Appendix A
Practices and Solutions

Table of Contents

The paper practices for this lesson are embedded in the lesson itself, to facilitate reviewing the database architecture for yourself and in class. Below are possible answers.

Practice 1-1: Reviewing the Database Architecture

For page 1-3: **Naming the Core Components of an Oracle Database Server**

1) The two main components of a basic Oracle Database system: instance and database.

2) The Instance consists of memory structures and background processes.

3) The three major structures in Oracle Database server architecture are: memory structures, process structures and storage structures.

4) A session is a connection between the user login and the database instance.

5) The graphic on slide 1-4 is the answer to the task on slide 1-3

For page 1-7: **Naming the Memory Structures of an Oracle Database**

1) Which are the components of the PGA: stack space and user global area.

2) Name the main components of the SGA:

   - Shared pool

   - Database buffer cache

   - Redo log buffer

   - Large pool

   - Java pool

   - Streams pool

   - Keep buffer pool

   - Recycle buffer pool

   - nK buffer pool

3) The graphic on slide 1-8 is the answer to the task on slide 1-7.

For page 1-14: **Adding Process Names**

1) The DBWn process writes the dirty buffers to the data files.

2) The LGWR process writes the redo entries to the online redo log files.

3) The CKPT process writes checkpoint information in the control file and each data file header.

4) The SMON process performs recovery on instance startup.

5) The PMON process performs process recovery when a user process fails.

6) The RECO process resolves in-doubt distributed transactions.

7) The ARCn processes copy redo log files to a designated storage device.

General Practice Note: To reduce clutter in the output, product banners, space lines and other repeating information is only shown when they first appear. Later, they are removed to not distract from the essence of a practice.

Practice 2-1: Configuring ARCHIVELOG Mode

In this practice, you configure your database to archive redo logs before reusing them.

1) Set up the environment for the ORCL database, using the oraenv script, and enter orcl when prompted for ORACLE_SID. If it is already set up for orcl (that is, you see orcl in the brackets), press Enter.

   Note: This command is a period, followed by a space, and then the oraenv script name.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1 is
/u01/app/oracle
```

2) Use labs as your working directory. Unless otherwise indicated, always work from that directory.

```
$ cd ~/labs
```

3) Determine the archive mode your database is running in now.

```
$ sqlplus / as sysdba
SQL*Plus: Release 11.2.0.1.0 Production on Tue Jul 21 14:32:29
2009

Copyright (c) 1982, 2009, Oracle.  All rights reserved.

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

SQL> archive log list
Database log mode              No Archive Mode
Automatic archival             Disabled
Archive destination            USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence     6
Current log sequence           8
SQL>
```

Note that it is running in NOARCHIVELOG mode.

Practice 2-1: Configuring ARCHIVELOG Mode (continued)

4) Because you can change the ARCHIVELOG mode only when the database is mounted, shut down the database.

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

5) Mount the database.

```
SQL> startup mount
ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337324 bytes
Variable Size             339740692 bytes
Database Buffers          134217728 bytes
Redo Buffers                5963776 bytes
Database mounted.
SQL>
```

6) Alter the database to use ARCHIVELOG mode.

```
SQL> alter database archivelog;

Database altered.

SQL>
```

7) Open the database.

```
SQL> alter database open;

Database altered.

SQL>
```

Practice 2-2: Resizing the Flash Recovery Area

In this practice, you enlarge the Flash Recovery Area.

1) Determine how big the Flash Recovery Area is now.

```
SQL> show parameter recovery_file_dest_size

NAME                                   TYPE        VALUE
                                                          -----
db_recovery_file_dest_size             big integer 4062M
SQL>
```

Note that it is 4062 MB or 4 GB in size.

2) How big *could* the Flash Recovery Area be?

a) Determine where the Flash Recovery Area is located.

```
SQL> show parameter recovery_file_dest

NAME                                   TYPE        VALUE
-------------------------------------- ----------- ----------------
db_recovery_file_dest                  string      +FRA
db_recovery_file_dest_size             big integer 4062
SQL>
```

Note that the Flash Recovery Area is in the FRA disk group.

Do not exit from your SQL*Plus session.
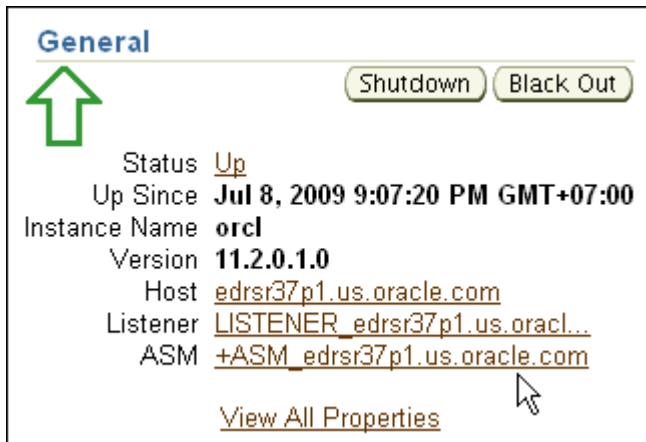
3) Use the https://<hostname>:1158/em URL to log into Enterprise Manager, as the SYS user with the oracle_4U password, and connect as SYSDBA.

Note: The first time that you are using a newly configured machine, you may be asked to add a security exception. The exact formulation and number of pages depends on your web browser. Follow the prompts and add the exception in the training environment.

Note 2: Also if Enterprise Manager shows, that the database is down, wait a minute and refresh the page. (This can occur due to the time intervals in which the database agent works.)

4) On the database home page, click the +ASM_<hostname> link.

Practice 2-2: Resizing the Flash Recovery Area (continued)

General

Shutdown | Black Out

Status **Up**
Up Since **Jul 8, 2009 9:07:20 PM GMT+07:00**
Instance Name **orcl**
Version **11.2.0.1.0**
Host edrsr37p1.us.oracle.com
Listener LISTENER_edrsr37p1.us.oracl...
ASM +ASM_edrsr37p1.us.oracle.com

View All Properties

5) Click the Disk Groups tab.
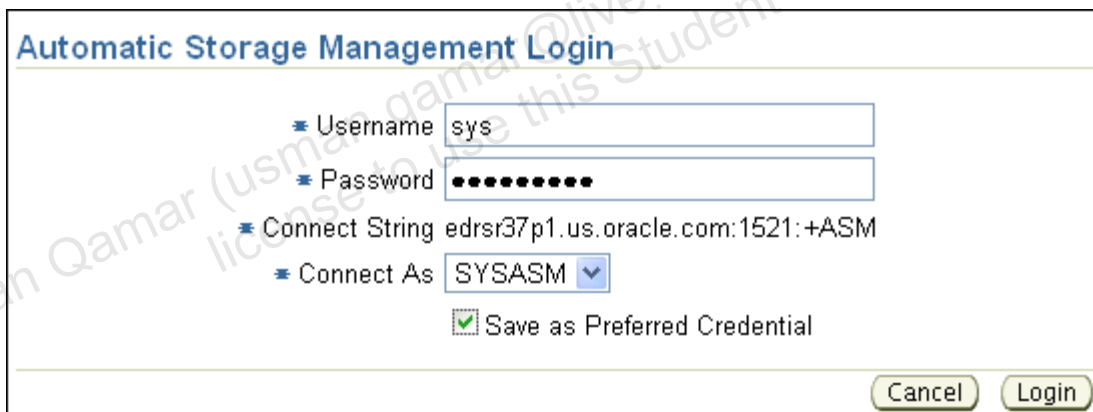
Automatic Storage Management: +ASM_edrsr37p1.us.oracle.com

| Home | Performance | Disk Groups | Configuration | Users | ASM Cluster File System |

6) If prompted for ASM login credentials, enter `sys` as username and `oracle_4U` as password. Connect as `SYSASM`, click "Save as Preferred Credential", and then click Login.

Automatic Storage Management Login

* Username `sys`
* Password `••••••••`
* Connect String edrsr37p1.us.oracle.com:1521:+ASM
* Connect As `SYSASM`
  ☑ Save as Preferred Credential

Cancel | Login

7) When the disk group list appears, note the Usable Free column for the `FRA` disk group.

Practice 2-2: Resizing the Flash Recovery Area (continued)

Automatic Storage Management: +ASM_edrsr37p1.us.oracle.com

Home   Performance   **Disk Groups**   Configuration   Users   ASM Cluster File System

(Create)   (Mount All)   (Dismount All)

(Mount)   (Dismount)   (Rebalance)   (Check)   (Delete)

Select All | Select None

Select	Name △	State	Redundancy	Size (GB)	Used (GB)	Used (%)	Usable Free (GB)	Member Disks
☐	DATA	MOUNTED	NORMAL	9.00	3.50	38.92	2.31	4
☐	FRA	MOUNTED	EXTERN	9.00	0.11	1.25	8.89	4

☑ **TIP** The usable free space specifies the amount of space that can be safely used for data. A value above zero means that redundancy can be properly restored after a disk failure.

☑ **TIP** Mount All and Dismount All operation will only mount and dismount the disk groups specified in the Auto Mount Disk Groups parameter.

Note that the FRA disk group has enough usable free space to enlarge the Flash Recovery Area considerably, although your displayed values may be a little different.

8) Change the Flash Recovery Area size to 6 GB.

a) Navigate to Database > Availability > Recovery Settings and change the Flash Recovery Area Size to 6 GB.

Flash Recovery

This database is using a flash recovery area. The chart shows space used by each file type that is not reclaimable by Oracle. Performing backups to tertiary storage is one way to make space reclaimable. Usable Flash Recovery Area includes free and reclaimable space.

Flash Recovery Area Location   +FRA

Flash Recovery Area Size   6   GB ▼

Flash Recovery Area Size must be set when the location is set.

Non-reclaimable Flash Recovery Area (B)   0

Reclaimable Flash Recovery Area (B)   0

Free Flash Recovery Area (GB)   3.97

b) Click Show SQL, and note the SQL that will be run. This is important to know because if the Flash Recovery Area is having sizing problems, you may not be able to run Enterprise Manager to change it.

```
ALTER SYSTEM SET db_recovery_file_dest_size = 6442450944 SCOPE=BOTH
```

c) Click Return, and then click Apply.

Practice 2-2: Resizing the Flash Recovery Area (continued)

9) Verify the size of the Flash Recovery Area by using SQL*Plus. Then exit your SQL*Plus session.

```
SQL> show parameter recovery_file_dest_size

NAME                                 TYPE        VALUE
------------------------------------ ----------- -------------
db_recovery_file_dest_size           big integer 6G

SQL> exit
Disconnected from Oracle Database 11g Enterprise Edition
Release 11.2.0.1.0 - Production
With the Partitioning, Automatic Storage Management, OLAP,
Data Mining
and Real Application Testing options
```

Practice 2-3: Verifying the Backup Destination

In this practice, you test the backup destination to see where backups are written.

Use the `oraenv` script to ensure you are still using the `orcl` instance in your terminal session.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

1) Start RMAN.

```
$ rman target /

Recovery Manager: Release 11.2.0.1.0 - Production on Tue Jul
21 14:52:20 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All
rights reserved.

connected to target database: ORCL (DBID=1220535480)
RMAN>
```

2) See if the control files are automatically backed up.

```
RMAN> show CONTROLFILE AUTOBACKUP;

using target database control file instead of recovery catalog
RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE CONTROLFILE AUTOBACKUP OFF; # default

RMAN>
```

Note that automatic backup is not enabled.

3) Configure RMAN to automatically back up the control file when any backups are done.

```
RMAN> configure controlfile autobackup on;

new RMAN configuration parameters:
CONFIGURE CONTROLFILE AUTOBACKUP ON;
new RMAN configuration parameters are successfully stored

RMAN>
```

4) List the database files in your schema, to understand which file you back up in the next task.

```
RMAN> report schema;

Report of database schema for database with db_unique_name
ORCL

List of Permanent Datafiles
```

Practice 2-3: Verifying the Backup Destination (continued)

```
==========================
File Size(MB) Tablespace           RB segs Datafile Name
---- -------- ------------------- ------- -------------------
-----
1   680      SYSTEM              YES
+DATA/orcl/datafile/system.256.692754557
2   590      SYSAUX              NO
+DATA/orcl/datafile/sysaux.257.692754559
3   100      UNDOTBS1            YES
+DATA/orcl/datafile/undotbs1.258.692754561
4   5        USERS               NO
+DATA/orcl/datafile/users.259.692754561
5   100      EXAMPLE             NO
+DATA/orcl/datafile/example.265.692754837

List of Temporary Files
=======================
File Size(MB) Tablespace       Maxsize(MB) Tempfile Name
---- -------- -------------- ----------- ----------------------
1   28       TEMP             32767       +DATA/orcl/temp01.dbf

RMAN>
```

Note: If you are not connected to the recovery catalog, the RB segs column contains *** as a value. It contains the YES and NO values when you are connected to the recovery catalog.

5) Which tablespace is stored in file 5?

Answer: The EXAMPLE tablespace

6) Take a backup of data file 5, and note where the backup is written, then exit.

```
RMAN> backup datafile 5;

Starting backup at 21-JUL-09
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=55 device type=DISK
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00005
name=+DATA/orcl/datafile/example.265.692754837
channel ORA_DISK_1: starting piece 1 at 21-JUL-09
channel ORA_DISK_1: finished piece 1 at 21-JUL-09
piece
handle=+FRA/orcl/backupset/2009_07_21/nnndf0_tag20090721t14535
8_0.260.692808839 tag=TAG20090721T145358 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:15
```

```
Finished backup at 21-JUL-09

Starting Control File and SPFILE Autobackup at 21-JUL-09
piece
handle=+FRA/orcl/autobackup/2009_07_21/s_692808854.261.6928088
57 comment=NONE
Finished Control File and SPFILE Autobackup at 21-JUL-09
RMAN>
RMAN> exit
```

Note that the backup file is written to the FRA.

Practice 2-4: Configuring the Retention Policy

In this practice, you change the retention policy for backups.
Note that the default retention policy in Oracle Database 11*g* Release 2 is already set to redundancy 1. So this practice is for training purposes only.

1) Use the `oraenv` script to ensure that you are still using the ORCL instance in your terminal session.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

2) Return to the RMAN session (or if you closed it, start a new one) and show the current retention policy setting.

```
$ rman target /
RMAN> show retention policy;

RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
RMAN>
```

3) If your redundancy is 1, go to step 5 and exit. If your redundancy had another value, change it to ensure that one copy of each file is backed up.

```
RMAN> configure retention policy to redundancy 1;

old RMAN configuration parameters:
CONFIGURE RETENTION POLICY TO NONE;
new RMAN configuration parameters:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1;
new RMAN configuration parameters are successfully stored

RMAN>
```

4) Check the retention policy setting again.

```
RMAN> show retention policy;

RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1;
```

5) Exit RMAN.

```
RMAN> exit

Recovery Manager complete.
```

Practice 3-1: Creating a Recovery Catalog

In this practice, you create a recovery catalog.

1) Use DBCA to start the process of creating a recovery catalog database.

