID=184 device type=DISK
```

```
channel ORA_DISK_1: restoring spfile from AUTOBACKUP /home/oracle/THISARA/autobackup/2023_09_25/o1_mf_s_1148445869_lk1kbrlz_.bkp  
channel ORA_DISK_1: SPFILE restore from AUTOBACKUP complete  
Finished restore at 25-SEP-23
```

```
RMAN> shutdown immediate
```

```
Oracle instance shut down
```

```
RMAN> startup
```

```
connected to target database (not started)  
Oracle instance started  
database mounted  
database opened
```

```
Total System Global Area      1526725760 bytes
```

```
Fixed Size                      9686144 bytes  
Variable Size                   956301312 bytes  
Database Buffers                553648128 bytes  
Redo Buffers                    7090176 bytes
```

```
RMAN> select name,dbid from v$database;
```

```
NAME          DBID  
-----  
THISARA       230773994
```

(b) Increase the processes parameter by 10.

- Step 1: Log in to SQL PLUS as sysdba

```
[oracle@localhost 21.0.0.0]$ sqlplus / as sysdba

SQL*Plus: Release 21.0.0.0.0 - Production on Mon Sep 25 05:42:38 2023
Version 21.3.0.0.0

Copyright (c) 1982, 2021, Oracle. All rights reserved.

Connected to:
Oracle Database 21c Enterprise Edition Release 21.0.0.0.0 - Production
Version 21.3.0.0.0

SQL> show parameter sessions;
```

```
SQL> show parameter processes;
```

NAME	TYPE	VALUE
aq_tm_processes	integer	1
db_writer_processes	integer	1
gcs_server_processes	integer	0
global_txn_processes	integer	1
job_queue_processes	integer	40
log_archive_max_processes	integer	4
processes	integer	300

```
SQL> alter system set processes=310 scope=spfile;
```

```
System altered.
```

```
SQL> shutdown abort
```

```
ORACLE instance shut down.
```

```
SQL> startup
```

```
ORACLE instance started.
```

```
Total System Global Area 1526725784 bytes
```

```
Fixed Size 9686168 bytes
```

```
Variable Size 956301312 bytes
```

```
Database Buffers 553648128 bytes
```

```
Redo Buffers 7090176 bytes
```

```
Database mounted.
```

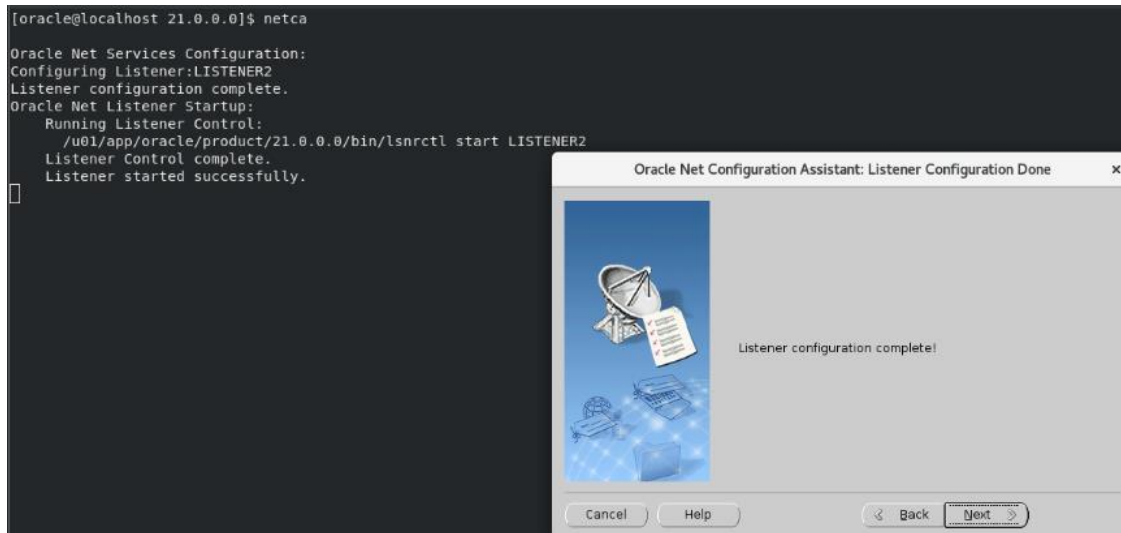
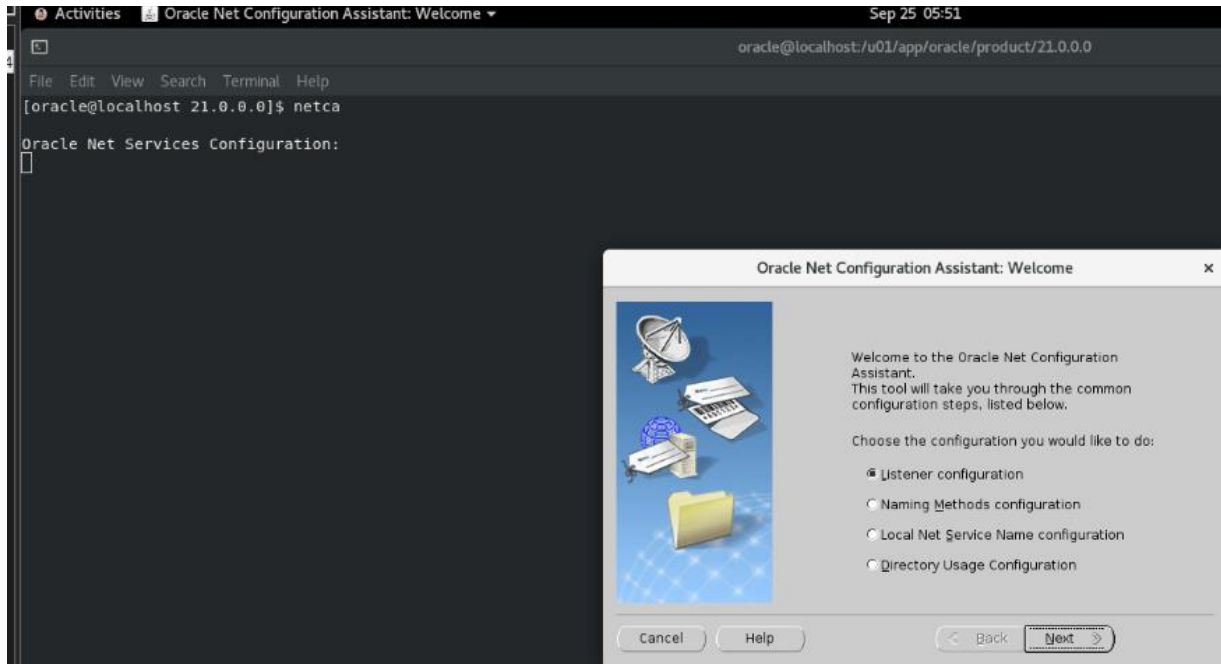
```
Database opened.
```