```
$ dbca
```

2) On the Welcome page, click Next.

3) On the Operations page, select the Create a Database option, and then click Next.

4) On the Database Templates page, leave the default of General Purpose or Transaction Processing, and then click Next.

5) On the Database Identification page, enter the name of the recovery catalog database. Use **rcat.example.com** as the Global Database Name. Then click Next.

An Oracle database is uniquely identified by a Global Database Name, typically of the form "name.domain".

Global Database Name: rcat.example.com

A database is referenced by at least one Oracle instance which is uniquely identified from any other instance on this computer by an Oracle System Identifier (SID).

SID: rcat

6) On the Management Options page, deselect the Configure Enterprise Manager option, and then click the Automatic Maintenance Tasks tab.

Enterprise Manager | Automatic Maintenance Tasks

☐ Configure Enterprise Manager

○ Register with Grid Control for centralized management

Management Service   No Agents Found

◉ Configure Database Control for local management

7) On the Automatic Maintenance Tasks page, deselect "Enable automatic maintenance tasks" and then click Next.

Practice 3-1: Creating a Recovery Catalog (continued)

| Enterprise Manager | Automatic Maintenance Tasks |

Oracle Database 11g provides the ability to automatically manage maintenance tasks such as optimizer statistics collection and proactive advisor reports. These tasks are run in a predefined maintenance window and their CPU consumption is throttled to prevent them from interfering with normal user work. The default maintenance windows are 10: 00 PM – 2:00 AM on weekdays, and all weekend long. These defaults can be changed using Enterprise Manager at any time.

☐ Enable automatic maintenance tasks

8) On the Database Credentials page, select the option Use the Same Administrative Password for All Accounts. Then enter `oracle_4U` in the password fields and click Next.

For security reasons, you must specify passwords for the following user accounts in the new database.

○ Use Different Administrative Passwords

User Name	Password	Confirm Password
SYS		
SYSTEM		

◉ Use the Same Administrative Password for All Accounts
Password: ●●●●●●●●●
Confirm Password: ●●●●●●●●●

Cancel   Help   Back   Next

9) On the Database File Locations Page, select **Automatic Storage Management (ASM)** as Storage Type. Click Use Common Location for All Database Files and then use the Browse button to select the +**DATA** disk group, and click OK.
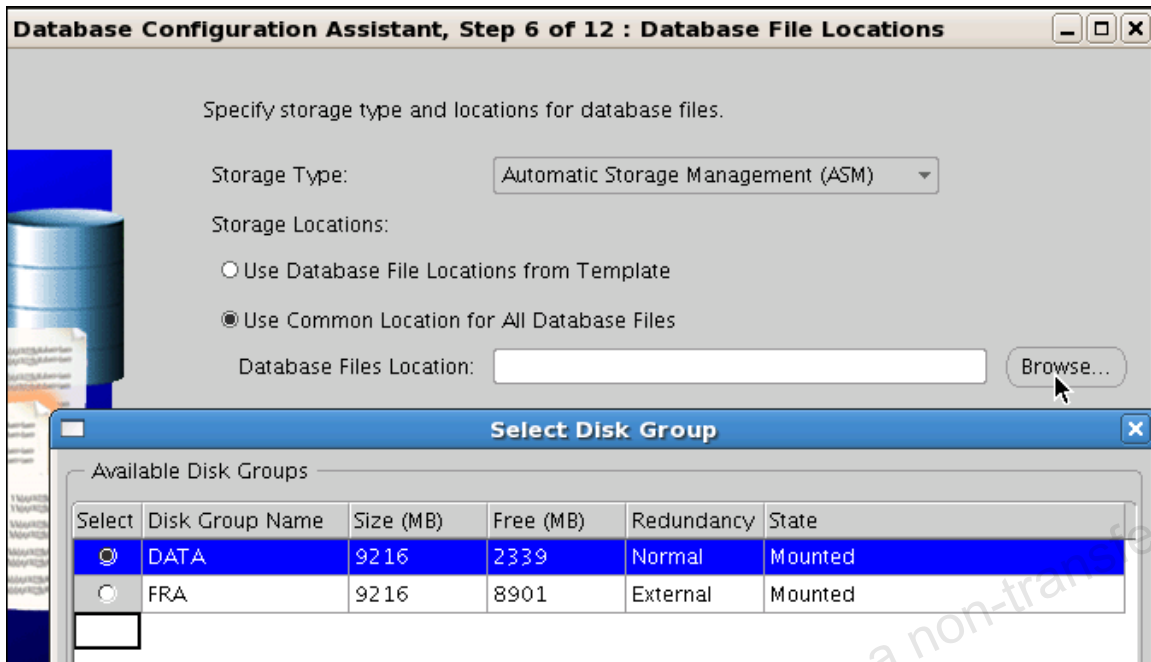
10) Then click Next.

11) On the Recovery Configuration page, select **Specify Flash Recovery Area**, use the Browse button to select the **+FRA** diskgroup (click OK) and ensure that the Flash Recovery Area Size is **4062 M Bytes**. Then click Next.
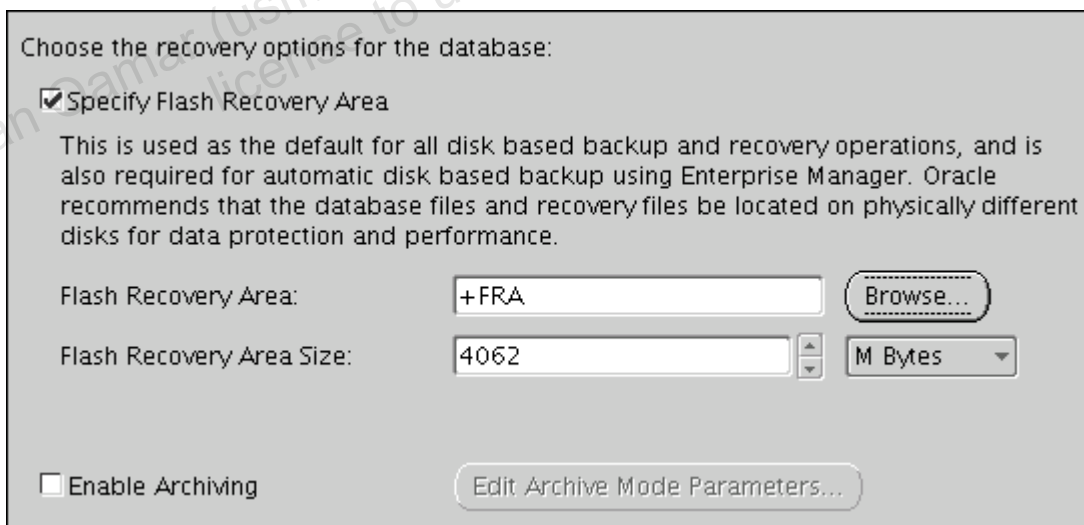
12) On the Database Content page, confirm that the Sample Schemas option is not selected, and then click Next.

Practice 3-1: Creating a Recovery Catalog (continued)
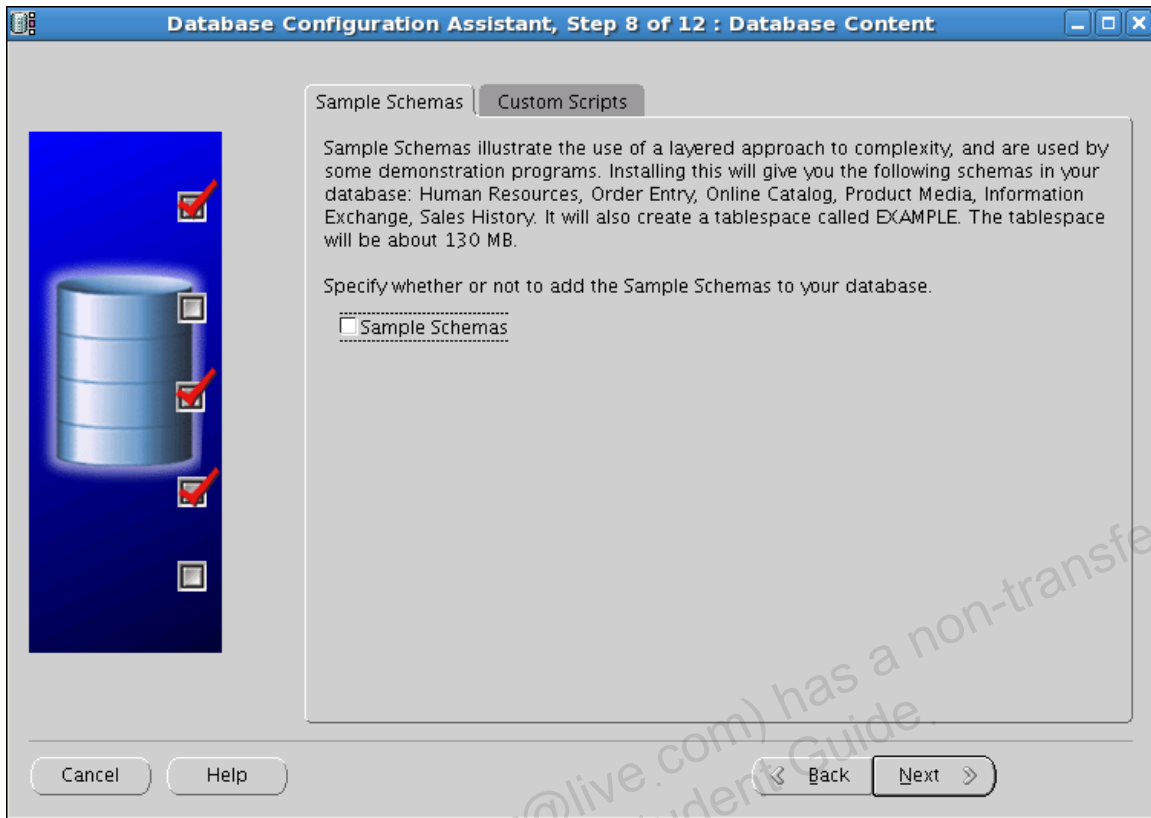
13) On the Initialization Parameter page, set the memory size to **303 MB**, click **Use Automatic Memory Management**, and then click the Character Sets tab.
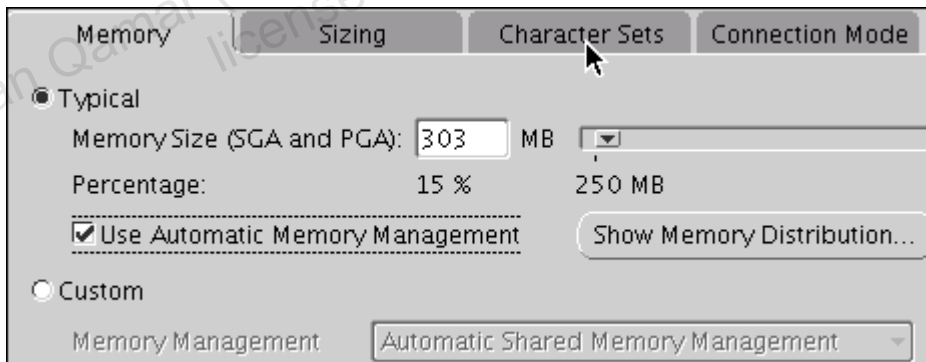
14) Click **Use Unicode (AL32UTF8)** and then click Next.

15) If the Security Settings page appears, keep the defaults, and then click Next.

16) On the Database Storage page, review the configuration, and then click Next.

17) On the Creation Options page, make sure that Create Database is the only option selected, and then click Finish.

Practice 3-1: Creating a Recovery Catalog (continued)
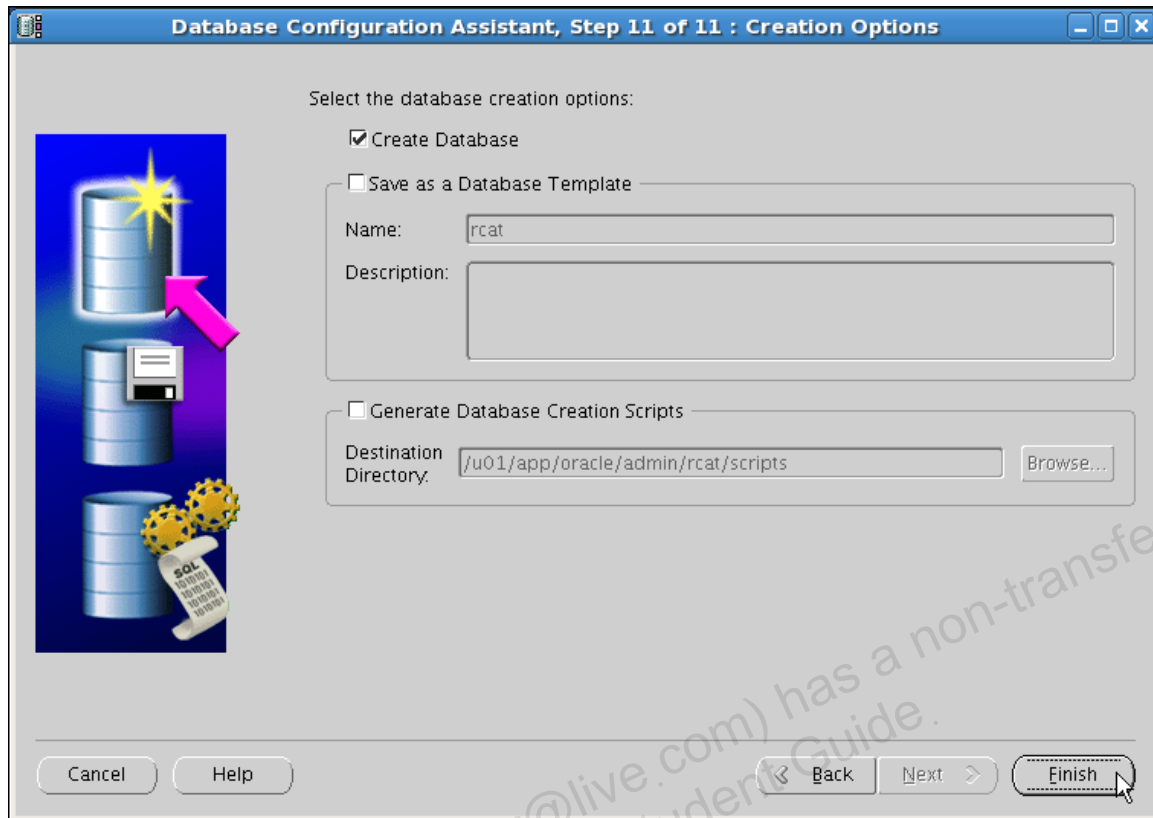
18) Review the Confirmation page, and then click OK to start the database creation process.

Confirmation

The following operations will be performed:
A database called "rcat" will be created.

Database Details:

Create Database – Summary

Database Configuration Summary

Global Database Name:	rcat.example.com
Database Configuration Type:	Oracle Restart Enabled Single Instance
SID:	rcat
Management Option Type:	None
Storage Type:	Automatic Storage Management (ASM)
Memory Configuration Type:	Automatic Memory Management

Database Configuration Details

Database Components

Component	Selected
Oracle JVM	true
Oracle Text	true
Oracle XML DB	true

Save as an HTML file...

OK   Cancel   Help

19) The Database Creation Assistant now creates the database.

Practice 3-1: Creating a Recovery Catalog (continued)
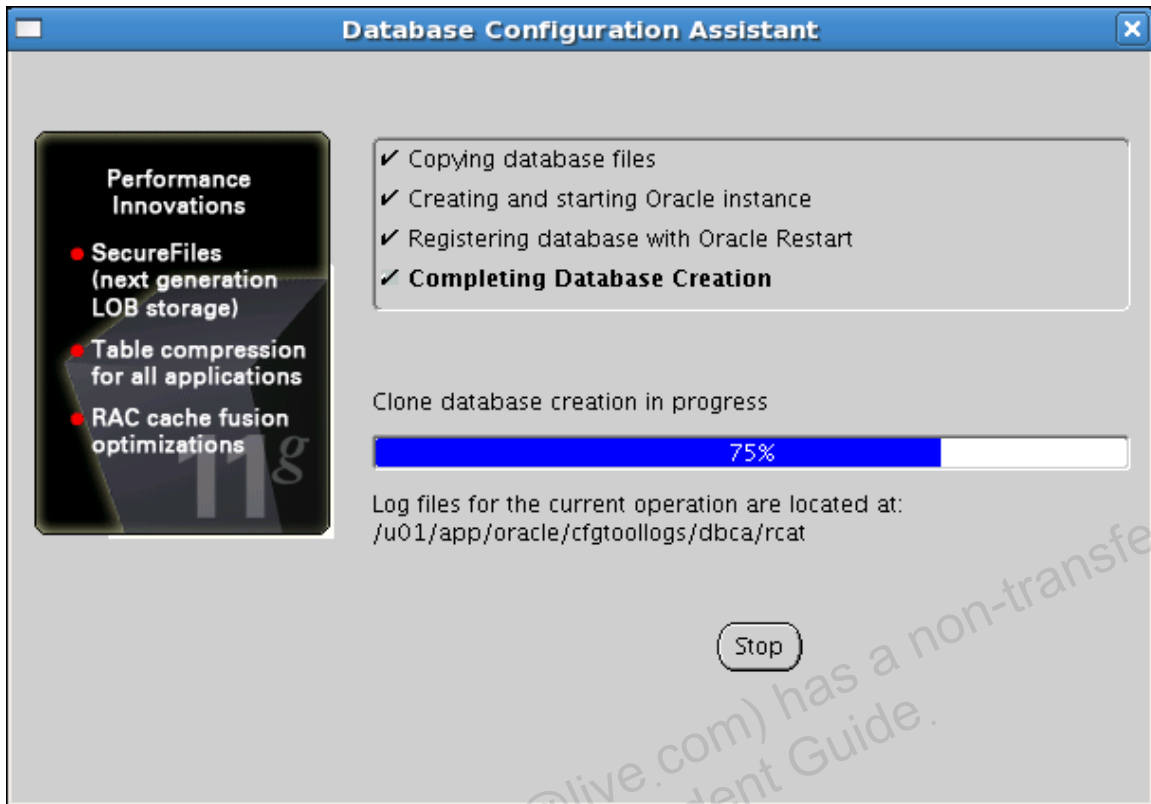
20) When the Database Configuration Assistant finishes running, view the final page, and then click Exit.
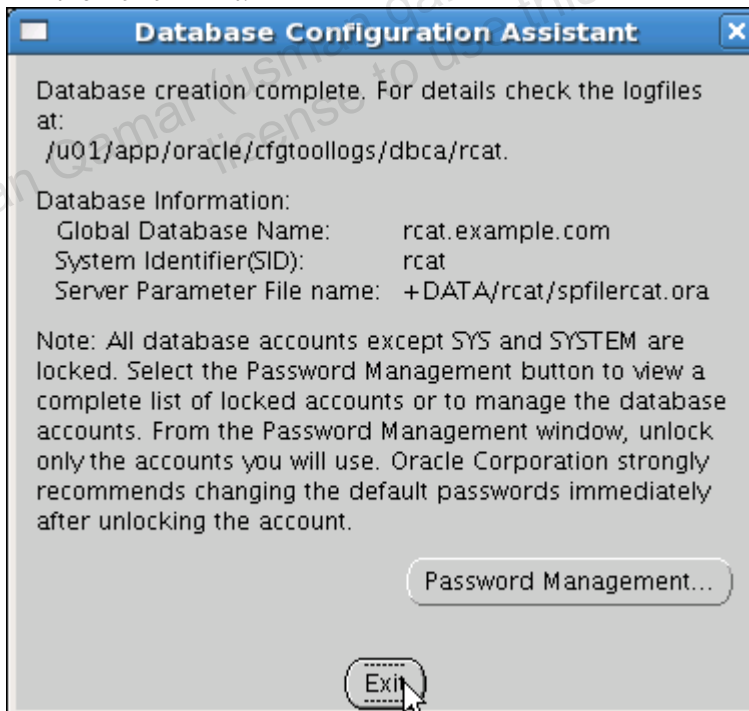
Practice 3-2: Creating the Recovery Catalog Owner

In this practice, you configure the recovery catalog database with a user ID and appropriate privileges, and register a database.

1) Use SQL*Plus to configure the recovery catalog database. Connect to it as SYS to the RCAT database.

```
$ sqlplus sys as sysdba

Enter password: oracle_4U@rcat    <<<not displayed

SQL>
```

2) Create a tablespace named RCAT to hold the repository data. Make it 15 MB in size.

```
SQL> CREATE TABLESPACE rcat DATAFILE '+DATA/rcat01.dbf' SIZE 15M;

Tablespace created.

SQL>
```

3) Create a user who will own the recovery catalog data. Name the user RCATOWNER. The default tablespace should be the RCAT tablespace, and the user should have unlimited quota on that tablespace.

```
SQL> CREATE USER rcatowner IDENTIFIED BY "oracle_4U"
  2 DEFAULT TABLESPACE rcat QUOTA unlimited on rcat;

User created.

SQL>
```

4) Grant the RECOVERY_CATALOG_OWNER role to the RCATOWNER user.

```
SQL> GRANT recovery_catalog_owner to rcatowner;

Grant succeeded.
SQL> exit
```

.

Practice 3-3: Creating the Recovery Catalog

In this practice, you create the recovery catalog inside the recovery catalog database you have prepared.

1) Connect to the recovery catalog database using RMAN. Log in as the recovery catalog owner you just created.

```
$ rman catalog rcatowner@rcat

Recovery Manager: Release 11.2.0.1.0 - Production on Fri Jul
10 19:54:04 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All
rights reserved.

recovery catalog database Password:oracle_4U <<<not displayed
connected to recovery catalog database

RMAN>
```

2) Create the recovery catalog. This command may take several minutes to complete.

```
RMAN> create catalog;

recovery catalog created

RMAN> exit
```

Practice 3-4: Registering a Database in the Recovery Catalog

In this practice, you register the ORCL database in the recovery catalog that you have just created.

1) Set up the environment for the ORCL database.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

2) Connect to the target database (to be registered) and the recovery catalog database using RMAN.

```
$ rman target / catalog rcatowner@rcat

Recovery Manager: Release 11.2.0.1.0 - Production on Tue Jul
21 15:30:32 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All
rights reserved.

connected to target database: ORCL (DBID=1220535480)
recovery catalog database Password:oracle_4U <<<not displayed
connected to recovery catalog database

RMAN>
```

3) Register the database in the catalog.

```
RMAN> register database;

database registered in recovery catalog
starting full resync of recovery catalog
full resync complete

RMAN> exit
```

4) Register the recovery catalog to be used by Enterprise Manager.

   a) In EM, navigate to Availability > Recovery Catalog Settings.

   b) Click Add Recovery Catalog.

   c) Enter the following information, then click Next:

Practice 3-4: Registering a Database in the Recovery Catalog (continued)

Host: <*your_hostname*>
Port: **1521**
SID: **rcat**
Recovery Catalog Username: **rcatowner**
Recovery Catalog Password: **oracle_4U**

Database Instance: orcl.example.com > Recovery Catalogs >

(Cancel) (Next)

Add Recovery Catalog: Database

Specify the host, port, and SID of a database with an existing recovery catalog along with the recovery catalog username and password. The recovery catalog should be stored in a dedicated database that is on a different disk than the target database. Protect the recovery catalog by backing it up.

* Host | edrsr37p1
* Port | 1521
* SID | rcat
* Recovery Catalog Username | rcatowner
* Recovery Catalog Password | ●●●●●●●●●

d) On the Review page, click Finish.

Add Recovery Catalog: Review

(Cancel) (Finish)

Finish

The recovery catalog database will be configured in Enterprise Manager.

Recovery Catalog Database   edrsr37p1:1521:rcat
Recovery Catalog User   rcatowner

e) Back on the Recovery Catalog Settings page, select Use Recovery Catalog. Make sure that the recovery catalog you just registered is selected in the drop-down list, and enter the following values:

Recovery Catalog Username: **rcatowner**
Recovery Catalog Password: **oracle_4U**

Username: **oracle**
Password: **oracle**

Practice 3-4: Registering a Database in the Recovery Catalog (continued)

Use Control File

Keep RMAN Records (days) 7

Specify how long to keep RMAN records in the control file before they can be reused.

● Use Recovery Catalog

Recovery Catalog edrsr37p1:1521:rcat-rcatowner ▼ [Add Recovery Catalog]

✴ Recovery Catalog Username rcatowner

✴ Recovery Catalog Password ●●●●●●●●●

Host username and password is required if your database is not registered with the selected catalog.

✴ Username oracle

✴ Password ●●●●●●

☑ Save as Preferred Credential

f)   Click Save as Preferred Credential and then click OK.

Practice 3-5: Backing up the Recovery Catalog

In this practice, you configure the retention policy for the recovery catalog and back up
your recovery catalog itself.

1) Set up the environment for the ORCL database.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

2) Start RMAN, use the recovery catalog database as the target, with no catalog
specified.

```
$ rman target sys@rcat

target database Password: oracle_4U <<< not displayed
connected to target database: RCAT (DBID= 464959795)

RMAN>
```

3) Make sure that the retention policy for the recovery catalog is set to redundancy
greater than 1. If it is not, set it to at least 2.

```
RMAN> show retention policy;

using target database control file instead of recovery catalog
RMAN configuration parameters for database with db_unique_name
RCAT are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default

RMAN> configure retention policy to redundancy 2;

new RMAN configuration parameters:
CONFIGURE RETENTION POLICY TO REDUNDANCY 2;
new RMAN configuration parameters are successfully stored

RMAN>
```

4) Try to back up the database.

```
RMAN> backup database;

Starting backup at 18-JUL-07
ORACLE error from target database:
ORA-00258: manual archiving in NOARCHIVELOG mode must identify
log

using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=137 device type=DISK
specification does not match any archived log in the recovery
catalog
backup cancelled because all files were skipped
```

```
Finished backup at 18-JUL-07

Starting backup at 18-JUL-07
using channel ORA_DISK_1
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
RMAN-00571:
===========================================================
RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS
===============
RMAN-00571:
===========================================================
RMAN-03002: failure of backup plus archivelog command at
07/18/2007 22:55:45
ORA-19602: cannot backup or copy active file in NOARCHIVELOG
mode

RMAN>
```

Note that you cannot back up an open database that is not in ARCHIVELOG mode.
The recovery catalog database should be run in ARCHIVELOG mode for maximum
availability.

5) Exit RMAN.

```
RMAN> exit
```

6) First, set up the environment for the RCAT database and then run the
   rcat_to_archivelog.sh script to change the recovery catalog database to
   run in ARCHIVELOG mode.

```
$ . oraenv
ORACLE_SID = [orcl] ? rcat

$ cd ~/labs
$ ./rcat_to_archivelog.sh
Database closed.
Database dismounted.
ORACLE instance shut down.
ORACLE instance started.

Total System Global Area  263639040 bytes
Fixed Size                  1299164 bytes
Variable Size             230690084 bytes
Database Buffers           25165824 bytes
Redo Buffers                6483968 bytes
Database mounted.

Database altered.
Database altered.
$
```

7) Set up the environment for the ORCL database.

```
$ . oraenv
ORACLE_SID = [rcat] ? orcl
```

8) Log in to RMAN again, as in the preceding step.

```
$ rman target sys@rcat

target database Password: oracle_4U <<< not displayed
connected to target database: RCAT (DBID= 464959795)

RMAN>
```

9) Back up the recovery catalog database. This time the operation should be
   successful.

```
RMAN> backup database;

Starting backup at 21-JUL-09
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=40 device type=DISK
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=+DATA/rcat/system01.dbf
input datafile file number=00002 name=+DATA/rcat/sysaux01.dbf
input datafile file number=00003 name=+DATA/rcat/undotbs01.dbf
input datafile file number=00005 name=+DATA/rcat01.dbf
input datafile file number=00004 name=+DATA/rcat/users01.dbf
channel ORA_DISK_1: starting piece 1 at 21-JUL-09
channel ORA_DISK_1: finished piece 1 at 21-JUL-09
piece
handle=+FRA/rcat/backupset/2009_07_21/nnndf0_tag20090721t15532
5_0.263.692812405 tag=TAG20090721T155325 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:02:37
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
including current control file in backup set
including current SPFILE in backup set
channel ORA_DISK_1: starting piece 1 at 21-JUL-09
channel ORA_DISK_1: finished piece 1 at 21-JUL-09
piece
handle=+FRA/rcat/backupset/2009_07_21/ncsnf0_tag20090721t15532
5_0.264.692812569 tag=TAG20090721T155325 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:03
Finished backup at 21-JUL-09

RMAN> exit
```

10) Run the disable_asynch_io.sh script to disable asynchronous input/output (I/O). After altering the system, the database is restarted. This improves performance on the following labs:

```
$ ~/labs/disable_asynch_io.sh
Setting up ORCL environment.
ORACLE_SID = [orcl] ? The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1 is
/u01/app/oracle

SQL*Plus: Release 11.2.0.1.0 Production on Tue Jul 21 15:58:51
2009

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

SQL>
System altered.

SQL>
System altered.

SQL> Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337324 bytes
Variable Size             360712212 bytes
Database Buffers          113246208 bytes
Redo Buffers                5963776 bytes
Database mounted.
Database opened.
SQL> Disconnected from Oracle Database 11g Enterprise Edition
Release 11.2.0.1.0 - Production
With the Partitioning, Automatic Storage Management, OLAP,
Data Mining
and Real Application Testing options
```

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Practice 4-1: Setting the Date and Time Format for RMAN

In this practice, you set the date/time format that RMAN uses for displaying timestamps.

1) Set the NLS_LANG and NLS_DATE_FORMAT variables such that RMAN includes
    time information in any timestamp values. Add the following two lines to the
    ~oracle/.bashrc file. Then exit all of your terminal windows. This ensures that
    when you create new ones, these settings will be in effect.

```
export NLS_LANG=american_america.al32utf8
export NLS_DATE_FORMAT="yyyy-mm-dd:hh24:mi:ss"
```

2) Start a new terminal window, and verify the settings by starting RMAN and listing
    the backups of the recovery catalog database.

    a) Set up the environment for the ORCL database.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

    b) Log in to RMAN.

```
$ rman target sys@rcat

target database Password: oracle_4U <<< not displayed
connected to target database: RCAT (DBID= 464959795)
```

    c) List the backups, and note the timestamp format.

```
RMAN> list backup;
using target database control file instead of recovery catalog

List of Backup Sets
===================

BS Key  Type LV Size         Device Type Elapsed Time Completion
Time
------- ---- -- ---------- ----------- ------------ ----------
---------
1       Full    9.36M       DISK        00:00:06     2009-07-
21:15:42:05
        BP Key: 1   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T154159
        Piece Name:
+FRA/rcat/backupset/2009_07_21/ncsnf0_tag20090721t154159_0.262
.692811721
   SPFILE Included: Modification time: 2009-07-21:15:32:47
   SPFILE db_unique_name: RCAT
```

Practice 4-1: Setting the Date and Time Format for RMAN (continued)

```
   Control File Included: Ckp SCN: 803770      Ckp time: 2009-
07-21:15:41:59


.
.
.
RMAN>
```

Note: Because the output of the RMAN commands can be quite long, consider using the RMAN SPOOL LOG command to direct the output to your specified file.

Practice 4-2: Enabling Control File Autobackup

In this practice, you configure RMAN to back up the control file and SPFILE each time it takes a backup of anything in the RCAT database.

1) In the same recovery catalog RMAN session, make sure that control file autobackup is enabled.

```
RMAN> show controlfile autobackup;

RMAN configuration parameters for database with db_unique_name
RCAT are:
CONFIGURE CONTROLFILE AUTOBACKUP OFF; # default

RMAN>
```

2) Enable control file autobackup.

```
RMAN> configure controlfile autobackup on;

new RMAN configuration parameters:
CONFIGURE CONTROLFILE AUTOBACKUP ON;
new RMAN configuration parameters are successfully stored

RMAN>
```

3) Verify that it is enabled by backing up the archive logs for the recovery catalog. Then exit RMAN.

```
RMAN> backup archivelog all;

Starting backup at 2009-07-21:16:22:10
current log archived
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=47 device type=DISK
channel ORA_DISK_1: starting archived log backup set
channel ORA_DISK_1: specifying archived log(s) in backup set
input archived log thread=1 sequence=5 RECID=1 STAMP=692814135
channel ORA_DISK_1: starting piece 1 at 2009-07-21:16:22:18
channel ORA_DISK_1: finished piece 1 at 2009-07-21:16:22:21
piece
handle=+FRA/rcat/backupset/2009_07_21/annnf0_tag20090721t16221
6_0.266.692814139 tag=TAG20090721T162216 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:04
Finished backup at 2009-07-21:16:22:21

Starting Control File and SPFILE Autobackup at 2009-07-
21:16:22:21
piece
handle=+FRA/rcat/autobackup/2009_07_21/s_692814141.267.6928141
45 comment=NONE
Finished Control File and SPFILE Autobackup at 2009-07-
21:16:22:28
```

Practice 4-2: Enabling Control File Autobackup (continued)

```
RMAN> exit
```

Note that the control file and SPFILE are automatically backed up now.

Practice 4-3: Configuring Devices for Backup

In this practice, you configure a tape device for use in making backups.
Note: This channel definition is used in the RMAN monitoring and tuning practice.
Therefore, steps 1-4 are mandatory; step 5 (performing a backup) is recommended, but optional.

1) Make sure the SID variable is set to ORCL.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

2) Start RMAN by connecting to the ORCL as the target database and using the recovery catalog database.

```
$ rman target / catalog rcatowner@rcat

recovery catalog database Password: oracle_4U <<<not displayed
RMAN>
```

3) Show all configuration settings to see whether there are any tape devices defined.

```
RMAN> show all;

RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
CONFIGURE BACKUP OPTIMIZATION OFF; # default
CONFIGURE DEFAULT DEVICE TYPE TO DISK; # default
CONFIGURE CONTROLFILE AUTOBACKUP ON;
CONFIGURE CONTROLFILE AUTOBACKUP FORMAT FOR DEVICE TYPE DISK
TO '%F'; # default
CONFIGURE DEVICE TYPE DISK PARALLELISM 1 BACKUP TYPE TO
BACKUPSET; # default
CONFIGURE DATAFILE BACKUP COPIES FOR DEVICE TYPE DISK TO 1; #
default
CONFIGURE ARCHIVELOG BACKUP COPIES FOR DEVICE TYPE DISK TO 1;
# default
CONFIGURE MAXSETSIZE TO UNLIMITED; # default
CONFIGURE ENCRYPTION FOR DATABASE OFF; # default
CONFIGURE ENCRYPTION ALGORITHM 'AES128'; # default
CONFIGURE COMPRESSION ALGORITHM 'BASIC' AS OF RELEASE
'DEFAULT' OPTIMIZE FOR LOAD TRUE ; # default
CONFIGURE ARCHIVELOG DELETION POLICY TO NONE; # default
CONFIGURE SNAPSHOT CONTROLFILE NAME TO
'/u01/app/oracle/product/11.2.0/dbhome_1/dbs/snapcf_orcl.f'; #
default

RMAN>
```

Note that there are no tape devices.

4) Define a channel for a tape device that uses the test interface. This actually writes to disk in the /tape directory.

Practice 4-3: Configuring Devices for Backup (continued)

```
RMAN> configure channel device type sbt
2> parms='SBT_LIBRARY=oracle.disksbt,ENV=(BACKUP_DIR=/tape)';

new RMAN configuration parameters:
CONFIGURE CHANNEL DEVICE TYPE 'SBT_TAPE' PARMS
'SBT_LIBRARY=oracle.disksbt,ENV=(BACKUP_DIR=/tape)';
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

RMAN>
```

5) Perform a backup to the tape device to make sure it works. Back up the USERS tablespace. Then exit RMAN.

```
RMAN> backup device type sbt tablespace users;

Starting backup at 2009-07-21:16:32:09
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=53 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: WARNING: Oracle Test Disk API
channel ORA_SBT_TAPE_1: starting full datafile backup set
channel ORA_SBT_TAPE_1: specifying datafile(s) in backup set
input datafile file number=00004
name=+DATA/orcl/datafile/users.259.692754561
channel ORA_SBT_TAPE_1: starting piece 1 at 2009-07-
21:16:32:10
channel ORA_SBT_TAPE_1: finished piece 1 at 2009-07-
21:16:32:11
piece handle=05kkn0sa_1_1 tag=TAG20090721T163210 comment=API
Version 2.0,MMS Version 8.1.3.0
channel ORA_SBT_TAPE_1: backup set complete, elapsed time:
00:00:01
Finished backup at 2009-07-21:16:32:11

Starting Control File and SPFILE Autobackup at 2009-07-
21:16:32:11
piece handle=c-1220535480-20090721-02 comment=API Version
2.0,MMS Version 8.1.3.0
Finished Control File and SPFILE Autobackup at 2009-07-
21:16:32:16

RMAN> exit
```

Note that it uses a channel called ORA_SBT_TAPE_1 to perform the backup.

Practice 5-1: Creating Fast Incremental Backups

In this practice, you enable block change tracking so that you can make incremental backups more quickly.

1) Use Enterprise Manager Database Control to configure backup optimization and enable block change tracking. Allow a default block change tracking file to be used.

a) From the Database home page of EM, navigate to Availability > Backup Settings > Policy, and enable backup optimization and block change tracking.

Database Instance: orcl.us.oracle.com >

Backup Settings

Device   Backup Set   **Policy**

Backup Policy

☑ Automatically backup the control file and server parameter file (SPFILE) with every backup and database structural change

Autobackup Disk Location [   ]

An existing directory or diskgroup name where the control file and server parameter file will be backed up. If you do not specify a location, the files will be backed up to the flash recovery area location.

☑ Optimize the whole database backup by skipping unchanged files such as read-only and offline datafiles that have been backed up

☑ Enable block change tracking for faster incremental backups

Block Change Tracking File [   ]

Specify a location and file, otherwise an Oracle managed file will be created in the database area.

b) Click OK.

c) If you see the following error, you have not entered the operating system credentials. Continue with the following steps if that is the case.

ⓧ **Validation Error**

Examine and correct the following errors, then retry the operation:

Error - Please specify a username.

d) Scroll to the bottom of the page, and enter `oracle` as username and `oracle` as password. Also, select the option to save this as the preferred credential.

Host Credentials

To save the backup settings, supply operating system login credentials to access the target database.

⊗ * Username   `oracle`

Please specify a username.

* Password   `******`

☑ Save as Preferred Credential

e) Click OK.

2) Make sure that the ORACLE_SID variable is set to ORCL.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

3) Log in to RMAN and create an incremental level 0 backup.

```
$ rman target / catalog rcatowner@rcat

recovery catalog database Password: oracle_4U <<<not displayed

RMAN> backup incremental level 0 database plus archivelog;

starting full resync of recovery catalog
full resync complete
.
.
.
piece
handle=+FRA/orcl/backupset/2009_07_21/annnf0_tag20090721t19055
7_0.273.692823957 tag=TAG20090721T190557 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:03
Finished backup at 21-JUL-09

Starting Control File and SPFILE Autobackup at 21-JUL-09
piece
handle=+FRA/orcl/autobackup/2009_07_21/s_692823962.274.6928239
65 comment=NONE
Finished Control File and SPFILE Autobackup at 21-JUL-09

RMAN>
```

4) Now that you have a level 0 incremental backup, you can take advantage of block change tracking to make fast incremental backups. Take a level 1 incremental backup.

```
RMAN> backup incremental level 1 database plus archivelog;

Starting backup at 21-JUL-09
current log archived
using channel ORA_DISK_1
.
.
```

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Practice 5-1: Creating Fast Incremental Backups (continued)

```
.
Finished Control File and SPFILE Autobackup at 21-JUL-09

RMAN>
```

5) In another terminal window, make sure you are at the ~/labs directory.

```
$ cd ~/labs
```

6) Review and execute the query_block_count.sh script to query
V$BACKUP_DATAFILE to see how many of the blocks were read for creating the
level 1 incremental backup.

```
$ cat query_block_count.sh
export ORACLE_SID=orcl
sqlplus / as sysdba <<-EOI
  select file#, avg(datafile_blocks),
    avg(blocks_read),
    avg(blocks_read/datafile_blocks) * 100 as
PCT_READ_FOR_BACKUP,
    avg(blocks)
  from v\$backup_datafile
  where used_change_tracking = 'YES'
    and incremental_level > 0
    group by file#;
  quit
EOI

$./query_block_count.sh

SQL>   2    3    4    5    6    7    8
     FILE# AVG(DATAFILE_BLOCKS) AVG(BLOCKS_READ)
PCT_READ_FOR_BACKUP AVG(BLOCKS)
---------- -------------------- ---------------- -------------
------ -----------
         1                87040              173
.198759191          34
         2                75520              957
1.26721398         344
         5                12800                1
.0078125            1
         4                  640                1
.15625              1
         3                12800              311
2.4296875           96
$
```

Note that the percentage of blocks read for making the backup is very low in most cases,
and sometimes very close to zero.

Practice 5-2: Cross-Checking Backups

In this practice, you cross-check backups against the recovery catalog, identifying and deleting any backups that are obsolete.

1) Make sure that you are at the ~/labs directory, and that the ORACLE_SID variable is set to ORCL.

```
$ cd ~/labs
$ . oraenv
ORACLE_SID = [orcl] ? orcl
```

2) Use the RMAN session from the previous practice or start RMAN. Make sure that you connect to both your target database and the recovery catalog database.

```
$ rman target / catalog rcatowner@rcat

connected to target database: ORCL (DBID=1220535480)
recovery catalog database Password: oracle_4U <<<not displayed
connected to recovery catalog database

RMAN>
```

3) List backups of data file 5, noting the entry corresponding to the example data file.

```
RMAN> list backup of datafile 5;

BS Key  Type LV Size        Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ -------------------
37      Full    68.99M      DISK         00:00:13    2009-07-21:14:54:11
        BP Key: 40   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T145358
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndf0_tag20090721t145358_0.260.692808839
  List of Datafiles in backup set 37
  File LV Type Ckp SCN    Ckp Time            Name
  ---- -- ---- ---------- ------------------- ----
  5       Full 908595     2009-07-21:14:53:59
+DATA/orcl/datafile/example.265.692754837

BS Key  Type LV Size        Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ -------------------
172     Incr 0  1.07G       DISK         00:02:47    2009-07-21:19:05:44
        BP Key: 176  Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T190255
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndn0_tag20090721t190255_0.271.692823777
  List of Datafiles in backup set 172
  File LV Type Ckp SCN    Ckp Time            Name
  ---- -- ---- ---------- ------------------- ----
  5    0  Incr 924152     2009-07-21:19:02:57
+DATA/orcl/datafile/example.265.692754837

BS Key  Type LV Size        Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ -------------------
237     Incr 1  3.74M       DISK         00:00:02    2009-07-21:19:10:35
```

Practice 5-2: Cross-Checking Backups (continued)

```
        BP Key: 241   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T191031
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndn1_tag20090721t191031_0.277.692824233
  List of Datafiles in backup set 237
  File LV Type Ckp SCN    Ckp Time            Name
  ---- -- ---- ---------- ------------------- ----
   5   1  Incr 924953      2009-07-21:19:10:33
+DATA/orcl/datafile/example.265.692754837

RMAN>
```

Take note of the only backup that is a full backup of data file 5. Also note that the
"Piece Name" is the name of the ASM file where the backup file resides.

4) In an OS terminal window, delete the backup set file. Start a separate terminal
session, so the RMAN session can stay connected. Use the +ASM environment
variables, review and execute the rm_asm_file.sh script to do this. Supply
YOUR full "Piece Name" as an argument to the script.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM

$ cat rm_asm_file.sh
export ORACLE_SID=+ASM
asmcmd <<-EOI
        rm -f $1
        exit
EOI
Exit

./rm_asm_file.sh \
> +FRA/orcl/backupset/2009_07_21/nnndf0_tag20090721t145358_0.260.692808839
ASMCMD> ASMCMD> $
$
```

5) In your still connected RMAN session, list the backups again, and look for the backup
that corresponds to the example data file.

```
RMAN> list backup of datafile 5;


List of Backup Sets
===================

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ -------------------
37      Full   68.99M      DISK        00:00:13     2009-07-21:14:54:11
        BP Key: 40   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T145358
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndf0_tag20090721t145358_0.260.692808839
  List of Datafiles in backup set 37
  File LV Type Ckp SCN    Ckp Time            Name
  ---- -- ---- ---------- ------------------- ----
```

```
  5      Full 908595     2009-07-21:14:53:59
+DATA/orcl/datafile/example.265.692754837

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ -------------------
172     Incr 0  1.07G       DISK         00:02:47     2009-07-21:19:05:44
        BP Key: 176   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T190255
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndn0_tag20090721t190255_0.271.692823777
  List of Datafiles in backup set 172
  File LV Type Ckp SCN    Ckp Time            Name
  ---- -- ---- ---------- ------------------- ----
  5    0  Incr 924152     2009-07-21:19:02:57
+DATA/orcl/datafile/example.265.692754837

BS Key  Type LV Size       Device Type Elapsed Time Completion Time
------- ---- -- ---------- ----------- ------------ -------------------
237     Incr 1  3.74M       DISK         00:00:02     2009-07-21:19:10:35
        BP Key: 241   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T191031
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndn1_tag20090721t191031_0.277.692824233
  List of Datafiles in backup set 237
  File LV Type Ckp SCN    Ckp Time            Name
  ---- -- ---- ---------- ------------------- ----
  5    1  Incr 924953     2009-07-21:19:10:33
+DATA/orcl/datafile/example.265.692754837

RMAN>
```

Note that the backups are still listed as before. That is because the repository is not aware of the fact that the file for the backup piece is missing.

6) Cross-check the backup sets to make the recovery catalog aware of the missing backup file.

```
RMAN> crosscheck backupset;

allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=48 device type=DISK
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=57 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: WARNING: Oracle Test Disk API
crosschecked backup piece: found to be 'EXPIRED'
backup piece
handle=+FRA/orcl/backupset/2009_07_21/nnndf0_tag20090721t14535
8_0.260.692808839 RECID=1 STAMP=692808839
crosschecked backup piece: found to be 'AVAILABLE'.
.
.
.

RMAN>
```

Note that the backup in question has expired.

Practice 5-2: Cross-Checking Backups (continued)

7) Delete all the expired backup sets.

```
RMAN> delete expired backupset;

using channel ORA_DISK_1
using channel ORA_SBT_TAPE_1

List of Backup Pieces
BP Key  BS Key  Pc# Cp# Status      Device Type Piece Name
------- ------- --- --- ----------- ----------- ----------
40      37      1   1   EXPIRED     DISK
+FRA/orcl/backupset/2009_07_21/nnndf0_tag20090721t145358_0.260
.692808839

Do you really want to delete the above objects (enter YES or
NO)? YES
deleted backup piece
backup piece
handle=+FRA/orcl/backupset/2009_07_21/nnndf0_tag20090721t14535
8_0.260.692808839 RECID=1 STAMP=692808839
Deleted 1 EXPIRED objects

RMAN>
```

8) List the backup sets again. See that the backup you just deleted is no longer listed.

```
RMAN> list backup of datafile 5;


List of Backup Sets
===================

BS Key  Type LV Size        Device Type Elapsed Time Completion
Time
------- ---- -- ---------- ----------- ------------ ----------
---------
172     Incr 0  1.07G       DISK         00:02:47     2009-07-
21:19:05:44
        BP Key: 176   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T190255
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndn0_tag20090721t190255_0.271
.692823777
  List of Datafiles in backup set 172
  File LV Type Ckp SCN    Ckp Time           Name
  ---- -- ---- ---------- ------------------ ----
  5    0  Incr 924152     2009-07-21:19:02:57
+DATA/orcl/datafile/example.265.692754837

BS Key  Type LV Size        Device Type Elapsed Time Completion
Time
```

Practice 5-2: Cross-Checking Backups (continued)

```
------- ---- -- --------- ---------- ----------- ----------
---------
237     Incr 1  3.74M      DISK            00:00:02     2009-07-
21:19:10:35
        BP Key: 241   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T191031
        Piece Name:
+FRA/orcl/backupset/2009_07_21/nnndn1_tag20090721t191031_0.277
.692824233
  List of Datafiles in backup set 237
  File LV Type Ckp SCN    Ckp Time              Name
  ---- -- ---- ---------- ------------------ ----
  5    1  Incr 924953     2009-07-21:19:10:33
+DATA/orcl/datafile/example.265.692754837

RMAN>
```

Practice 5-3: Listing Backup Files and Creating Archival Backup

In this practice, you list backup files.

1) Continue to use the RMAN session from the previous practice, and generate a report of all the obsolete backup files.

```
RMAN> report obsolete;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
Report of obsolete backups and copies
Type                 Key    Completion Time    Filename/Handle
-------------------- ------ ------------------ ---------------
-----
Backup Set           38     2009-07-21:14:54:16
  Backup Piece       41     2009-07-21:14:54:16
+FRA/orcl/autobackup/2009_07_21/s_692808854.261.692808857
Backup Set           68     2009-07-21:16:29:17
  Backup Piece       71     2009-07-21:16:29:17 03kkn0mt_1_1
Backup Set           77     2009-07-21:16:29:22
  Backup Piece       79     2009-07-21:16:29:22 c-1220535480-
20090721-01
Backup Set           93     2009-07-21:16:32:10
  Backup Piece       96     2009-07-21:16:32:10 05kkn0sa_1_1
Archive Log          151    2009-07-21:17:49:04
+FRA/orcl/archivelog/2009_07_21/thread_1_seq_9.268.692819337
Backup Set           105    2009-07-21:16:32:14
  Backup Piece       107    2009-07-21:16:32:14 c-1220535480-
20090721-02
Archive Log          163    2009-07-21:19:02:49
+FRA/orcl/archivelog/2009_07_21/thread_1_seq_10.269.692823767
Backup Set           171    2009-07-21:19:02:53
  Backup Piece       175    2009-07-21:19:02:53
+FRA/orcl/backupset/2009_07_21/annnf0_tag20090721t190251_0.270
.692823773
Backup Set           205    2009-07-21:19:06:06
  Backup Piece       207    2009-07-21:19:06:06
+FRA/orcl/autobackup/2009_07_21/s_692823962.274.692823965
RMAN>
```

Your list of files might look different. - What can you deduce about these backup files, given that the retention policy is set to REDUNDANCY 1?

2) Which backups would be considered obsolete if the retention policy were set to redundancy of 2, instead of 1? Answer this without changing the retention policy.

```
RMAN> report obsolete redundancy 2;

Report of obsolete backups and copies
Type                 Key    Completion Time    Filename/Handle
-------------------- ------ ------------------ ---------------
Backup Set           38     2009-07-21:14:54:16
```

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

```
  Backup Piece        41      2009-07-21:14:54:16
+FRA/orcl/autobackup/2009_07_21/s_692808854.261.692808857
Backup Set           68      2009-07-21:16:29:17
  Backup Piece        71      2009-07-21:16:29:17 03kkn0mt_1_1
Backup Set           77      2009-07-21:16:29:22
  Backup Piece        79      2009-07-21:16:29:22 c-1220535480-
20090721-01
Backup Set          105      2009-07-21:16:32:14
  Backup Piece       107      2009-07-21:16:32:14 c-1220535480-
20090721-02

RMAN>
```

Note that far fewer backups are obsolete in this hypothetical report. That is because with an increased redundancy, more of the backups are required. This command is run without affecting the retention policy.