```
SQL> show parameter processes;
```

NAME	TYPE	VALUE
aq_tm_processes	integer	1
db_writer_processes	integer	1
gcs_server_processes	integer	0
global_txn_processes	integer	1
job_queue_processes	integer	40
log_archive_max_processes	integer	4
processes	integer	310

```
SQL>
```

(c) Create a new listener called LISTNER2 with port number 1522.



```

Oracle Linux 8 64-bit (3) - VMware Workstation
File Edit View VM Tabs Help
Library
Type here to search
My Computer
Oracle Linux 8 64-bit
Sep 25 05:56
oracle@localhost:~$ netca

Oracle Net Services Configuration:
Configuring Listener:LISTENER2
Listener configuration complete.
Oracle Net Listener Startup:
Running Listener Control:
/u01/app/oracle/product/21.0.0.0/bin/lsnrctl start LISTENER2
Listener Control complete.
Listener started successfully.
Oracle Net Services configuration successful. The exit code is 0
[oracle@localhost 21.0.0.0]$ ss -napt | grep 1521
ESTAB 0 0 192.168.122.1:49212 192.168.122.1:1521 users:((("ora_lreg_thisar",pid=18954,fd=9))
LISTEN 0 128 *:1521 *: users:((("tnslsnr",pid=14736,fd=9))
ESTAB 0 0 [::ffff:192.168.122.1]:1521 [::ffff:192.168.122.1]:49212 users:((("tnslsnr",pid=14736,fd=14))
[oracle@localhost 21.0.0.0]$ ss -napt | grep 1522
LISTEN 0 128 *:1522 *: users:((("tnslsnr",pid=19377,fd=9))
[oracle@localhost 21.0.0.0]$

```

**Question 4** - Create a new tablespace EXAMPLE1 of size 5 MB with one data file. After that, expand the tablespace size to 8MB by adding a new data file.

```

SQL> create tablespace EXAMPLE1 datafile '/u01/app/oracle/oradata/THISARA/EXAMPLE1_1.dbf' size 5M;

Tablespace created.

SQL> ALTER TABLESPACE EXAMPLE1
  2 ADD DATAFILE '//u01/app/oracle/oradata/THISARA/EXAMPLE1_2.dbf'
  3 SIZE 3M;

Tablespace altered.