3) Delete all obsolete backups.

```
RMAN> delete noprompt obsolete;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
using channel ORA_DISK_1
using channel ORA_SBT_TAPE_1
Deleting the following obsolete backups and copies:
Type               Key    Completion Time     Filename/Handle
------------------ ------ ----------------- ---------------
-----
Backup Set           38      2009-07-21:14:54:16
  Backup Piece        41      2009-07-21:14:54:16
+FRA/orcl/autobackup/2009_07_21/s_692808854.261.692808857
Backup Set           68      2009-07-21:16:29:17
  Backup Piece        71      2009-07-21:16:29:17 03kkn0mt_1_1
Backup Set           77      2009-07-21:16:29:22
.
.
.

deleted backup piece
backup piece handle=05kkn0sa_1_1 RECID=5 STAMP=692814730
deleted backup piece
backup piece handle=c-1220535480-20090721-02 RECID=6
STAMP=692814734
Deleted 4 objects

RMAN>
```

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

Note: Your number of objects may be different, depending on repetitions of practice steps.

4) List the backup archivelog files that could be used to recover to a point in time one hour ago.
Note: You may need to adjust the following SYSDATE expression to see some results that differ from the list command that does not use a SYSDATE qualifier at all. For example, try 'sysdate-05/60/24' to indicate 5 minutes ago.

```
RMAN> list backup of archivelog until time 'sysdate-1/24';


List of Backup Sets
===================


BS Key  Size        Device Type Elapsed Time Completion Time
------- ---------- ----------- ------------ -----------------
-
191     1.05M       DISK         00:00:01      2009-07-
21:19:05:58
        BP Key: 197   Status: AVAILABLE  Compressed: NO   Tag:
TAG20090721T190557
        Piece Name:
+FRA/orcl/backupset/2009_07_21/annnf0_tag20090721t190557_0.273
.692823957

  List of Archived Logs in backup set 191
  Thrd Seq     Low SCN    Low Time           Next SCN    Next
Time
  ---- ------- ---------- ------------------ ---------- -----
----
  1    11      924126     2009-07-21:19:02:46 924627     2009-
07-21:19:05:53

BS Key  Size        Device Type Elapsed Time Completion Time
------- ---------- ----------- ------------ -----------------
-
236     277.00K     DISK         00:00:01      2009-07-
21:19:10:29
        BP Key: 240   Status: AVAILABLE  Compressed: NO   Tag:
TAG20090721T191028
        Piece Name:
+FRA/orcl/backupset/2009_07_21/annnf0_tag20090721t191028_0.276
.692824229

  List of Archived Logs in backup set 236
  Thrd Seq     Low SCN    Low Time           Next SCN    Next
Time
```

```
     ---- ------- ---------- ------------------ ---------- -----
----
   1    12      924627     2009-07-21:19:05:53 924928      2009-
07-21:19:10:26

BS Key  Size       Device Type Elapsed Time Completion Time
------- ---------- ----------- ------------ -----------------
-
258     7.50K      DISK          00:00:01     2009-07-
21:19:10:39
        BP Key: 264   Status: AVAILABLE  Compressed: NO  Tag:
TAG20090721T191037
        Piece Name:
+FRA/orcl/backupset/2009_07_21/annnf0_tag20090721t191037_0.279
.692824239

  List of Archived Logs in backup set 258
  Thrd Seq     Low SCN    Low Time         Next SCN    Next
Time
  ---- ------- ---------- ---------------- ---------- -----
----
  1    13      924928     2009-07-21:19:10:26 924960      2009-
07-21:19:10:36

RMAN>
```

5) List the image copies of the single data file in the USERS tablespace.

   a) Report on the schema to find out which data file number belongs to the USERS tablespace.

```
RMAN> report schema;

Report of database schema for database with db_unique_name
ORCL

List of Permanent Datafiles
===========================
File Size(MB) Tablespace          RB segs Datafile Name
---- -------- ------------------- ------- -------------------
-----
1    680      SYSTEM              YES
+DATA/orcl/datafile/system.256.692754557
2    590      SYSAUX              NO
+DATA/orcl/datafile/sysaux.257.692754559
3    100      UNDOTBS1            YES
+DATA/orcl/datafile/undotbs1.258.692754561
4    5        USERS               NO
+DATA/orcl/datafile/users.259.692754561
```

```
5    100     EXAMPLE              NO
+DATA/orcl/datafile/example.265.692754837

List of Temporary Files
=======================
File Size(MB) Tablespace           Maxsize(MB) Tempfile Name
---- -------- -------------------- ----------- ---------------
-----
1    28      TEMP                 32767
+DATA/orcl/tempfile/temp.264.692754825
RMAN>
```

Note that the file in question is data file number 4.

b) List any image copies of data file number 4.

```
RMAN> list copy of datafile 4;

specification does not match any datafile copy in the repository

RMAN>
```

Note that, in this case, there is no image copy of this file.

6) Delete any data file 4 image copies that exist.
   Note: You may not have any.

```
RMAN> delete copy of datafile 4;

released channel: ORA_DISK_1
released channel: ORA_SBT_TAPE_1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=105 device type=DISK
List of Datafile Copies
=======================

Key     File S Completion Time    Ckp SCN    Ckp Time
------- ---- - ------------------ ---------- ----------------
---
115     4    A 2009-05-27:21:08:45 1917108    2009-05-
27:20:50:57
        Name: /tmp/users_copy.dat


Do you really want to delete the above objects (enter YES or
NO)? yes

RMAN> list copy of datafile 4;

specification does not match any datafile copy in the
repository
```

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

```
RMAN>
```

7) To simplify your training environment, disable control file autobackup for the next few steps.

```
RMAN> configure controlfile autobackup off;

old RMAN configuration parameters:
CONFIGURE CONTROLFILE AUTOBACKUP ON;
new RMAN configuration parameters:
CONFIGURE CONTROLFILE AUTOBACKUP OFF;
new RMAN configuration parameters are successfully stored
starting full resync of recovery catalog
full resync complete

RMAN>
```

8) Make an image file backup of data file 4.

```
RMAN> backup as copy datafile 4;

Starting backup at 2009-07-21:20:27:25
released channel: ORA_SBT_TAPE_1
using channel ORA_DISK_1
channel ORA_DISK_1: starting datafile copy
input datafile file number=00004
name=+DATA/orcl/datafile/users.259.692754561
output file name=+FRA/orcl/datafile/users.274.692828845
tag=TAG20090721T202725 RECID=2 STAMP=692828849
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:07
Finished backup at 2009-07-21:20:27:32

RMAN>
```

9) Make another image copy of the data file, but make this one an archival backup.

```
RMAN> backup as copy datafile 4 keep forever;

Starting backup at 2009-07-21:20:28:30
current log archived

using channel ORA_DISK_1
backup will never be obsolete
archived logs required to recover from this backup will be
backed up
channel ORA_DISK_1: starting datafile copy
input datafile file number=00004
name=+DATA/orcl/datafile/users.259.692754561
```

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

```
RMAN-00571:
===========================================================
RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS
===============
RMAN-00571:
-----------------------------------------------------------
RMAN-03002: failure of backup command at 07/21/2009 20:28:34
ORA-19811: cannot have files in DB_RECOVERY_FILE_DEST with
keep attributes
RMAN>
```

Note that the backup command failed. This is because a backup with the KEEP
attribute (an archival backup) cannot be written to the Flash Recovery Area. Allowing
this has the potential of causing the Flash Recovery Area to quickly run out of space,
forcing you to specify a different location.

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

10) Create an archival backup with a FORMAT clause that causes the backup to be written to the /tmp directory.

```
RMAN> backup keep forever as copy datafile 4 format
'/tmp/bu_%d_%s_%p.dbf';

Starting backup at 2009-07-21:20:31:14
current log archived

using channel ORA_DISK_1
backup will never be obsolete
archived logs required to recover from this backup will be
backed up
channel ORA_DISK_1: starting datafile copy
input datafile file number=00004
name=+DATA/orcl/datafile/users.259.692754561
output file name=/tmp/bu_ORCL_17_1.dbf tag=TAG20090721T203114
RECID=3 STAMP=692829077
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:03
.
.
.
piece handle=/tmp/bu_ORCL_20_1.dbf tag=TAG20090721T203114
comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:01
Finished backup at 2009-07-21:20:31:29

RMAN>
```

11) See if there are any obsolete backups. (If you repeat practice steps you might have obsolete ones.)

```
RMAN> report obsolete;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
no obsolete backups found

RMAN>
```

12) Create another (nonarchive) backup of data file 4.

```
RMAN> backup as copy datafile 4;

Starting backup at 2009-07-21:20:33:52
using channel ORA_DISK_1
channel ORA_DISK_1: starting datafile copy
```

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

```
input datafile file number=00004
name=+DATA/orcl/datafile/users.259.692754561
output file name=+FRA/orcl/datafile/users.261.692829233
tag=TAG20090721T203352 RECID=4 STAMP=692829233
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:01
Finished backup at 2009-07-21:20:33:54

RMAN>
```

13) Report on the obsolete backups.

```
RMAN> report obsolete;

RMAN retention policy will be applied to the command
RMAN retention policy is set to redundancy 1
Report of obsolete backups and copies
Type                    Key    Completion Time    Filename/Handle
-------------------- ------ ----------------- ----------------
-----
Datafile Copy        349    2009-07-21:20:27:29
+FRA/orcl/datafile/users.274.692828845

RMAN>
```

Note that the first backup taken is now obsolete.

14) For an alternate view of the backups, in EM, navigate to Availability > Manage Current Backups > Image Copies.

15) Ensure that the username and password of oracle/oracle are in the host credentials section at the bottom of the page, and then at the upper-right corner of the page, click Delete All Obsolete.

16) When the Specify Job Parameters page appears, click Show RMAN Script.

Note that the script issues the DELETE NOPROMPT OBSOLETE command. Click OK.

17) Click Submit Job.

18) After the job is submitted, click View Job.

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

Manage Current Backups

(Catalog Additional Files) (Crosscheck All) (Delete All Obsolete) (Delete All Expired)

ⓘ **Job submission succeeded.**

Job Bkp_Mgmt_orcl.us.oracle.com_000001 was successfully submitted for the Delete All Obsolete operation. It will be executed at the scheduled time.

View Job

19) When the job status is Running, use your browser's Reload button until the job status appears as Succeeded. Then navigate back to the backup listing page for image copies (Database > Availability > Manage Current Backups > Image Copies).

Results

(Crosscheck) (Change to Unavailable) (Delete) (Validate)

Select All | Select None

Select	Key	Name	File Type	Tag	Completion Time ▽	Status	Keep
☐	4	+FRA/orcl/datafile /users.288.695437683	DATAFILE	TAG20090821T010801	Aug 21, 2009 1:08:02 AM	AVAILABLE	NO
☐	3	/tmp/bu_ORCL_23_1.dbf	DATAFILE	TAG20090821T010402	Aug 21, 2009 1:04:06 AM	AVAILABLE	Forever

20) Note that there are now only two backups of data file 4. The obsolete one has been deleted because it was the third of three, and the retention policy is set to 1, meaning there need only be two backups of any given file. (Remember the archival backup is not counted.)

Results

(Crosscheck) (Change to Unavailable) (Delete) (Validate)

Select All | Select None

Select	Key	Name	File Type ▽	Tag	Completion Time	Status	Keep
☐	467	+FRA/orcl/datafile /users.261.692829233	DATAFILE	TAG20090721T203352	Jul 21, 2009 8:33:53 PM	AVAILABLE	NO
☐	415	/tmp/bu_ORCL_17_1.dbf	DATAFILE	TAG20090721T203114	Jul 21, 2009 8:31:17 PM	AVAILABLE	Forever

21) Click the Backup Sets tab on this page. What archival backup sets appear there? Why are they there?

Results

(Crosscheck) (Change to Unavailable) (Delete) (Validate)

Select All | Select None

Select	Key	Tag	Completion Time ▽	Contents	Device Type	Status	Keep	Pieces
☐	438	TAG20090721T203114	Jul 21, 2009 8:31:28 PM	CONTROLFILE	DISK	AVAILABLE	Forever	1
☐	437	TAG20090721T203114	Jul 21, 2009 8:31:26 PM	ARCHIVED LOG	DISK	AVAILABLE	Forever	1
☐	410	TAG20090721T203114	Jul 21, 2009 8:31:19 PM	SPFILE	DISK	AVAILABLE	Forever	1

Practice 5-3: Listing Backup Files and Creating Archival Backup (continued)

Answer: These archival backup sets are here because they were taken as a byproduct of taking the data file image copy as an archival backup. When the data file archival backup was taken, control file autobackup was enabled, which causes the control file and the SPFILE to be backed up. Also, any archive redo logs that are required to recover the image copy are taken. Because the image copy was an archival backup, every other file that is backed up as a part of that backup task is also an archival backup.

22) Enable the automatic backup of the control file again and exit RMAN.

```
RMAN> configure controlfile autobackup on;
RMAN> exit
```

Practice 6-1: Backing up the Database

In this practice, you create a cold backup of the rcat database.

Because ASM does not expose its files to the operating system, you create backups to a regular file system destination, so that you can setup various learning situations in the following practices.

Note: The RCAT database is in the ARCHIVE log mode, and is capable of performing an inconsistent backup. In this exercise though, you will perform a consistent cold backup.

1) Create the /home/oracle/BACKUP directory to hold backup files.

```
$ cd

$ pwd

/home/oracle

$ mkdir BACKUP
```

2) Make sure that your environment is pointing at the rcat database.

```
$. oraenv
ORACLE_SID = [+ASM] ? rcat
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1 is
/u01/app/oracle
$
```

3) Shut down the database with the IMMEDIATE option, then mount it.

```
$ sqlplus / as sysdba

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

SQL> startup mount
ORACLE instance started.

Total System Global Area  318046208 bytes
Fixed Size                  1336244 bytes
Variable Size             251661388 bytes
Database Buffers           58720256 bytes
Redo Buffers                6328320 bytes
```

Practice 6-1: Backing up the Database (continued)

```
Database mounted.
SQL> exit
```

4) Make a whole database image copy backup into the $HOME/BACKUP directory using RMAN commands.

```
$ rman target /

Recovery Manager: Release 11.2.0.1.0 - Production on Tue Jul 21
22:26:33 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All rights
reserved.

connected to target database: RCAT (DBID=464959795, not open)

RMAN> backup database format '/home/oracle/BACKUP/cold_%U';

Starting backup at 2009-07-29:08:11:12
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=1 device type=DISK
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=+DATA/rcat/datafile/system.267.692935353
input datafile file number=00002
name=+DATA/rcat/datafile/sysaux.268.692935357
input datafile file number=00003
name=+DATA/rcat/datafile/undotbs1.269.692935357
input datafile file number=00005
name=+DATA/rcat/datafile/rcat.277.692937003
input datafile file number=00004
name=+DATA/rcat/datafile/users.270.692935359
channel ORA_DISK_1: starting piece 1 at 2009-07-29:08:11:13
channel ORA_DISK_1: finished piece 1 at 2009-07-29:08:13:08
piece handle=/home/oracle/BACKUP/cold_0fklb6h1_1_1
tag=TAG20090729T081113 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:01:55
Finished backup at 2009-07-29:08:13:08

Starting Control File and SPFILE Autobackup at 2009-07-29:08:13:09
piece handle=+FRA/rcat/autobackup/2009_07_29/s_693475040.330.693475991
comment=NONE
Finished Control File and SPFILE Autobackup at 2009-07-29:08:13:16
RMAN> exit
```

5) Open the RCAT database.

```
$ . oraenv
ORACLE_SID = [rcat] ? rcat
sqlplus / as sysdba

SQL> alter database open;

Database altered.
```

Practice 6-1: Backing up the Database (continued)

6) Use the ALTER DATABASE command to back up the control file as a trace file.

```
SQL> alter database  backup controlfile to trace as
'/home/oracle/BACKUP/trace_control.bck';

Database altered.
SQL> exit
```

7) View the content of the /home/oracle/BACKUP directory.

```
$ ls -l /home/oracle/BACKUP
total 1100568
-rw-r----- 1 oracle dba 1125867520 Jul 29 08:12 cold_0fklb6h1_1_1
-rw-r--r-- 1 oracle dba       6601 Jul 29 08:18 trace_control.bck
$
```

Practice 6-2: Recovering from the Loss of a Data File

Because ASM does not expose its files to the operating system, you create tablespaces with data files in a regular file system destination, so that you can setup various learning situations in the following practices.

In the ORCL database, you create the BR_TBS tablespace with the CUSTOMERS table.

1) Log into the ORCL instance with SQL*Plus as the SYS user.

```
$ . oraenv
ORACLE_SID = [rcat] ? orcl

$ sqlplus / as sysdba

SQL>
```

2) Create the BR_TBS tablespace with the CUSTOMERS table.

```
SQL> CREATE TABLESPACE br_tbs
  DATAFILE '/home/oracle/BACKUP/br01.dbf' SIZE 25M;

Tablespace created.

SQL> CREATE TABLE customers tablespace br_tbs
  AS SELECT * FROM sh.customers;

Table created.
SQL>
```

3) Find out the number of your new data file and back up the data files to the /home/oracle/BACKUP directory. (You might find it useful to keep the SQL*Plus window open and start the RMAN session in another terminal window, but it is not mandatory.)

```
$ . oraenv
ORACLE_SID = [+ASM] ? orcl

$ rman target / catalog rcatowner@rcat

connected to target database: ORCL (DBID=1220535480)
recovery catalog database Password: oracle_4U <<<not displayed
connected to recovery catalog database

RMAN> report schema;
starting full resync of recovery catalog
full resync complete
Report of database schema for database with db_unique_name ORCL

List of Permanent Datafiles
===========================
File Size(MB) Tablespace          RB segs Datafile Name
```

```
---- -------- ------------------- ------- ----------------------
1   690     SYSTEM              YES
+DATA/orcl/datafile/system.256.692754557
2   610     SYSAUX              NO
+DATA/orcl/datafile/sysaux.257.692754559
3   100     UNDOTBS1            YES
+DATA/orcl/datafile/undotbs1.258.692754561
4   5       USERS               NO
+DATA/orcl/datafile/users.259.692754561
5   100     EXAMPLE             NO
+DATA/orcl/datafile/example.265.692754837
6   25      BR_TBS              NO
/home/oracle/BACKUP/br01.dbf

List of Temporary Files
=======================
File Size(MB) Tablespace          Maxsize(MB) Tempfile Name
---- -------- ------------------- ----------- -------------------
--
1   28      TEMP                32767
+DATA/orcl/tempfile/temp.264.692754825

RMAN> backup as copy datafile 6 format
'/home/oracle/BACKUP/br_%d_%s_%p.dbf';

Starting backup at 2009-07-29:08:38:47
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=29 device type=DISK
channel ORA_DISK_1: starting datafile copy
input datafile file number=00006
name=/home/oracle/BACKUP/br01.dbf
output file name=/home/oracle/BACKUP/br_ORCL_22_1.dbf
tag=TAG20090729T083848 RECID=5 STAMP=693477530
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:03
Finished backup at 2009-07-29:08:38:51

Starting Control File and SPFILE Autobackup at 2009-07-
29:08:38:51
piece
handle=+FRA/orcl/autobackup/2009_07_29/s_693477533.332.693477535
comment=NONE
Finished Control File and SPFILE Autobackup at 2009-07-
29:08:38:54
RMAN>
```

4) To simulate the passage of time, and to make sure that this data is not cached in the buffer cache, perform the following steps and exit from SQL*Plus.

```
SQL> alter system switch logfile;

System altered;
```

Practice 6-2: Recovering from the Loss of a Data File (continued)

```
SQL> alter system checkpoint;

System altered.

SQL> alter system switch logfile;

System altered
SQL> exit
```

5) Delete the data file belonging to the BR_TBS tablespace (**not** the backup).

```
$ cd ~/BACKUP

$ ls -l br*

-rw-r----- 1 oracle dba 26222592 Jul 22 20:57 br01.dbf

-rw-r----- 1 oracle dba 26222592 Jul 22 20:52 br_ORCL_22_1.dbf

$ rm br01.dbf

$ ls -l br*

-rw-r----- 1 oracle dba 26222592 Jul 22 20:52 br_ORCL_22_1.dbf

$
```

6) Now log back in to the database, flush the buffer cache and try to access the data in the CUSTOMERS table.

```
$ sqlplus / as sysdba

SQL> alter system flush buffer_cache;
System altered.

SQL> select count(*) from sys.customers;
select count(*) from sys.customers

ERROR at line 1:
ORA-01116: error in opening database file 6
ORA-01110: data file 6: '/home/oracle/BACKUP/br01.dbf'
ORA-27041: unable to open file
Linux Error: 2: No such file or directory
Additional information: 3
```

7) Knowing you are going to have to restore this file, you now take it offline, and exit from SQL*Plus.

```
SQL> alter database datafile 6 offline;

Database altered.

SQL> exit
```

Practice 6-2: Recovering from the Loss of a Data File (continued)

8) Now navigate to your $HOME/BACKUP directory, to find what backups you have of the data file. Then choose the most recent, and copy *YOUR* file into where the live one should be.

```
$ cd /home/oracle/BACKUP/

$ ls -al
total 1126216
drwxr-xr-x  2 oracle oinstall       4096 Jul 29 08:42 .
drwxrwxrwx 24 oracle oinstall       4096 Jul 29 08:02 ..
-rw-r-----  1 oracle dba        26222592 Jul 29 08:38 br_ORCL_22_1.dbf
-rw-r-----  1 oracle dba      1125867520 Jul 29 08:12 cold_0fklb6h1_1_1
-rw-r--r--  1 oracle dba           6601 Jul 29 08:18 trace_control.bck

$ cp br_ORCL_22_1.dbf br01.dbf
$ ls -l
-rw-r-----  1 oracle oinstall   26222592 Jul 29 08:38 br01.dbf
-rw-r-----  1 oracle dba        26222592 Jul 29 08:38 br_ORCL_22_1.dbf
-rw-r-----  1 oracle dba      1125867520 Jul 29 08:12 cold_0fklb6h1_1_1
-rw-r--r--  1 oracle dba           6601 Jul 29 08:18 trace_control.bck
```

9) Now log in to SQL*Plus and try to bring the file online.

```
$ sqlplus / as sysdba

SQL> alter database datafile 6 online;
alter database datafile 6 online
*
ERROR at line 1:
ORA-01113: file 6 needs media recovery
ORA-01110: data file 6: '/home/oracle/BACKUP/br01.dbf'
```

10) The data file cannot be brought online as it is too old and, therefore, you need to perform media recovery to roll it forward.

```
SQL> recover datafile 6;
Media recovery complete.
SQL>
```

11) Now try to bring the data file online.

```
SQL> alter database datafile 6 online;

Database altered.
```

12) Try again to access the sys.customers table, and then exit SQL*Plus.

```
SQL> select count(*) from sys.customers;

  COUNT(*)
----------
```

```
      55500

SQL> exit
```

13) For the ORCL database, confirm that the control file is automatically backed up and
    that the backup rentention is set to 1 (if not, modify it), take a database backup and
    delete obsolete files (in preparation for the following practices).

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl

$ rman target / catalog rcatowner@rcat

connected to target database: ORCL (DBID=1220535480)
recovery catalog database Password: oracle_4U <<<not displayed
connected to recovery catalog database

RMAN> show retention policy;

RMAN configuration parameters for database with db_unique_name
ORCL are:
CONFIGURE RETENTION POLICY TO REDUNDANCY 1; # default
RMAN>
RMAN> backup database;
Starting backup
.
.
.

RMAN>

RMAN> delete noprompt obsolete;
RMAN retention policy will be applied to the command
.
.
.

RMAN> exit
$
```

Practice 6-3: Recovering from the Loss of all Control Files

This practice makes use of the ORCL database and the recovery catalog. You will simulate the loss of all control files, and then restore the control files and recover the database.

1) Connect to the ORCL database and make a binary backup of the control file.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$ sqlplus / as sysdba

SQL> alter database backup controlfile to
'/home/oracle/BACKUP/ctrl.bkp';
Database altered.
```

2) Identify the current control files for the ORCL database. You need to know them in one of the following tasks. Then shutdown the ORCL database to allow the control files to be deleted and exit SQL*Plus.

```
SQL> select name from v$controlfile;

NAME
--------------------------------------------
+DATA/orcl/controlfile/current.260.692879691
+FRA/orcl/controlfile/current.256.692879691

SQL> shutdown immediate;
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> exit
```

3) Set the environment to the ASM instance and run the asmcmd utility to delete the two control files identified above.

Note: The names of your control files may be different. Delete *YOUR* control files.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle

$ asmcmd rm +DATA/orcl/controlfile/current.260.692879691
$ asmcmd rm +FRA/orcl/controlfile/current.256.692879691
```

4) Set the environment back to the ORCL database and attempt to start up the database.

```
$ . oraenv
ORACLE_SID = [+ASM] ? orcl
```

Practice 6-3: Recovering from the Loss of all Control Files (continued)

```
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1 is
/u01/app/oracle

$ sqlplus / as sysdba

SQL*Plus: Release 11.2.0.1.0 Production on Wed Jul 29 10:03:55
2009
Copyright (c) 1982, 2009, Oracle.  All rights reserved.

Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area  418484224 bytes
Fixed Size                  1336908 bytes
Variable Size             268437940 bytes
Database Buffers          142606336 bytes
Redo Buffers                6103040 bytes
ORA-00205: error in identifying control file, check alert log for
more info

SQL> exit
```

5) Using RMAN, connect to the ORCL target database, to the RCAT catalog database, and restore the control file from the autobackup.

```
$ rman target / catalog rcatowner@rcat

Recovery Manager: Release 11.2.0.1.0 - Production on Wed Jul 29
10:06:22 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All
rights reserved.

connected to target database: ORCL (not mounted)
recovery catalog database Password: oracle_4U <<<not displayed
connected to recovery catalog database

RMAN> restore controlfile from autobackup;

Starting restore at 2009-07-29:10:06:48
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=27 device type=DISK

recovery area destination: +FRA
database name (or database unique name) used for search: ORCL
```

Practice 6-3: Recovering from the Loss of all Control Files (continued)

```
channel ORA_DISK_1: AUTOBACKUP
+fra/ORCL/AUTOBACKUP/2009_07_29/s_693478885.335.693478885 found
in the recovery area
channel ORA_DISK_1: looking for AUTOBACKUP on day: 20090729
channel ORA_DISK_1: restoring control file from AUTOBACKUP
+fra/ORCL/AUTOBACKUP/2009_07_29/s_693478885.335.693478885
channel ORA_DISK_1: control file restore from AUTOBACKUP complete
output file name=+DATA/orcl/controlfile/current.260.693482811
output file name=+FRA/orcl/controlfile/current.256.693482813
Finished restore at 2009-07-29:10:06:54/
```

6) Mount the restored control file and attempt to open the database.

```
RMAN> alter database mount;
database mounted
released channel: ORA_DISK_1
RMAN> alter database open resetlogs;
RMAN-00571:
===========================================================
RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS
===============
RMAN-00571:
===========================================================
RMAN-03002: failure of alter db command at 07/29/2009 10:08:45
ORA-01152: file 1 was not restored from a sufficiently old backup
ORA-01110: data file 1:
'+DATA/orcl/datafile/system.256.692879503'
```

7) Because the control files have been restored, the database must be recovered.

```
RMAN> recover database;
Starting recover at 2009-07-29:10:08:58
Starting implicit crosscheck backup at 2009-07-29:10:08:58
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=27 device type=DISK
Crosschecked 12 objects
Finished implicit crosscheck backup at 2009-07-29:10:09:00

Starting implicit crosscheck copy at 2009-07-29:10:09:00
using channel ORA_DISK_1
Crosschecked 4 objects
Finished implicit crosscheck copy at 2009-07-29:10:09:01
searching for all files in the recovery area
cataloging files...
cataloging done
List of Cataloged Files
=======================
File Name:
+fra/ORCL/AUTOBACKUP/2009_07_29/s_693478885.335.693478885
using channel ORA_DISK_1
```

Practice 6-3: Recovering from the Loss of all Control Files (continued)

```
starting media recovery

archived log for thread 1 with sequence 59 is already on disk as
file +DATA/orcl/onlinelog/group_2.262.692879707
archived log file name=+DATA/orcl/onlinelog/group_2.262.692879707
thread=1 sequence=59
media recovery complete, elapsed time: 00:00:01
Finished recover at 2009-07-29:10:09:05
```

8) Attempt to open the database with the RESETLOGS option after recovery.

```
RMAN> alter database open resetlogs;

database opened
new incarnation of database registered in recovery catalog
starting full resync of recovery catalog
full resync complete
```

9) Perform a full database backup and delete obsolete files to be prepared for future labs.

```
RMAN> backup database;

Starting backup at 2009-07-29:10:49:21
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=46 device type=DISK
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00002
name=+DATA/orcl/datafile/sysaux.257.692879505
channel ORA_DISK_1: starting piece 1 at 2009-07-29:10:49:22
channel ORA_DISK_1: finished piece 1 at 2009-07-29:10:50:18
piece
handle=+FRA/orcl/backupset/2009_07_29/nnndf0_tag20090729t104922_0
.340.693485363 tag=TAG20090729T104922 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:56
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=+DATA/orcl/datafile/system.256.692879503
channel ORA_DISK_1: starting piece 1 at 2009-07-29:10:50:22
channel ORA_DISK_1: finished piece 1 at 2009-07-29:10:52:04
piece
handle=+FRA/orcl/backupset/2009_07_29/nnndf0_tag20090729t104922_0
.341.693485425 tag=TAG20090729T104922 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:01:42
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00006
name=/home/oracle/BACKUP/br01.dbf
```

Practice 6-3: Recovering from the Loss of all Control Files (continued)

```
input datafile file number=00003
name=+DATA/orcl/datafile/undotbs1.258.692879507
input datafile file number=00004
name=+DATA/orcl/datafile/users.259.692879509
input datafile file number=00005
name=+DATA/orcl/datafile/example.265.692879765
channel ORA_DISK_1: starting piece 1 at 2009-07-29:10:52:11
channel ORA_DISK_1: finished piece 1 at 2009-07-29:10:52:57
piece
handle=+FRA/orcl/backupset/2009_07_29/nnndf0_tag20090729t104922_0
.342.693485537 tag=TAG20090729T104922 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:00:46
Finished backup at 2009-07-29:10:52:57

Starting Control File and SPFILE Autobackup at 2009-07-
29:10:52:57
piece
handle=+FRA/orcl/autobackup/2009_07_29/s_693485589.343.693485603
comment=NONE
Finished Control File and SPFILE autobackup at 2009-07-29:10:53

RMAN> delete noprompt obsolete;
. . .

RMAN> exit
```

Practice 6-4: Recovering from the Loss of a Redo Log Group

This practice makes use of the ORCL database. You will delete the current redo log files, and see the effect this has on the database.

1) Log in to the ORCL database using SQL*Plus, and run the redo_view.sql query to gather information about your redo logs.

```
$ sqlplus / as sysdba

SQL> @redo_view.sql
SQL> set linesize 120
SQL> col member format a43
SQL> col status format a10
SQL> select l.group#, l.sequence#, l.archived,
  2  l.status, f.member
  3  from v$log l, v$logfile f
  4  where l.group#=f.group#;


    GROUP#  SEQUENCE# ARC STATUS     MEMBER
---------- ---------- --- ---------- -----------------------------
---------------
         3          0 YES UNUSED
+DATA/orcl/onlinelog/group_3.263.692879721
         3          0 YES UNUSED
+FRA/orcl/onlinelog/group_3.259.692879727
         2          0 YES UNUSED
+DATA/orcl/onlinelog/group_2.262.692879707
         2          0 YES UNUSED
+FRA/orcl/onlinelog/group_2.258.692879715
         1          1 NO  CURRENT
+DATA/orcl/onlinelog/group_1.261.692879693
         1          1 NO  CURRENT
+FRA/orcl/onlinelog/group_1.257.692879701

6 rows selected.
SQL>
```

2) From this it can be seen in our example that log group 1 is the current log group. Your current redo log group may be different from the one shown. Note the exact group names of your current group. You need the names during the next step.

Determine the current redo log group for your database, and then delete its member files with the asmcmd utility. You must shutdown the database in order to delete files that are in use in an ASM disk group.

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

Practice 6-4: Recovering from the Loss of a Redo Log Group (continued)

```
SQL> exit
```

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ asmcmd rm +DATA/orcl/onlinelog/group_1.261.692879693
$ asmcmd rm +FRA/orcl/onlinelog/group_1.257.692879701
```

3) Attempt to start the ORCL database and observe what happens. Then exit your SQL*Plus session.

```
$ . oraenv
ORACLE_SID = [+ASM] ? orcl
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1 is
/u01/app/oracle
$ sqlplus / as sysdba

SQL*Plus: Release 11.2.0.1.0 Production on Tue Aug 4 03:07:48
2009
Copyright (c) 1982, 2009, Oracle.  All rights reserved.
Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337352 bytes
Variable Size             411043832 bytes
Database Buffers           62914560 bytes
Redo Buffers                5963776 bytes
Database mounted.
ORA-03113: end-of-file on communication channel
Process ID: 29445
Session ID: 1 Serial number: 5
SQL> exit
```

4) Display the last section of the alert log to find out more details related to the failure in starting the ORCL instance.

```
$ tail /u01/app/oracle/diag/rdbms/orcl/orcl/trace/alert_orcl.log
ORA-15012: ASM file '+FRA/orcl/onlinelog/group_1.257.692879701'
does not exist
ORA-00312: online log 1 thread 1:
'+DATA/orcl/onlinelog/group_1.261.692879693'
ORA-17503: ksfdopn:2 Failed to open file
+DATA/orcl/onlinelog/group_1.261.692879693
```

Practice 6-4: Recovering from the Loss of a Redo Log Group (continued)

```
ORA-15012: ASM file '+DATA/orcl/onlinelog/group_1.261.692879693'
does not exist
Errors in file
/u01/app/oracle/diag/rdbms/orcl/orcl/trace/orcl_ora_15563.trc:
ORA-00313: open failed for members of log group 1 of thread
ORA-00312: online log 1 thread 1:
'+DATA/orcl/onlinelog/group_1.261.692879693'
ORA-00312: online log 1 thread 1:
'+FRA/orcl/onlinelog/group_1.257.692879701'
USER (ospid: 15563): terminating the instance due to error 313
Instance terminated by USER, pid = 15563
```

As you can observe, the instance terminates due to missing all the members of your log group.

5) Log into SQL*Plus as SYSDBA, start up and mount the ORCL instance. Query the V$LOG view to determine which log group is the current group and whether its files have been archived already.

```
$ sqlplus / as sysdba

SQL> startup mount
ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337352 bytes
Variable Size             411043832 bytes
Database Buffers           62914560 bytes
Redo Buffers                5963776 bytes
Database mounted.

SQL> select group#,status,archived from v$log;

    GROUP# STATUS           ARC
---------- ---------------- ---
         1 CURRENT          NO
         3 UNUSED           YES
         2 UNUSED           YES
```

6) If you clear *YOUR* missing log file group, then this will re-create the missing log files.

```
SQL> alter database clear logfile group 1;
alter database clear logfile group 1
*
ERROR at line 1:
ORA-00350: log 1 of instance orcl (thread 1) needs to be archived
ORA-00312: online log 1 thread 1:
'+DATA/orcl/onlinelog/group_1.261.693969247'
```

Practice 6-4: Recovering from the Loss of a Redo Log Group (continued)

```
ORA-00312: online log 1 thread 1:
'+FRA/orcl/onlinelog/group_1.257.693969255'
```

This is because the logfile has been deleted, and therefore cannot be archived. Because the log file has not been archived, lgwr is not allowed to overwrite it, even if the file no longer exists.

7) Because the logfile group has not been archived, you must use the keyword "unarchived" in the command. Open the database and exit SQL*Plus.

```
SQL> alter database clear unarchived logfile group 1;
Database altered.

SQL> alter database open;
Database altered.

SQL> exit
```

8) Perform a backup of the ORCL database including archive logs to be ready for future labs.

```
$ rman target / catalog rcatowner@rcat

Recovery Manager: Release 11.2.0.1.0 - Production on Wed Jul 29
10:49:07 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All
rights reserved.

connected to target database: ORCL (DBID=1220660426)
recovery catalog database Password: oracle_4U <<<not displayed
connected to recovery catalog database

RMAN> backup database plus archivelog;
.. .
Finished backup at 20-AUG-09

Starting Control File and SPFILE Autobackup at 20-AUG-09
piece
handle=+FRA/orcl/autobackup/2009_08_20/s_695409765.279.695409767
comment=NONE
Finished Control File and SPFILE Autobackup at 20-AUG-09

RMAN> delete noprompt obsolete;
. . .

Deleted 2 objects

RMAN> exit
```

Note: Your number of deleted objects will most likely be different.

Practice 7-1: Recovering Image Copies

In this practice, you recover an image copy of a file to the current SCN, to allow faster recovery time later. You create a new tablespace called APPRAISAL, which has one table in it. After creating it initially with a small amount of data, you take an incremental backup of it. Then you add many rows and take another incremental backup. At that point, you have an image copy of the APPRAISAL tablespace and also an incremental backup of it. Because you need to recover the tablespace later, you recover the image copy so that it is as up-to-date as the last incremental backup. This is done without going to the expense of creating a new image copy.

1) Make sure you are at the ~/labs directory and run the create_appraisal_ts.sh script to create a new tablespace called APPRAISAL.

```
$ cd ~/labs
$ ./create_appraisal_ts.sh
Tablespace created.
Table created.
$
```

2) Make a level 1 backup of the tablespace, to be used for image copy recovery. If no level 1 exists yet, it will actually create a level 0 incremental backup. This takes several minutes.

```
$ rman target / catalog rcatowner@rcat

Recovery Manager: Release 11.2.0.1.0 - Production on Wed Jul 29
10:49:07 2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All rights
reserved.

connected to target database: ORCL (DBID=1220660426)
recovery catalog database Password: oracle_4U <<<not displayed
connected to recovery catalog database

RMAN> backup incremental level 1 for recover of copy with tag
'app_incr' database;

Starting backup at 2009-08-05:03:00:24
starting full resync of recovery catalog
full resync complete
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=58 device type=DISK
no parent backup or copy of datafile 1 found
no parent backup or copy of datafile 2 found
no parent backup or copy of datafile 5 found
no parent backup or copy of datafile 3 found
```

```
no parent backup or copy of datafile 6 found
no parent backup or copy of datafile 7 found
no parent backup or copy of datafile 4 found
channel ORA_DISK_1: starting datafile copy
input datafile file number=00001
name=+DATA/orcl/datafile/system.260.694050517
output file name=+FRA/orcl/datafile/system.301.694062029
tag=APP_INCR RECID=6 STAMP=694062094
channel ORA_DISK_1: datafile copy complete, elapsed time: 00:01:16
channel ORA_DISK_1: starting datafile copy
input datafile file number=00002
name=+DATA/orcl/datafile/sysaux.266.694050521
output file name=+FRA/orcl/datafile/sysaux.300.694062109
tag=APP_INCR RECID=7 STAMP=694062216
channel ORA_DISK_1: datafile copy complete, elapsed time: 00:01:56
channel ORA_DISK_1: starting datafile copy
input datafile file number=00005
name=+DATA/orcl/datafile/example.259.694050813
output file name=+FRA/orcl/datafile/example.298.694062227
tag=APP_INCR RECID=8 STAMP=694062237
channel ORA_DISK_1: datafile copy complete, elapsed time: 00:00:15
channel ORA_DISK_1: starting datafile copy
input datafile file number=00003
name=+DATA/orcl/datafile/undotbs1.278.694050521
output file name=+FRA/orcl/datafile/undotbs1.297.694062243
tag=APP_INCR RECID=9 STAMP=694062251
channel ORA_DISK_1: datafile copy complete, elapsed time: 00:00:15
channel ORA_DISK_1: starting datafile copy
input datafile file number=00006 name=/home/oracle/BACKUP/br01.dbf
output file name=+FRA/orcl/datafile/br_tbs.296.694062259
tag=APP_INCR RECID=10 STAMP=694062265
channel ORA_DISK_1: datafile copy complete, elapsed time: 00:00:21
channel ORA_DISK_1: starting datafile copy
input datafile file number=00007
name=+DATA/orcl/datafile/appraisal.256.694061937
output file name=+FRA/orcl/datafile/appraisal.295.694062283
tag=APP_INCR RECID=11 STAMP=694062285
channel ORA_DISK_1: datafile copy complete, elapsed time: 00:00:08
channel ORA_DISK_1: starting datafile copy
input datafile file number=00004
name=+DATA/orcl/datafile/users.264.694050521
output file name=+FRA/orcl/datafile/users.294.694062289 tag=APP_INCR
RECID=12 STAMP=694062289
channel ORA_DISK_1: datafile copy complete, elapsed time: 00:00:03
Finished backup at 2009-08-05:03:04:51

Starting Control File and SPFILE Autobackup at 2009-08-05:03:04:51
piece
handle=+FRA/orcl/autobackup/2009_08_05/s_694062294.292.694062307
comment=NONE
Finished Control File and SPFILE Autobackup at 2009-08-05:03:05:09

RMAN>
```

3) In a separate terminal window, perform some DML on the table in the APPRAISAL tablespace. Use the emp_inserts.sh script.