SQL> select tablespace_name,bytes / 1024 / 1024 MB From dba_free_space Where tablespace_name = 'EXAMPLE1';

TABLESPACE_NAME          MB
-----
EXAMPLE1                  2
EXAMPLE1                  4

SQL>

```

**Question 5** - Write a report about database security features and their use in Oracle 19c or 21c. The word count is 300 words.

Oracle Database 19c and 21c are at the forefront of database technology, offering advanced features and capabilities to meet the evolving needs of modern organizations. In the era of data-centric operations, the importance of robust database security cannot be overstated.

#### 01. Authentication and Access Control

##### a) Role-based Access Control (RBAC):

Role-based access control (RBAC) in Oracle 19c/21c is a pivotal security feature that enables organizations to finely tune user access to their databases. It operates on the principle of assigning roles to users, each with specific privileges, rather than assigning privileges directly to users. Here's how RBAC is relevant to database security in Oracle 19c/21c:

- Granular Access Control:

RBAC provides a granular level of control over who can access what data and perform specific actions within the database. This granularity reduces the risk of unauthorized data access and helps organizations enforce the principle of least privilege.

- Simplified Administration:

RBAC simplifies user management and access control. Instead of managing individual user privileges, administrators can create roles with appropriate permissions and assign users to these roles, making access control more manageable and reducing the risk of errors.

##### b) Privilege Analysis:

Privilege analysis is a security feature that assists in identifying and managing unnecessary or unused privileges within the database. Here's its relevance:

- Enhancing Security:

Privilege analysis enhances security by identifying privileges that are no longer necessary for a user's role. Unnecessary privileges can be revoked, reducing the potential attack surface and minimizing the risk of privilege abuse or unauthorized access.

- Optimizing Performance:

By eliminating unused privileges, privilege analysis can also improve database performance since it reduces the overhead associated with unnecessary access controls.

##### c) Multifactor Authentication (MFA):

- Multifactor authentication (MFA) is a robust authentication mechanism that requires users to provide multiple forms of verification to access the database. Its relevance lies in:



- **Strengthening User Authentication:**  
MFA enhances database security by requiring users to provide multiple forms of verification, such as a password, a smart card, a fingerprint, or a one-time code. This makes it significantly harder for malicious actors to gain unauthorized access, even if they obtain one authentication factor.
  - **Protecting Against Credential Theft:**  
MFA mitigates the risk of credential theft, as even if an attacker manages to steal a password, they would still need the second factor for access.
- d) **Oracle Label Security (OLS):**  
Oracle Label Security (OLS) is a specialized feature for organizations with strict data classification and access control requirements. Its relevance includes:
- **Data Labeling and Access Control:**  
OLS enforces data labeling and access controls based on data classifications. This is particularly valuable for organizations dealing with sensitive or classified information, as it ensures that data is accessed only by users with the appropriate security labels.
  - **Compliance Assurance:**  
OLS helps organizations adhere to regulatory compliance requirements by providing a robust framework for data classification and access control, making it an essential feature for industries with stringent compliance mandates.

## 02. Data Encryption

- e) **Transparent Data Encryption (TDE):**  
Transparent Data Encryption (TDE) is a fundamental security feature in Oracle 19c/21c that ensures the confidentiality of data at rest. Its relevance includes:
- **Preventing Unauthorized Access:**  
TDE encrypts data stored on disk, preventing unauthorized access to sensitive information even if physical storage devices are compromised.
  - **Regulatory Compliance:**  
TDE helps organizations meet regulatory compliance requirements by safeguarding sensitive data, which is particularly crucial for industries dealing with sensitive customer information, financial data, or healthcare records.
- f) **Data Redaction:**

Data Redaction is another crucial feature in Oracle 19c/21c that helps protect data confidentiality while allowing controlled access:

- **Confidentiality Control:**  
Data Redaction allows organizations to mask or partially obscure sensitive data based on user privileges, ensuring that only authorized users see complete information while protecting sensitive data from unauthorized viewing.
- **Data Privacy Compliance:**  
It assists in complying with data privacy regulations, such as GDPR, by enabling organizations to share data while protecting individual privacy.

g) **Encryption of Backup Data:**

The encryption of backup data in Oracle 19c/21c is significant for ensuring the security of data during backup and restore operations:

- **Backup Data Security:**  
Encrypting backup data prevents unauthorized access to sensitive information during backup and restore processes, safeguarding data both at rest and during data transfer.
- **Disaster Recovery:**  
Encrypted backups enhance disaster recovery strategies by ensuring that backed-up data remains secure, even if backup files are lost or stolen.

h) **Integration with Hardware Security Modules (HSM):**

Integration with Hardware Security Modules (HSMs) in Oracle 19c/21c is crucial for securing encryption keys:

- **Key Security:**  
HSM integration adds an extra layer of security by safeguarding encryption keys in dedicated, tamper-resistant hardware devices, making it extremely difficult for attackers to access or tamper with the keys.

- **Regulatory Compliance:**  
It helps meet compliance requirements that mandate strong key management practices, as HSMs are often required for storing cryptographic keys securely.