Practice 7-1: Recovering Image Copies (continued)

```
$ cd ~/labs
$ ./emp_inserts.sh

107 rows created.

Commit complete.

214 rows created.

Commit complete.

$
```

4) List the copy of the APPRAISAL tablespace to see its SCN.

```
RMAN> list copy of tablespace appraisal;

List of Datafile Copies
=======================

Key      File S Completion Time      Ckp SCN    Ckp Time
-------  ---- - -------------------  --------   -------------
---
1975     7    A 2009-08-05:03:04:45  853719     2009-08-
05:03:04:39
         Name: +FRA/orcl/datafile/appraisal.295.694062283
         Tag: APP_INCR
RMAN>
```

5) Run the script to perform more transactions on the table that resides in the
   APPRAISAL tablespace.

```
$ ./emp_inserts.sh

428 rows created.

Commit complete.

856 rows created.

Commit complete.

$
```

6) Perform another level 1 backup. This one will indeed be a level 1 because you already
   have a level 0.

```
RMAN> backup incremental level 1 for recover of copy with tag
'app_incr' database;


Starting backup at 2009-08-05:03:25:48
using channel ORA_DISK_1
```

Practice 7-1: Recovering Image Copies (continued)

```
channel ORA_DISK_1: starting incremental level 1 datafile
backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00001
name=+DATA/orcl/datafile/system.260.694050517
channel ORA_DISK_1: starting piece 1 at 2009-08-05:03:25:49
channel ORA_DISK_1: finished piece 1 at 2009-08-05:03:25:50
piece
handle=+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.285.69
4063549 tag=APP_INCR comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:01
channel ORA_DISK_1: starting incremental level 1 datafile
backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00002
name=+DATA/orcl/datafile/sysaux.266.694050521
channel ORA_DISK_1: starting piece 1 at 2009-08-05:03:25:51
channel ORA_DISK_1: finished piece 1 at 2009-08-05:03:25:54
piece
handle=+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.284.69
4063551 tag=APP_INCR comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:03
channel ORA_DISK_1: starting incremental level 1 datafile
backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00006
name=/home/oracle/BACKUP/br01.dbf
input datafile file number=00003
name=+DATA/orcl/datafile/undotbs1.278.694050521
input datafile file number=00004
name=+DATA/orcl/datafile/users.264.694050521
input datafile file number=00005
name=+DATA/orcl/datafile/example.259.694050813
input datafile file number=00007
name=+DATA/orcl/datafile/appraisal.256.694061937
channel ORA_DISK_1: starting piece 1 at 2009-08-05:03:25:54
channel ORA_DISK_1: finished piece 1 at 2009-08-05:03:25:55
piece
handle=+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.277.69
4063555 tag=APP_INCR comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time:
00:00:01
Finished backup at 2009-08-05:03:25:55

Starting Control File and SPFILE Autobackup at 2009-08-
05:03:25:55
piece
handle=+FRA/orcl/autobackup/2009_08_05/s_694063556.261.6940635
57 comment=NONE
```

Practice 7-1: Recovering Image Copies (continued)

```
Finished Control File and SPFILE Autobackup at 2009-08-
05:03:25:59
RMAN>
```

7) List **and note** the SCN of the APPRAISAL tablespace incremental backup (not the image copy).

```
RMAN> list backup of tablespace appraisal;

List of Backup Sets
===================


BS Key  Type LV Size        Device Type Elapsed Time Completion
Time
------- ---- -- ---------- ----------- ------------ ----------
---------
2036    Incr 1  2.24M        DISK         00:00:00     2009-08-
05:03:25:54
        BP Key: 2041   Status: AVAILABLE  Compressed: NO  Tag:
APP_INCR
        Piece Name:
+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.277.694063555
  List of Datafiles in backup set 2036
  File LV Type Ckp SCN    Ckp Time               Name
  ---- -- ---- ---------- ---------------------- ----
   7    1  Incr 855661     2009-08-05:03:25:54
+DATA/orcl/datafile/appraisal.256.694061937
RMAN>
```

8) Use the incremental backup to recover the APPRAISAL tablespace image copy.

```
RMAN> recover copy of tablespace appraisal with tag
'app_incr';

Starting recover at 2009-08-05:03:29:20
using channel ORA_DISK_1
channel ORA_DISK_1: starting incremental datafile backup set
restore
channel ORA_DISK_1: specifying datafile copies to recover
recovering datafile copy file number=00007
name=+FRA/orcl/datafile/appraisal.288.694063519
channel ORA_DISK_1: reading from backup piece
+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.277.694063555
channel ORA_DISK_1: piece
handle=+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.277.69
4063555 tag=APP_INCR
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
Finished recover at 2009-08-05:03:29:21

Starting Control File and SPFILE Autobackup at 2009-08-
05:03:29:21
```

Practice 7-1: Recovering Image Copies (continued)

```
piece
handle=+FRA/orcl/autobackup/2009_08_05/s_694063763.260.6940637
63 comment=NONE
Finished Control File and SPFILE Autobackup at 2009-08-
05:03:29:26
RMAN>
```

9) List the SCN for the APPRAISAL tablespace image copy. What is it now?

```
RMAN> list copy of tablespace appraisal;

List of Datafile Copies
=======================

Key     File S Completion Time      Ckp SCN   Ckp Time
------- ---- - ------------------- --------- ----------------
---
2090    7    A 2009-08-05:03:29:20  855661    2009-08-
05:03:25:54
        Name: +FRA/orcl/datafile/appraisal.288.694063519
        Tag: APP_INCR
RMAN>
```

Note that it is now equal to the SCN of the last incremental backup.

10) Recover all the data file image copies in the database based on the most recent incremental backup.

```
RMAN> recover copy of database with tag 'app_incr';

Starting recover at 2009-08-05:03:33:29
using channel ORA_DISK_1
no copy of datafile 7 found to recover
channel ORA_DISK_1: starting incremental datafile backup set
restore
channel ORA_DISK_1: specifying datafile copies to recover
recovering datafile copy file number=00001
name=+FRA/orcl/datafile/system.291.694063333
channel ORA_DISK_1: reading from backup piece
+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.285.694063549
channel ORA_DISK_1: piece
handle=+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.285.69
4063549 tag=APP_INCR
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
channel ORA_DISK_1: starting incremental datafile backup set
restore
channel ORA_DISK_1: specifying datafile copies to recover
recovering datafile copy file number=00002
name=+FRA/orcl/datafile/sysaux.316.694063393
channel ORA_DISK_1: reading from backup piece
+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.284.694063551
```

```
channel ORA_DISK_1: piece
handle=+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.284.69
4063551 tag=APP_INCR
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
channel ORA_DISK_1: starting incremental datafile backup set
restore
channel ORA_DISK_1: specifying datafile copies to recover
recovering datafile copy file number=00003
name=+FRA/orcl/datafile/undotbs1.290.694063491
recovering datafile copy file number=00004
name=+FRA/orcl/datafile/users.283.694063527
recovering datafile copy file number=00005
name=+FRA/orcl/datafile/example.307.694063477
recovering datafile copy file number=00006
name=+FRA/orcl/datafile/br_tbs.289.694063517
channel ORA_DISK_1: reading from backup piece
+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.277.694063555
channel ORA_DISK_1: piece
handle=+FRA/orcl/backupset/2009_08_05/nnndn1_app_incr_0.277.69
4063555 tag=APP_INCR
channel ORA_DISK_1: restored backup piece 1
channel ORA_DISK_1: restore complete, elapsed time: 00:00:01
Finished recover at 2009-08-05:03:33:33

Starting Control File and SPFILE Autobackup at 2009-08-
05:03:33:33
piece
handle=+FRA/orcl/autobackup/2009_08_05/s_694064014.262.6940640
15 comment=NONE
Finished Control File and SPFILE Autobackup at 2009-08-
05:03:33:37
RMAN>
```

11) View the SCNs of all the image copies now. They should all be, at the most, equal to the latest incremental backup.

```
RMAN> list copy;

specification does not match any control file copy in the
repository
List of Datafile Copies
=======================

Key      File S Completion Time     Ckp SCN    Ckp Time
------- ---- - ------------------- ---------- ----------------
---
2144     1    A 2009-08-05:03:33:30 855654     2009-08-
05:03:25:49
        Name: +FRA/orcl/datafile/system.291.694063333
        Tag: APP_INCR
```

Practice 7-1: Recovering Image Copies (continued)

```
2145    2   A 2009-08-05:03:33:31 855657      2009-08-
05:03:25:51
        Name: +FRA/orcl/datafile/sysaux.316.694063393
        Tag: APP_INCR

2149    3   A 2009-08-05:03:33:32 855661      2009-08-
05:03:25:54
        Name: +FRA/orcl/datafile/undotbs1.290.694063491
        Tag: APP_INCR

2148    4   A 2009-08-05:03:33:32 855661      2009-08-
05:03:25:54
        Name: +FRA/orcl/datafile/users.283.694063527
        Tag: APP_INCR

1491    4   A 2009-08-05:02:19:40 847825      2009-08-
05:02:19:40
        Name: +FRA/orcl/datafile/users.299.694059581
        Tag: TAG20090805T021940

1436    4   A 2009-08-05:02:18:41 847727      2009-08-
05:02:18:41
        Keep: BACKUP_LOGS        Until: FOREVER
        Name: /tmp/bu_ORCL_17_1.dbf
        Tag: TAG20090805T021838

2146    5   A 2009-08-05:03:33:32 855661      2009-08-
05:03:25:54
        Name: +FRA/orcl/datafile/example.307.694063477
        Tag: APP_INCR

2147    6   A 2009-08-05:03:33:32 855661      2009-08-
05:03:25:54
        Name: +FRA/orcl/datafile/br_tbs.289.694063517
        Tag: APP_INCR

1641    6   A 2009-08-05:02:24:21 848546      2009-08-
05:02:24:20
        Name: /home/oracle/BACKUP/br_ORCL_23_1.dbf
        Tag: TAG20090805T022420

2090    7   A 2009-08-05:03:29:20 855661      2009-08-
05:03:25:54
        Name: +FRA/orcl/datafile/appraisal.288.694063519
        Tag: APP_INCR

RMAN>
```

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Practice 7-2: Performing Fast Recovery

In this practice, you take advantage of the Flash Recovery Area to perform a fast recovery of a data file.

Note: The data file numbers in your database may differ from what is shown here.

1) Use the RMAN session from the previous practice and take the APPRAISAL data file offline.

```
RMAN> sql "alter tablespace appraisal offline";

sql statement: alter tablespace appraisal offline
starting full resync of recovery catalog
full resync complete

RMAN>
```

2) Use the SWITCH command to replace the data file from the flash recovery area.

a) Determine the name of the data file that is currently associated with the APPRAISAL tablespace.

```
RMAN> report schema;

Report of database schema for database with db_unique_name
ORCL

List of Permanent Datafiles
===========================
File Size(MB) Tablespace          RB segs Datafile Name
---- -------- -------------------- ------- --------------------
-----
1    680      SYSTEM              YES
+DATA/orcl/datafile/system.260.694050517
2    570      SYSAUX              NO
+DATA/orcl/datafile/sysaux.266.694050521
3    85       UNDOTBS1            YES
+DATA/orcl/datafile/undotbs1.278.694050521
4    5        USERS               NO
+DATA/orcl/datafile/users.264.694050521
5    100      EXAMPLE             NO
+DATA/orcl/datafile/example.259.694050813
6    25       BR_TBS              NO
/home/oracle/BACKUP/br01.dbf
7    25       APPRAISAL           NO
+DATA/orcl/datafile/appraisal.256.694061937

List of Temporary Files
=======================
File Size(MB) Tablespace          Maxsize(MB) Tempfile Name
---- -------- -------------------- ----------- -------------
1    28       TEMP                32767
+DATA/orcl/tempfile/temp.265.694050795
```

Practice 7-2: Performing Fast Recovery (continued)

Note that there is only one data file for the tablespace. In this case, it is data file number 7. You can use that data file number, instead of the tablespace name, in the upcoming set of commands.

b) Confirm that you have an image copy for data file 7 that you can switch to.

```
RMAN> list copy of datafile 7;

List of Datafile Copies
=======================

Key      File S Completion Time      Ckp SCN    Ckp Time
------- ---- - ------------------ ---------- ----------------
---
2090    7    A 2009-08-05:03:29:20 855661     2009-08-
05:03:25:54
         Name: +FRA/orcl/datafile/appraisal.288.694063519
         Tag: APP_INCR
RMAN>
```

c) Switch to that copy of the image file.

```
RMAN> switch datafile 7 to copy;

datafile 7 switched to datafile copy
"+FRA/orcl/datafile/appraisal.288.694063519"
starting full resync of recovery catalog
full resync complete

RMAN>
```

d) Recover data file 7.

```
RMAN> recover datafile 7;

Starting recover at 2009-08-05:03:43:34
using channel ORA_DISK_1

starting media recovery
media recovery complete, elapsed time: 00:00:01

Finished recover at 2009-08-05:03:43:35
RMAN>
```

3) Bring the APPRAISAL tablespace back online.

```
RMAN> sql "alter tablespace appraisal online";

sql statement: alter tablespace appraisal online
starting full resync of recovery catalog
full resync complete

RMAN>
```

Practice 7-2: Performing Fast Recovery (continued)

4) Report the schema to note the file name for the APPRAISAL tablespace.

```
RMAN> report schema;

Report of database schema for database with db_unique_name
ORCL

List of Permanent Datafiles
===========================
File Size(MB) Tablespace          RB segs Datafile Name
---- -------- ------------------- ------- --------------------
-----
1    680      SYSTEM              YES
+DATA/orcl/datafile/system.260.694050517
2    570      SYSAUX              NO
+DATA/orcl/datafile/sysaux.266.694050521
3    85       UNDOTBS1            YES
+DATA/orcl/datafile/undotbs1.278.694050521
4    5        USERS               NO
+DATA/orcl/datafile/users.264.694050521
5    100      EXAMPLE             NO
+DATA/orcl/datafile/example.259.694050813
6    25       BR_TBS              NO
/home/oracle/BACKUP/br01.dbf
7    25       APPRAISAL           NO
+FRA/orcl/datafile/appraisal.288.694063519

List of Temporary Files
=======================
File Size(MB) Tablespace          Maxsize(MB) Tempfile Name
---- -------- ------------------- ----------- ---------------
-----
1    28       TEMP                32767
+DATA/orcl/tempfile/temp.265.694050795

RMAN>
```

Note that you are now using the Flash Recovery Area data file as the open data file for the online tablespace.

5) Determine what happened to the original data file.

List the image copies for data file 7, to see if it is listed.

```
RMAN> list copy of datafile 7;

List of Datafile Copies
=======================

Key     File S Completion Time    Ckp SCN    Ckp Time
------- ---- - ------------------ ---------- ----------------
---
```

Practice 7-2: Performing Fast Recovery (continued)

```
2248    7    A 2009-08-05:03:42:49 856719        2009-08-
05:03:39:13
         Name: +DATA/orcl/datafile/appraisal.256.694061937
```

Note that it is still there and is listed now as an image copy. But, the reason for switching was because this data file was considered to be on a damaged disk, or the data file itself was corrupted.

6) In a separate terminal window, make sure you are at the ~/labs directory.

```
$ cd ~/labs
```

7) Remember that the reason for switching was because this data file was considered to be on a damaged disk, or the data file itself was corrupted in some way. So, run the rm_asm_file.sh script to delete the file. But first, you must ensure that you are pointing to the +ASM instance.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ asmcmd rm +DATA/orcl/datafile/appraisal.256.694061937
```

8) Eventually, you want to refrain from using the Flash Recovery Area as storage for active data files. By now, the hardware or corruption problem has been remedied, so switch the data file back to the original location.

a) Back up the data file, specifying the DATA ASM disk group, using the DATAFILE template.

```
RMAN> backup as copy to destination '+DATA(datafile)' datafile
7;

Starting backup at 2009-08-05:03:49:30
using channel ORA_DISK_1
channel ORA_DISK_1: starting datafile copy
input datafile file number=00007
name=+FRA/orcl/datafile/appraisal.288.694063519
output file name=+DATA/orcl/datafile/appraisal.256.694064971
tag=TAG20090805T034930 RECID=28 STAMP=694064971
channel ORA_DISK_1: datafile copy complete, elapsed time:
00:00:03
Finished backup at 2009-08-05:03:49:33

Starting Control File and SPFILE Autobackup at 2009-08-
05:03:49:33
piece
handle=+FRA/orcl/autobackup/2009_08_05/s_694064975.295.6940649
77 comment=NONE
Finished Control File and SPFILE Autobackup at 2009-08-
05:03:49:42
RMAN>
```

Practice 7-2: Performing Fast Recovery (continued)

b) Take the data file offline.

```
RMAN> sql "alter database datafile 7 offline";

sql statement: alter database datafile 7 offline

RMAN>
```

c) Switch the data file to the newly made copy.

```
RMAN> switch datafile 7 to copy;

datafile 7 switched to datafile copy
"+DATA/orcl/datafile/appraisal.256.694064971"
starting full resync of recovery catalog
full resync complete

RMAN>
```

d) Report the schema to confirm that the data file location has changed.

```
RMAN> report schema;

Report of database schema for database with db_unique_name
ORCL

List of Permanent Datafiles
===========================
File Size(MB) Tablespace          RB segs Datafile Name
---- -------- -------------------- ------- -------------------
-----
1    680      SYSTEM              YES
+DATA/orcl/datafile/system.260.694050517
2    570      SYSAUX              NO
+DATA/orcl/datafile/sysaux.266.694050521
3    85       UNDOTBS1            YES
+DATA/orcl/datafile/undotbs1.278.694050521
4    5        USERS               NO
+DATA/orcl/datafile/users.264.694050521
5    100      EXAMPLE             NO
+DATA/orcl/datafile/example.259.694050813
6    25       BR_TBS              NO
/home/oracle/BACKUP/br01.dbf
7    25       APPRAISAL           NO
+DATA/orcl/datafile/appraisal.256.694064971

List of Temporary Files
=======================
File Size(MB) Tablespace          Maxsize(MB) Tempfile Name
---- -------- -------------------- ----------- ---------------
-----
1    28       TEMP                32767
+DATA/orcl/tempfile/temp.265.694050795
```

Practice 7-2: Performing Fast Recovery (continued)

9) Recover the data file.

```
RMAN> recover datafile 7;

Starting recover at 2009-08-05:03:53:27
using channel ORA_DISK_1

starting media recovery
media recovery complete, elapsed time: 00:00:00

Finished recover at 2009-08-05:03:53:27
RMAN>
```

10) Bring the data file online.

```
RMAN> sql "alter database datafile 7 online";

sql statement: alter database datafile 7 online

RMAN>
```

11) Cross-check the image copy backups and remove the obsolete data file 7 image copy.
Exit RMAN when finished.

```
RMAN> crosscheck copy;

released channel: ORA_DISK_1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=58 device type=DISK
specification does not match any control file copy in the
repository
validation succeeded for datafile copy
datafile copy file
name=+FRA/orcl/datafile/system.291.694063333 RECID=21
STAMP=694064010
..
validation failed for datafile copy
datafile copy file
name=+DATA/orcl/datafile/appraisal.256.694061937 RECID=27
STAMP=694064569
..
name=+FRA/orcl/archivelog/2009_08_05/thread_1_seq_2.326.694061
513 RECID=21 STAMP=694061513
validation succeeded for archived log
archived log file
name=+FRA/orcl/archivelog/2009_08_05/thread_1_seq_3.311.694061
747 RECID=22 STAMP=694061750
Crosschecked 29 objects

RMAN> list expired copy;

specification does not match any archived log in the
repository
```

Practice 7-2: Performing Fast Recovery (continued)

```
List of Datafile Copies
=======================

Key      File S Completion Time    Ckp SCN    Ckp Time
------- ---- - ------------------ ---------- ----------------
---
2248     7    X 2009-08-05:03:42:49 856719     2009-08-
05:03:39:13
        Name: +DATA/orcl/datafile/appraisal.256.694061937

RMAN> delete expired copy;

released channel: ORA_DISK_1
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=58 device type=DISK
specification does not match any control file copy in the
repository
specification does not match any archived log in the
repository
List of Datafile Copies
=======================

Key      File S Completion Time    Ckp SCN    Ckp Time
------- ---- - ------------------ ---------- ----------------
---
2248     7    X 2009-08-05:03:42:49 856719     2009-08-
05:03:39:13
        Name: +DATA/orcl/datafile/appraisal.256.694061937
Do you really want to delete the above objects (enter YES or
NO)? YES
deleted datafile copy
datafile copy file
name=+DATA/orcl/datafile/appraisal.256.694061937 RECID=27
STAMP=694064569
Deleted 1 EXPIRED objects

RMAN> exit
```

Practice 8-1: Monitoring RMAN Jobs

In this practice, you execute a long-running RMAN job and monitor its progress to determine how much longer it is expected to run.

1) Point to the ORCL instance, invoke RMAN and delete all obsolete backups. You need to perform a cross-check first, so that the repository is up-to-date.

```
$ . oraenv
orcl
$ rman target / catalog rcatowner@rcat
recovery catalog database Password: oracle_4U <<<not displayed

RMAN> crosscheck backup;
. . .
RMAN> delete noprompt obsolete;
. . .
```

2) Open a second terminal window. Change to the labs directory and point to the 20cl instance. Invoke SQL*Plus and connect as SYSDBA. You use this second session to monitor a database backup.

```
$ . oraenv
orcl
$ sqlplus / as sysdba
```

3) Return to your first terminal window. In your RMAN session, begin a database backup to the tape device.

```
RMAN> backup device type sbt database;

Starting backup at 2009-08-05:04:23:41
released channel: ORA_DISK_1
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=47 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: WARNING: Oracle Test Disk API
channel ORA_SBT_TAPE_1: starting full datafile backup set
channel ORA_SBT_TAPE_1: specifying datafile(s) in backup set
input datafile file number=00001
name=+DATA/orcl/datafile/system.260.694050517
channel ORA_SBT_TAPE_1: starting piece 1 at 2009-08-
05:04:23:42
channel ORA_SBT_TAPE_1: finished piece 1 at 2009-08-
05:04:24:37
piece handle=20klt7qe_1_1 tag=TAG20090805T042342 comment=API
Version 2.0,MMS Ver
sion 8.1.3.0...
```

Practice 8-1: Monitoring RMAN Jobs (continued)

4) Use your SQL*Plus session to monitor the progress of the database backup by querying the V$SESSION_LONGOPS view. By using this view, you can determine whether the backup is progressing normally or hanging. If the backup is progressing normally, the TIME_REMAINING column should be decreasing. Execute the query_longops2.sql script a few times to query V$SESSION_LONGOPS. Since the script contains multiple SELECT statements, you cannot enter slash to rerun the script. You must type or paste the script name for each run. Each time you should see the TIME_REMAINING value decreasing for the SID associated with the backup task. The detail data section pertains to individual channel openings and closings. The aggregate data section describes the entire RMAN job progress.

```
SQL> @query_longops2.sql

Detail Data
----------------------------------------
Detail Progress Information (per file)


      SID START_TIME              ELAPSED_SECONDS TIME_REMAINING
---------- -------------------    --------------- --------------
       40 2009-08-05:05:12:19                  20             24


Aggregate Data
------------------------------
Aggregate Progress Information


  SID    SERIAL#    CONTEXT       SOFAR   TOTALWORK %_COMPLETE
------- ---------- ---------- ---------- ---------- -------
   21       934          4       43999      236000      18.64
SQL> @query_longops2.sql
Detail Data
----------------------------------------
Detail Progress Information (per file)


      SID START_TIME              ELAPSED_SECONDS TIME_REMAINING
---------- -------------------    --------------- --------------
       40 2009-08-05:05:13:26                  12             35


Aggregate Data
------------------------------
Aggregate Progress Information


   SID     SERIAL#    CONTEXT       SOFAR   TOTALWORK %_COMPLETE
-------- ---------- ---------- ---------- ---------- -------
     21       934          4      131039      236000      55.53
```

Practice 8-1: Monitoring RMAN Jobs (continued)

5) Exit your RMAN and SQL sessions.

6) Run the cleanup_archivelogs.sh script to back up and remove archivelog files. This takes several minutes to run.

```
$ cd ~/labs
$ ./cleanup_archivelogs.sh
```

7) Run the cleanup_tape_dir.sh script to remove files from the /tape directory.

```
$ ./cleanup_tape_dir.sh
```

In this lesson you learn about diagnosing and repairing block corruption.
In these practices, you employ various diagnostic capabilities to solve errors.

Practice 9-1: Diagnostic Scenario

In this optional practice, you create a data dictionary corruption that you analyze using Support Workbench and ADRCI. *If you begin this practice, you must complete it.*

1) Execute the hm_setup.sh script from the labs subdirectory. This script corrupts the data dictionary.

```
$ . oraenv
orcl
$ cd ~/labs
$ cat hm_setup.sh
#!/bin/bash

cd /home/oracle/labs

sqlplus / as sysdba <<EOF

set echo on
create table scott.tabjmw(c number) tablespace users;
variable obj number;

begin
select object_id into :obj from dba_objects where
owner='SCOTT' and object_name='TABJMW';
end;
/
print obj;
update tab$ set cols=1001 where obj#=:obj;
commit;
EOF

$ ./hm_setup.sh

SQL> SQL> SQL>
Table created.

SQL> SQL> SQL>    2    3    4
PL/SQL procedure successfully completed.

SQL>
        OBJ
----------
     74657

SQL>
1 row updated.

SQL>
Commit complete.
$
```

Practice 9-1: Diagnostic Scenario (continued)

2) Use EM to trigger a health check on the data dictionary.

    a) From the Database home page (connected as the SYS user), click Advisor Central
        at the bottom of the page in the Related Links section.

    b) On the Advisor Central page, click the Checkers tab.

    c) On the Checker tabbed page, click Dictionary Integrity Check.

Advisor Central

Advisors	**Checkers**	

Page Refreshed **July 22, 2009 11:11:05 PM GMT+07:00**

Checkers

DB Structure Integrity Check	Redo Integrity Check	Undo Segment Integrity Check
Data Block Integrity Check	Dictionary Integrity Check	CF Block Integrity Check
Transaction Integrity Check		
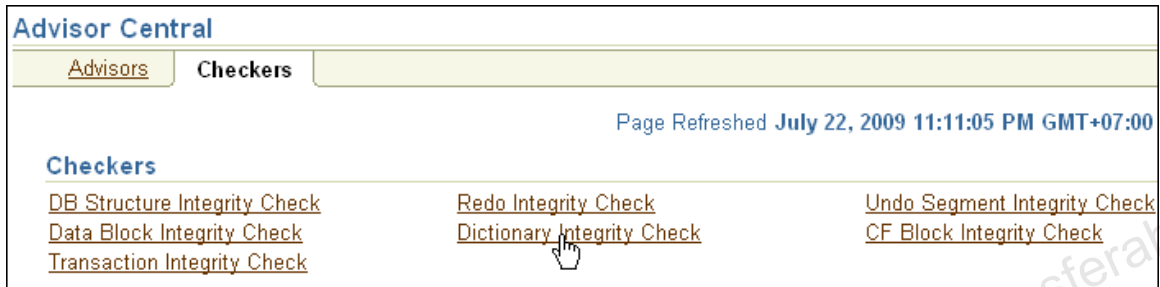
    d) On the Run Dictionary Integrity Check page, specify a Run Name: DictCheck
        and click OK.

Run Dictionary Integrity Check

Cancel   OK

Checks dictionary integrity

Options

Specify the following parameters in order to run this checker.

Parameter	Value	Description
Run Name	DictCheck	The run name parameter is used to identify this run.
Timeout (sec)		The time allocated for this run before its forced to stop.
TABLE_NAME		Table name
CHECK_MASK		Check mask

    e) Back to the Advisor Central Checkers page, you should see a Confirmation
        message indicating that your check ran successfully.

    f) Select your DictCheck run and click Details.

Results

Details

Select	Checker Name	Run Name	Run Type	Status	Start Time ▽	End Time
⊙	Dictionary Integrity Check	DictCheck	Manual	Completed	July 22, 2009 11:12:55 PM GMT+07:00	July 22, 2009 11:13:01 PM GMT+07:00
○	DB Structure Integrity Check	HM_RUN_1	Reactive	Completed	July 20, 2009 11:52:28 PM GMT+07:00	July 20, 2009 11:52:29 PM GMT+07:00

    g) This takes you to the Run Details Findings tabbed page, where you can see some
        Data Corruption. In particular, you should see the following finding: "SQL
        dictionary health check: invalid column number 8 on object TAB$ failed."

Practice 9-1: Diagnostic Scenario (continued)

Select	Description	Priority	Damage Translation	Incident ID	Status ▽	Time Detected
☐	▼ All Findings					
☐	SQL dictionary health check: invalid column number 8 on object TAB$ failed	Critical	Damaged rowid is AAAAACAABAAAUfPAAC - description: Object SCOTT.TABJMW is referenced		Open	July 22, 2009 11:12:56 PM GMT+07:00

The corruption should correspond to a row in TAB$ that references SCOTT.TABJMW.

3) How would you get a report about the previous finding using SQL*Plus?

```
$ sqlplus / as sysdba

SQL> set long 100000
SQL> set pages 999

SQL> select dbms_hm.get_run_report('DictCheck') from dual;

DBMS_HM.GET_RUN_REPORT('DICTCHECK')
-------------------------------------------------------------------
------------
Basic Run Information
 Run Name                    : DictCheck

 Run Id                      : 481

 Check Name                  : Dictionary I
ntegrity Check
 Mode                        : MANUAL

 Status                      : COMPLETED

 Start Time                  : 2009-07-22
23:12:55.920739 +07:00
 End Time                    : 2009-07-22 23:13:01.5127
11 +07:00
 Error Encountered           : 0

 Source Incident Id          : 0

 Number of Incidents Created : 0


Input Paramters for the Run
 TABLE_NAME=ALL_CORE_TABLES
 CHECK_MASK=ALL

Run Findings And Recommendations
 Finding

 Finding Name  : Dictionary Inconsistency

 Finding ID    : 482
```

Practice 9-1: Diagnostic Scenario (continued)

```
 Type          : FAILURE

 Status        : OPEN

 Priority      : CRITICAL

 Message       : SQL dictionary health check: i
nvalid column number 8 on
               object TAB$ failed

 Message       : Damaged rowid is AAAAACAABAAAU
fPAAC - description: Object
               SCOTT.TABJMW is referenced


SQL>
```

4) Navigate to your EM Home page. What do you observe in the Alerts section?

You should see a new critical alert (Data Failure) for the previously detected corruption in the Alerts section of the Home page. (*It may take a while to appear.*)

Severity ▽	Category	Name	Impact	Message	Alert Triggered
✕	Data Failure	Data Failure Detected		Checker run found 1 new persistent data failures.	Jul 22, 2009 11:15:07 PM
⚠	User Audit	Audited User		User SYS logged on from edrsr37p1.us.oracle.com.	Jul 22, 2009 11:20:28 PM

▼ Alerts

Category All ☑ (Go) Critical ✕ 1 Warning ⚠ 1

5) Flush your shared pool and buffer cache first, and then exit and reconnect as the SYS user.

```
$ sqlplus / as sysdba
SQL> alter system flush shared_pool;
System altered.

SQL>
SQL> alter system flush buffer_cache;
System altered.

SQL> exit
```

```
$ sqlplus / as sysdba
```

6) From a SQL*Plus session connected as the SYS user, execute the following statement: select * from scott.tabjmw;
Question: What do you observe?

```
SQL> select * from scott.tabjmw;

select * from scott.tabjmw
*
ERROR at line 1:
```

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Practice 9-1: Diagnostic Scenario (continued)

```
ORA-03113: end-of-file on communication channel
Process ID: 14872
Session ID: 66 Serial number: 6259
SQL>
```

Answer: At first the session seems to hang, then the ORA-03113 error is displayed.

7) Use EM to investigate the previous problem.

   a) From the EM Home page, you should see one active incident. Click the Active Incident link. If not, click Software and Support. On the Software and Support tabbed page, click Support Workbench in the Support section.

   b) On the Support Workbench Problems tabbed page, you should see a new Active Incident whose description is similar to ORA 7445 [qcstda()+690].

   c) Click the "+" icon in the Details column for this problem.

   d) This shows you the corresponding first-time incident.

   e) Make a note of the incident number (In this screenshot it is 8729).

   f) Click that incident number.

   g) This takes you to the corresponding Incident Details page.

   h) On the Incident Details page, in the Application Information section, you can see the cause the incident. It is: "select * from scott.tabjmw".

Practice 9-1: Diagnostic Scenario (continued)

Incident Details: 8729

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Summary

Problem Key	ORA-7445		Data Dumped	Yes
	[qcstda()+690]		ECID	Unknown
	[SIGSEGV]		Correlation Keys	SID = 66.6259, ProcId = 41.90
	[ADDR:0x0]			PQ = (0, 1248280045), Client ProcId = oracle@edrsr37p1.us.oracle.com (TNS V1-V3).14872_3707568
	[PC:0x9D93D68]			
	[Address not mapped to object]			August 21, 2009 11:27:26 PM GMT+07:00 (Purging
Status	Ready		Purge Date	Enabled) (Disable Purging)
Active	Yes			
Timestamp	July 22, 2009 11:27:26 PM GMT+07:00			
Impact	Unknown			
Source	System Generated			

Application Information

SQL ID	f18d4qk7w52s7
SQL Text	select * from scott.tabjmw
User	SYS
Module	sqlplus@edrsr37p1.us.oracle.com (TNS V1-V3)
Action	Unknown

Dump Files | Checker Findings | Additional Diagnostics

File Name	Size (MB)	Timestamp	Path	View Contents
orcl_ora_14872_i8729.trc	9.33	July 22, 2009 11:28:43 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl/incident/incdir_8729	👓
orcl_ora_14872.trc	< 0.01	July 22, 2009 11:28:43 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl/trace	👓

You can also see two dump files generated from the Dump Files tabbed page. The first one corresponds to the incident dump file and is located in the ADR directory `/u01/app/oracle/diag/rdbms/orcl/orcl/incident/incdir_nnnn n`. The second one is the classical corresponding trace file located in `/u01/app/oracle/diag/rdbms/orcl/orcl/trace`.

h) Click the eyeglasses icon in the View Contents column for the incident trace (first row).

i) If you did not save your Host credentials previously, then the Host Credentials page is displayed. Enter `oracle` as username and enter `oracle` as password, then click Continue.

8) On the Contents page, you see the structured trace information. Expand the `incident_dump` and `custom_assert_dump` nodes.

Practice 9-1: Diagnostic Scenario (continued)

Contents: orcl_ora_14872_i8729.trc

9) Then click the "current sql statement" link.

10) This prints the culprit SQL statement in the window below the Trace Map.

```
----- Current SQL Statement for this session (sql_id=f18d4gk7w52s7) -----
select * from scott.tabjmw
```

11) Click OK.

12) On the Incident Details page again, click the Problem Key link.

Summary

Problem Key	ORA 7445
	[qcstda()+690]
	[SIGSEGV]
	[ADDR:0x0]
	[PC:0x9D93D68]
	[Address not mapped to object]
Status	Ready
Active	Yes

13) On the Problem Details page, click Edit to the right of the SR field.

14) Enter 1234 in the SR Number pop-up window that appears and click OK. It is assumed that you already opened an SR (1234) with MetaLink.

Practice 9-1: Diagnostic Scenario (continued)

Problem Details: ORA 7445 [qcstda()+690]

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Investigate an

Go to My Or

Summary

SR#	--	[Edit]
Bug#	--	[Edit]
Active	**Yes**	
Packaged	**No**	
Number of Incidents	**1**	

Last Dumped Incident

The page at https://edrsr37p1.us.oracle.co...

Please enter a Service Request Number (SR)

1234

[OK] [Cancel]

15) You should now see the SR number on the Problem Details page.

16) Click the Activity Log tab.

17) This takes you to the Activity Log tabbed page, on which you can now see your last action on the problem. You can optionally enter a comment here. (If you do, click Add Comment to save your comment.)

Incidents	**Activity Log**

Comment This is a test comment fot SR 1234   [Add Comment]

User	Action	Description	Timestamp ▽
SYS	Comment	Set SR : 1234	July 22, 2009 11:52:33 PM GMT+07:00

18) Back to your terminal window, locate your incident and your health check report in ADR. (Your incident number may be different.)

```
$ cd $ORACLE_BASE/diag/rdbms/orcl/orcl

$ ls
alert  cdump  hm  incident  incpkg  ir  lck  metadata  stage
sweep  trace
$ cd incident
$ ls -la
total 12
drwxr-x---  3 oracle dba 4096 Jul 22 23:27 .
drwxr-x--- 13 oracle dba 4096 Jul 20 23:49 ..
drwxr-xr-x  2 oracle dba 4096 Jul 22 23:27 incdir_8729

$ cd incdir_8729

$ ls
orcl_ora_14872_i8729.trc  orcl_ora_14872_i8729.trm

$ cd ../..
$ ls
alert  cdump  hm  incident  incpkg  ir  lck  metadata  stage
sweep  trace
```

Practice 9-1: Diagnostic Scenario (continued)

```
$ cd hm
$ ls
HMREPORT_DictCheck.hm
$ cd ..
$
```

19) Use ADRCI to locate your incident and problem information.

```
$ adrci

ADRCI: Release 11.2.0.0.2 - Beta on Thu Jun 4 20:14:32 2009
ADRCI: Release 11.2.0.1.0 - Production on Thu Jul 23 01:04:39
2009

Copyright (c) 1982, 2009, Oracle and/or its affiliates.  All
rights reserved.

ADR base = "/u01/app/oracle"
adrci> set homepath diag/rdbms/orcl/orcl

adrci> show homes
ADR Homes:
diag/rdbms/orcl/orcl
adrci> show incidents
ADR Home = /u01/app/oracle/diag/rdbms/orcl/orcl:
*****************************************************************
***********
INCIDENT_ID          PROBLEM_KEY
CREATE_TIME
-------------------- ---------------------------------------
----------------- ---------------------------------------
8729                 ORA 7445 [qcstda()+690]
2009-07-22 23:27:26.129000 +07:00
1 rows fetched
adrci>
```

20) Use Enterprise Manager to package your problem quickly.

21) From the Problem Details page, click Quick Package in the Investigate and Resolve section.

Practice 9-1: Diagnostic Scenario (continued)

22) On the Quick Packaging: Create New Package page, leave the default package name (something similar to ORA7445qc_20090723011838) and select No for "Send to Oracle Support" entry.

23) When the page is refreshed, click Next.

24) On the Quick Packaging: View Contents page, you can see the list of incidents that are part of this package. There should be only one incident in your case. Click Next.

25) On the Quick Packaging: View Manifest page, look at the package name and the path.

Practice 9-1: Diagnostic Scenario (continued)

Quick Packaging: View Manifest

Cancel   Back   Step 3 of 4   Next

Target	orcl.us.oracle.com
Problems Selected	ORA 7445 [qcstda()+690]
Package Name	ORA7445qc_20090723011838

Logged in As   **SYS**
Service Request Number (SR#)
Total Size (uncompressed)   **9.45 MB**

Path **/u01/app/oracle/diag/rdbms/orcl/orcl/incpkg/pkg_1/seq_1/manifest_1_1.txt**

Manifest for package 1

Manifest details

26) Click Next.

27) On the Quick Packaging: Schedule page, ensure Immediately is selected and click Submit.

Quick Packaging: Schedule

Cancel   Back   Step 4 of 4   Submit

Target	orcl.us.oracle.com
Problems Selected	ORA 7445 [qcstda()+690]
Package Name	ORA7445qc_20090723011838

Logged in As   **SYS**
Service Request Number (SR#)
Total Size (uncompressed)   **9.45 MB**

Larger upload files may take longer to generate and send to Oracle.

◉ Immediately
○ Later

28) The Processing: Generating Upload File for Package page appears. Wait until it is finished.

29) On the Confirmation page, you should see something similar to: "Generating an upload file for package: ORA7445qc_20090723011838 has failed."

📖 **Confirmation**

Generating an upload file for package: ORA7445qc_20090723011838 has failed.

OK

30) Click OK.

31) On the Problem Details page, click the Activity Log tab.

32) Back to the Problem Details Activity Log tabbed page, you should now see two new entries in the log reporting about the package creation for this problem.

	Incidents	**Activity Log**		

Comment [   ]   Add Comment

User	Action	Description	Timestamp ▽
SYS	Package	Failed to create physical file : packageId = 1	July 23, 2009 1:26:09 AM GMT+07:00
SYS	Comment	Created package : Id = 1 Name = ORA7445qc_20090723011838	July 23, 2009 1:21:36 AM GMT+07:00

33) In the Summary section, click Yes to the right of the Packaged entry.

34) This takes you to the Packages page, from where you can see your package.

View

Select	Name	Status	Type	Description	Main Problem Keys
◉	ORA7445qc_20090723011838	Active		ORA 7445 [qcstda()+690]	July 23, 2009 1:21:35 AM GMT+07:00

Practice 9-1: Diagnostic Scenario (continued)

35) Select your package, and click View.

Package Details: ORA7445qc_20090723011838

Page Refreshed **July 23, 2009 1:31:59 AM GMT+07:00** (Refresh)

(Customize Package)

Summary

Status	**Active** (Finish Contents Preparation)
Type	**Main**
Total Size (uncompressed)	**12.24 MB**
Incremental Size (uncompressed)	**0.1 MB**
Created	**July 23, 2009 1:21:35 AM GMT+07:00**
Description	**N/A**
Problems in Package	ORA 7445 [qcstda()+690]
Incidents Previously Excluded by User	**0**
Files Excluded by User	**0**

Incidents   Files   Activity Log

ID	Type	Problem ID	Description	Size (MB)	Timestamp
8729	Main	1	ORA-7445 [qcstda()+690] [SIGSEGV] [ADDR:0x0] [PC:0x9D93D68] [Address not mapped to object]	0	July 22, 2009 11:27:26 PM GMT+07:00

This takes you to the Package Details page, where you can see the package details.

36) Click the Files tab.

Incidents   **Files**   Activity Log

View Full Package Contents ▼

⊙ Previous 1-25 of 50 ▼ Next 25 ⊙

Source	Name	Size (MB)	Has User Data	Timestamp	Path	View
Incident	orcl_ora_14872_i8729.trm	0.11	No	July 22, 2009 11:28:43 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /incident/incdir_8729	
Incident	orcl_ora_14872_i8729.trc	9.33	No	July 22, 2009 11:28:43 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /incident/incdir_8729	∞
Common	orcl_ora_14872.trc	< 0.01	No	July 22, 2009 11:28:43 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /trace	∞
Common	orcl_ora_14872.trm	< 0.01	No	July 22, 2009 11:28:43 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /trace	
Common	manifest_1_1.xml	0.01	No	July 23, 2009 1:26:03 AM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /incpkg/pkg_1/seq_1	
Common	manifest_1_1.html	0.01	No	July 23, 2009 1:26:03 AM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /incpkg/pkg_1/seq_1	
Common	manifest_1_1.txt	0.02	No	July 23, 2009 1:26:04 AM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /incpkg/pkg_1/seq_1	
Common	log.xml	0.37	No	July 22, 2009 11:28:46 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl /alert	
Common	alert_orcl.log	0.07	No	July 22, 2009 11:28:46 PM GMT+07:00	/u01/app/oracle/diag/rdbms/orcl/orcl	

On the Files tabbed page, you can now see the Full Package Content view.

37) Use ADRCI to determine the list of existing packages.

```
$ adrci

ADRCI: Release 11.1.0.5.0 - Beta on Thu May 24 07:57:13 2007
```

Practice 9-1: Diagnostic Scenario (continued)

```
Copyright (c) 1982, 2007, Oracle.  All rights reserved.

ADR base = "/u01/app/oracle"
adrci> set homepath diag/rdbms/orcl/orcl
adrci> query ips_package


ADR Home = /u01/app/oracle/diag/rdbms/orcl/orcl:
************************************************************
**********
PACKAGE_ID              FLAGS                 STATUS
CREATION_TIME                                 LAST_SEQUENCE
LAST_COMPLETE_SEQUEN PROBLEM_ID               NAME
DESCRIPTION
CORRELATION_LEVEL     DRIVING_INCIDENT     BEGIN_TIME
END_TIME                                     UPDATE_TIME
LAST_BASE_SEQUENCE
------------------ ------------------ --------------------
------------------------------------------- -------------------
------------------ ------------------ ---------------------
------------------------------------------------------------
------------------ ---------------------------------------
------------------------------------------------------------
------------------------------------------------------------
------------------------------------------------------------
------------------------------------------------------------
---------- ------------------ ------------------- --------
------------------------------------ ------------------------
-------------------------------------- --------------------
------------
1                  0                      4
2009-07-23 01:21:35.798774 +07:00        1
1                  1
ORA7445qc_20090723011838
2                  8729
2009-07-23 01:21:35.919160 +07:00        0
1 rows fetched

adrci> exit
```

38) After analyzing the problem, you know that the number of columns for TABJMW is wrong in TAB$. Fix the issue by updating TAB$ and close your problem. You can execute hm_fix.sh from the labs subdirectory for that purpose.

```
$ cd ~/labs
$ cat hm_fix.sh
#!/bin/bash
# For training purpose only

sqlplus / as sysdba <<EOF
set echo on
variable obj number;
```

Practice 9-1: Diagnostic Scenario (continued)

```
begin
select object_id into :obj from dba_objects where
owner='SCOTT' and object_name='TABJMW';
end;
/
print obj;
update tab$ set cols=1 where obj#=:obj;
commit;
EOF
$ ./hm_fix.sh
SQL> SQL> SQL>    2    3    4
PL/SQL procedure successfully completed.

SQL>
       OBJ
----------
     74657

SQL>
1 row updated.

SQL>
Commit complete.
$
```

39) Use Enterprise Manager to close your incident.

40) On the Package Details page, click the "problem" link to the right of the "Problems in Package" field in the Summary section.

41) On the Problem Details Incidents tabbed page, select your incident and click Close.

Practice 9-1: Diagnostic Scenario (continued)

		Incidents	Activity Log				

Status [Open Incidents ▼] Data Dumped [Yes ▼] (Go)

(View) (Close)

Select All | Select None | Show All Details | Hide All Details

Select	Details	ID	Description	Data Dumped	Active	Status	Timestamp ▽
☑	▶ Show	8729	ORA-7445 [qcstda()+690] [SIGSEGV] [ADDR:0x0] [PC:0x9D93D68] [Address not mapped to object]	Yes	Yes	Ready	July 22, 2009 11:27:26 PM GMT+07:00

42) On the Confirmation page, click Yes.

Practice 9-2: Repairing Block Corruption

1) To set up this block corruptions practice, use a terminal window, navigate to the
   $HOME/labs directory, and execute the bc_setup.sh script. This script creates a
   tablespace called BCTBS and a user called BC. The tablespace is then populated. A
   backup of the new tablespace is performed.

   Take a few moments to inspect each script actions before executing it. As usual you
   point to the orcl instance.

```
$ cd ~/labs
$ . oraenv
ORACLE_SID = [orcl] ? orcl

$ cat bc_setup.sh
#!/bin/bash
# For training purpose only
# Run as oracle OS user

sqlplus -S /nolog > /tmp/setup.log 2>&1 <<EOF
connect / as sysdba

-- CLEANUP from previous run
DROP USER bc CASCADE;

DROP TABLESPACE bctbs INCLUDING CONTENTS AND DATAFILES;

-- Create tablespace
CREATE TABLESPACE bctbs
DATAFILE '/home/oracle/BACKUP/bctbs01.dbf' SIZE 10M
SEGMENT SPACE MANAGEMENT MANUAL;

-- Create user
CREATE USER bc IDENTIFIED BY oracle_4U
DEFAULT TABLESPACE bctbs
QUOTA UNLIMITED ON bctbs;

GRANT CREATE SESSION TO bc;

-- create table and populate
-- be sure table is at least 2 blocks long
CREATE TABLE bc.bccopy
TABLESPACE bctbs
AS SELECT * FROM HR.EMPLOYEES;

INSERT INTO bc.bccopy
SELECT * FROM bc.bccopy;

INSERT INTO bc.bccopy
SELECT * FROM bc.bccopy;
EOF
```

```
#-- Create backup of the bctbs tablespace

rman target / > /tmp/rman.log 2>&1 <<EOF

BACKUP AS COPY TABLESPACE bctbs;
EOF

#-- update the table
sqlplus -S /nolog >> /tmp/setup.log 2>&1 <<EOF
connect / as sysdba

UPDATE bc.bccopy SET salary = salary+1;

COMMIT;

EOF
```

```
$  ./bc_setup.sh
```

2) Log into SQL*Plus as the SYS user and execute the bc_critical script, which corrupts the data file. Enter your displayed block number.

```
$ sqlplus / as sydba

SQL> @bc_critical
Connected.

    FILE_NO   BLOCK_NO
---------- ----------
         7        129

System altered.

'Enter Block number when prompted'
Enter value for block_no: 129
0+1 records in
0+1 records out
80 bytes (80 B) copied, 6.1724e-05 seconds, 1.3 MB/s
0+1 records in
0+1 records out
79 bytes (79 B) copied, 5.7166e-05 seconds, 1.4 MB/s

SELECT * from bc.bccopy
               *
ERROR at line 1:
ORA-01578: ORACLE data block corrupted (file # 7, block # 129)
ORA-01110: data file 7: '/home/oracle/BACKUP/bctbs01.dbf'

SQL>
```

3) Use RMAN to back up the TBSBC tablespace. What happens?

```
$ rman target / nocatalog
RMAN> backup tablespace bctbs;

Starting backup at 2009-07-23:16:21:16
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=1 device type=DISK
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=00007
name=/home/oracle/BACKUP/bctbs01.dbf
channel ORA_DISK_1: starting piece 1 at 2009-07-23:16:21:16
RMAN-00571:
===========================================================
RMAN-00569: =============== ERROR MESSAGE STACK FOLLOWS
===============
RMAN-00571:
===========================================================
RMAN-03009: failure of backup command on ORA_DISK_1 channel at
07/23/2009 16:21:23
ORA-19566: exceeded limit of 0 corrupt blocks for file
/home/oracle/BACKUP/bctbs01.dbf

RMAN> exit
```

The backup fails upon encountering the first corrupt block.

4) Use the RMAN `list failure` command to provide details about the errors.

```
$ rman target / nocatalog

Recovery Manager: Release 11.1.0.6.0 - Production on Mon Aug
27 09:49:50 2007

connected to target database: ORCL (DBID=1158576740)

RMAN> list failure detail;

RMAN> List of Database Failures
=========================

Failure ID Priority Status    Time Detected        Summary
---------- -------- --------- ------------------- -------
562        HIGH     OPEN      2009-07-23:16:11:04 Datafile 7:
'/home/oracle/BACKUP/bctbs01.dbf' contains one or more corrupt
blocks
  Impact: Some objects in tablespace BCTBS might be
unavailable
  List of child failures for parent failure ID 562
  Failure ID Priority Status    Time Detected        Summary
```

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```
   ----------  --------  ---------  -------------------  -------
    571        HIGH      OPEN        2009-07-23:16:11:05 Block 130
in datafile 7: '/home/oracle/BACKUP/bctbs01.dbf' is media
corrupt
    Impact: Object BCCOPY owned by BC might be unavailable
    565        HIGH      OPEN        2009-07-23:16:11:04 Block 129
in datafile 7: '/home/oracle/BACKUP/bctbs01.dbf' is media
corrupt
    Impact: Object BCCOPY owned by BC might be unavailable
```

Note: Do not close this RMAN session.

5) Alternatively, in another terminal window, you can query the V$IR_FAILURE view
   to view details about the failure:

```
$ sqlplus / as sysdba
SQL> set pages 999
SQL> select failure_id, time_detected, description, impacts
from V$IR_FAILURE where impacts like '%BC%';

FAILURE_ID TIME_DETECTED
---------- -------------------
DESCRIPTION
----------------------------------------------------------------
------------------
IMPACTS
----------------------------------------------------------------
------------------
       562 2009-07-23:16:11:04
Datafile 7: '/home/oracle/BACKUP/bctbs01.dbf' contains one or
more corrupt block
s
Some objects in tablespace BCTBS might be unavailable

       565 2009-07-23:16:11:04
Block 129 in datafile 7: '/home/oracle/BACKUP/bctbs01.dbf' is
media corrupt
Object BCCOPY owned by BC might be unavailable

       571 2009-07-23:16:11:05
Block 130 in datafile 7: '/home/oracle/BACKUP/bctbs01.dbf' is
media corrupt
Object BCCOPY owned by BC might be unavailable


SQL>
SQL> exit
```

6) Continue in your RMAN session. Execute the RMAN `advise failure all` command to view recovery options.

```
RMAN> advise failure all;
List of Database Failures
=========================

Failure ID Priority Status    Time Detected       Summary
---------- -------- --------- ------------------- -------
562        HIGH     OPEN      2009-07-23:16:11:04 Datafile 7:
'/home/oracle/BACKUP/bctbs01.dbf' contains one or more corrupt
blocks

analyzing automatic repair options; this may take some time
using channel ORA_DISK_1
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=24 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: WARNING: Oracle Test Disk API
analyzing automatic repair options complete

Mandatory Manual Actions
========================
no manual actions available

Optional Manual Actions
=======================
no manual actions available

Automated Repair Options
========================
Option Repair Description
------ ------------------
1      Recover multiple corrupt blocks in datafile 7
  Strategy: The repair includes complete media recovery with
no data loss
  Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3952673413.hm

RMAN>
```

Note: An `advise failure` command **must** precede a `repair` command. So, do not execute other commands, but continue with the next step.

7) Continue in your RMAN session and execute the RMAN `repair failure` command . Enter **YES**, when asked if you want to execute the repair.
   Note: Your actual script name is most likely different than the example.

```
RMAN> repair failure;

Strategy: The repair includes complete media recovery with no
data loss
Repair script:
/u01/app/oracle/diag/rdbms/orcl/orcl/hm/reco_3952673413.hm

contents of repair script:
   # block media recovery for multiple blocks
   recover datafile 7 block 129 to 130;

Do you really want to execute the above repair (enter YES or
NO)? YES
executing repair script

Starting recover at 2009-07-23:16:35:34
using channel ORA_DISK_1
using channel ORA_SBT_TAPE_1

ORA-01013: user requested cancel of current operatio
channel ORA_SBT_TAPE_1: restoring block(s) from datafile copy
+FRA/orcl/datafile/bctbs.296.692986085

starting media recovery
media recovery complete, elapsed time: 00:00:03

Finished recover at 2009-07-23:16:35:38
repair failure complete

RMAN>
```

8) List all failures in RMAN. There should by none.

```
RMAN> list failure all;

no failures found that match specification

RMAN> exit
```

9) To clean up the practice environment, run the `bc_cleanup.sh` script from the `$HOME/labs` directory.

```
$ cat bc_cleanup.sh
#!/bin/bash
# For training purpose only
#-- Cleanup the tablespace, and user from the corrupt blocks
```

Practice 9-2: Repairing Block Corruption (continued)

```
sqlplus -S /nolog > /tmp/cleanup.lo 2>&1 <<EOF
connect / as sysdba

-- CLEANUP from previous run
DROP USER bc CASCADE;

DROP TABLESPACE bctbs INCLUDING CONTENTS AND DATAFILES;

EXIT;
EOF
$ ./bc_cleanup.sh
```

Flashback Transaction Backout is a logical recovery option to roll back a specific transaction and dependent transactions while the database remains online. A dependent transaction is related by a write-after-write (WAW) relationship, in which a transaction modifies the same data that was changed by the target transaction, or a primary-key constraint relationship, in which a transaction reinserts the primary-key value that was deleted by the target transaction. Flashback Transaction utilizes undo and the redo generated for undo blocks to create and execute a compensating transaction for reverting the affected data to its original state.

Practice 10-1: Flashback Transaction Backout

In this practice, you view a demonstration of backing out erroneous transactions.

1) Click the `oracle's Home` icon on your desktop.

2) Navigate to the `/home/oracle/demos/fbt_backout` directory.

3) Double-click the `fbt_backout_viewlet_swf.html` file.

4) In the Run or Display window, click Display and view the presentation.

5) Use the controls at the bottom of the viewlet window to start, pause and stop the presentation, as suits your personal learning style.

6) Uninterrupted viewing of the demos takes about ten minutes. When you have finished viewing the presentation, close your Web browser window.

These practices cover the use of Flashback Data Archive.

Practice 11-1: Using Flashback Data Archive

In this practice, you use Oracle Total Recall.

1) Log into SQL*Plus as the SYS user and execute the `flada_setup` script from the `$HOME/labs` directory. The setup script creates a second undo tablespace, a small `FLA_TBS1` tablespace, and the `ARCHIVE_ADMIN` user with the `oracle_4U` password. The password is case-sensitive by default. Take a few moments to inspect the script before executing it.

```
$ sqlplus / as sysdba

SQL> @flada_setup
Connected.
SQL> set serveroutput on
SQL> -- set verify on
SQL> set term on
SQL> set lines 200
SQL> set pages 44
SQL> set pause on
SQL>
SQL> /*== Create a tablespace for your flashback data archive
==*/
SQL> DROP TABLESPACE fla_tbs1 INCLUDING CONTENTS
  2  /
DROP TABLESPACE fla_tbs1 INCLUDING CONTENTS
*
ERROR at line 1:
ORA-00959: tablespace 'FLA_TBS1' does not exist

SQL> CREATE SMALLFILE TABLESPACE fla_tbs1
  2  DATAFILE '$HOME/BACKUP/fla_tbs01.dbf'
  3  SIZE 10M REUSE AUTOEXTEND ON NEXT 640K MAXSIZE 32767M
  4  NOLOGGING EXTENT MANAGEMENT LOCAL SEGMENT SPACE
MANAGEMENT AUTO
  5  /
Tablespace created.
SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL>
SQL> /*== Create a second undo tablespace for testing ==*/
SQL> DROP TABLESPACE undotbs2 INCLUDING CONTENTS
  2  /
DROP TABLESPACE undotbs2 INCLUDING CONTENTS
*
ERROR at line 1:
ORA-00959: tablespace 'UNDOTBS2' does not exist

SQL> CREATE SMALLFILE UNDO TABLESPACE undotbs2
  2  DATAFILE '$HOME/BACKUP/undotbs02.dbf'
  3  SIZE 105M REUSE AUTOEXTEND ON NEXT 5120K MAXSIZE 32767M
```

Practice 11-1: Using Flashback Data Archive (continued)

```
   4   /

Tablespace created.

SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL> /*== Create an ARCHIVE_ADMIN user like the HR user ==*/
SQL> /*==   with FLA_TBS1 default tablespace ==*/
SQL> CREATE USER ARCHIVE_ADMIN PROFILE DEFAULT IDENTIFIED BY
"oracle_4U"
  2  DEFAULT TABLESPACE FLA_TBS1 TEMPORARY TABLESPACE TEMP
  3  ACCOUNT UNLOCK;

User created.

SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL> GRANT ALTER SESSION TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT CREATE DATABASE LINK TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT CREATE SEQUENCE TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT CREATE SESSION TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT CREATE SYNONYM TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT CREATE VIEW TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT UNLIMITED TABLESPACE TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT EXECUTE ON SYS.DBMS_STATS TO ARCHIVE_ADMIN;
Grant succeeded.

SQL> GRANT CONNECT, RESOURCE TO ARCHIVE_ADMIN;
Grant succeeded.
SQL>
SQL> /*== Setup for Flashback Data Archive completed ==*/
SQL> /*== The ARCHIVE_ADMIN user has the password: oracle_4U
==*/
SQL> pause Press [Enter] to continue...
Press [Enter] to continue...
SQL>
```

Practice 11-1: Using Flashback Data Archive (continued)

2) To give the ARCHIVE_ADMIN user administrative privileges for creating, maintaining, and dropping flashback data archives, execute the following command as the SYS user:
GRANT FLASHBACK ARCHIVE ADMINISTER TO archive_admin;

```
$ sqlplus / as sysdba
SQL> GRANT FLASHBACK ARCHIVE ADMINISTER TO archive_admin;

Grant succeeded.

SQL> exit
```

3) In SQL*Plus, connect as the ARCHIVE_ADMIN user with the ARCHIVE_ADMIN password.
Note: The password is case-sensitive; the username is not case-sensitive.

```
$ sqlplus archive_admin
Enter password: oracle_4U  <<< not displayed

SQL>
```

4) To create a flashback data archive, execute the following command:
CREATE FLASHBACK ARCHIVE fla1
TABLESPACE fla_tbs1
QUOTA 10M
RETENTION 1 YEAR
/

Entering the command is recommended for better retention, but if typing is a difficulty, you can also execute the flada_create.sql script.

```
SQL> CREATE FLASHBACK ARCHIVE fla1
TABLESPACE fla_tbs1
QUOTA 10M
RETENTION 1 YEAR
/  2    3    4    5

Flashback archive created.

SQL>
```

5) Give the privilege to use the FLA1 archive to the HR user, by executing the following command:

GRANT FLASHBACK ARCHIVE on FLA1 to HR;

```
SQL> GRANT FLASHBACK ARCHIVE on FLA1 to HR;

Grant succeeded.

SQL>
```

Practice 11-1: Using Flashback Data Archive (continued)

6) You now switch to the role of a flashback archive user. Connect as the HR user with the oracle_4U password. To enable this flashback data archive for the EMPLOYEES table, execute the following command:

ALTER TABLE hr.employees FLASHBACK ARCHIVE fla1;

```
SQL> connect HR
Enter password: oracle_4U <<< not displayed
Connected.
SQL> ALTER TABLE hr.employees FLASHBACK ARCHIVE fla1;

Table altered.

SQL>
```

7) To view and increase the salary of Mr. Fox three times by 1000, execute the flada_dml script as the HR user. This produces activity in the flashback data archive.

```
SQL> @flada_dml
SQL> REM "******************************************** "
SQL> REM "For demo purposes ONLY: Flashback Data Archive "
SQL>
SQL> set echo on
SQL> set serveroutput on
SQL> -- set verify on
SQL> set term on
SQL> set lines 200
SQL> set pages 44
SQL> set pause on pause "Press [Enter] to continue..."
SQL>
SQL> /*== Query the current salary for Mr. Fox ==*/
SQL>
SQL> SELECT employee_id, last_name, salary
  2  FROM   hr.employees
  3  WHERE  last_name = 'Fox'
  4  /
Press [Enter] to continue...

EMPLOYEE_ID LAST_NAME                        SALARY
----------- ------------------------- ----------
        170 Fox                             9600

1 row selected.

SQL>
SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL>
SQL> /*== Increase the  salary three times by 1000 ==*/
SQL>
SQL> UPDATE hr.employees
```

```
  2  SET salary = salary + 1000
  3  WHERE last_name = 'Fox'
  4  /

1 row updated.

SQL> COMMIT
  2  /

Commit complete.

SQL> UPDATE hr.employees
  2  SET salary = salary + 1000
  3  WHERE last_name = 'Fox'
  4  /

1 row updated.

SQL> COMMIT
  2  /

Commit complete.

SQL> UPDATE hr.employees
  2  SET    salary = salary + 1000
  3  WHERE  last_name = 'Fox'
  4  /

1 row updated.

SQL> COMMIT
  2  /

Commit complete.

SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL>
SQL> /*== Query the up-to-date value for Mr. Fox ==*/
SQL>
SQL> SELECT employee_id, last_name, salary
  2  FROM   hr.employees
  3  WHERE  last_name = 'Fox'
  4  /
Press [Enter] to continue...

EMPLOYEE_ID LAST_NAME                         SALARY
----------- ------------------------- ----------
        170 Fox                            12600

1 row selected.
```

Practice 11-1: Using Flashback Data Archive (continued)

```
SQL>
SQL> pause  Press [Enter] to continue...
Press [Enter] to continue...

SQL>
SQL> set pause off
SQL>
```

8) To query the internal name of the archive table, execute the following command:

SELECT * FROM USER_FLASHBACK_ARCHIVE_TABLES;

```
SQL> SELECT * FROM USER_FLASHBACK_ARCHIVE_TABLES;

TABLE_NAME                           OWNER_NAME
----------------------------- -----------------------------
FLASHBACK_ARCHIVE_NAME
-------------------------------------------------------------
ARCHIVE_TABLE_NAME
-------------------------------------------------------
EMPLOYEES                            HR
FLA1

SYS_FBA_HIST_73137

1 row selected.

SQL>
```

9) To ensure that the following queries use the archive tables, and not the undo, switch
   the undo tablespaces and drop the old one. As a SYS user, assign **UNDOTBS2** as the
   current undo tablespace, by using Enterprise Manager > Server> Automatic Undo
   Management > "Change Tablespace" button, selecting the UNDOTBS2 tablespace,
   and clicking OK, or by executing the following commands:

connect / as sysdba

ALTER SYSTEM SET UNDO_TABLESPACE=UNDOTBS2;

DROP TABLESPACE UNDOTBS1;

```
SQL> connect / as sysdba
Connected.

SQL> ALTER SYSTEM SET UNDO_TABLESPACE=UNDOTBS2;
System altered.

SQL> DROP TABLESPACE UNDOTBS1;
Tablespace dropped.
```

Note: If you execute the DROP command too quickly, while internal processing still
occurs, you might receive an ORA-30013 error. Wait several minutes and try again.

Practice 11-1: Using Flashback Data Archive (continued)

10) As the HR user, choose a time after the creation of the flashback data archive and before you executed the erroneous DML. To view Mr. Fox's employee record as of that time, execute the following query (replace *'15' MINUTE* with your chosen historic date, format examples: '50' SECOND, '10' DAY, '5' MONTH):
Note: You receive an ORA-1466 error, if the time you specify a time before the flashback data archive was started. Reduce the time to a smaller interval and try again. If you still see the salary of 12600, increase your time interval.

```
SELECT employee_id, last_name, salary
FROM   hr.employees AS OF TIMESTAMP
       (SYSTIMESTAMP - INTERVAL '15' MINUTE)
WHERE  last_name = 'Fox';
```

Entering the command is recommended for better retention and selecting the right time interval, but if typing is a difficulty, you can also execute the flada_sel.sql script.

```
SQL> connect hr
Ener password: oracle_4U  <<< not displayed
Connected.
SQL> SELECT employee_id, last_name, salary
  2  FROM hr.employees AS OF TIMESTAMP
  3     (SYSTIMESTAMP - INTERVAL '15' MINUTE)
  4     WHERE last_name = 'Fox';

EMPLOYEE_ID LAST_NAME                       SALARY
----------- ------------------------- ----------
        170 Fox                             9600
1 row selected.
SQL>
```

11) As the HR user, you realize that the recent updates were mistakes. To revert to the original values for your chosen historic date (for example, ten minutes ago), execute the following command (replace *'15' MINUTE* with your chosen historic date):
```
UPDATE hr.employees
SET salary = (SELECT salary FROM hr.employees
    AS OF TIMESTAMP (SYSTIMESTAMP - INTERVAL '15' MINUTE)
    WHERE last_name = 'Fox')
WHERE last_name = 'Fox';
```

Entering the command is recommended for better retention and selecting the right time interval, but if typing is a difficulty, you can also execute the flada_upd.sql script.

```
SQL> UPDATE hr.employees
  2  SET salary = (SELECT salary FROM hr.employees
  3     AS OF TIMESTAMP (SYSTIMESTAMP - INTERVAL '15' MINUTE)
  4     WHERE last_name = 'Fox')
```

Practice 11-1: Using Flashback Data Archive (continued)

```
   5   WHERE last_name = 'Fox';

1 row updated.

SQL>
```

12) From your SQL*Plus session, connect to the database as the SYS user and list the
    data dictionary views available to you. Execute the flada_list1.sql file:

```
SQL> connect / as sysdba
Connected.
SQL> @flada_list1
SQL> REM "*******************************************  "
SQL> REM "For demo purposes ONLY:"
SQL>
SQL> connect / as sysdba
Connected.
SQL>
SQL> set echo on
SQL> set serveroutput on
SQL> -- set verify on
SQL> set term on
SQL> set lines 200
SQL> set pages 44
SQL> set pause on pause "Press [Enter] to continue ..."
SQL>
SQL> /*== To list the available data dictioary views ==*/
SQL>
SQL> SELECT table_name
  2   FROM    dict
  3   WHERE   table_name LIKE '%FLASHBACK_ARCHIVE%'
  4   /
Press [Enter] to continue ...

TABLE_NAME
----------------------------
DBA_FLASHBACK_ARCHIVE
DBA_FLASHBACK_ARCHIVE_TABLES
DBA_FLASHBACK_ARCHIVE_TS
USER_FLASHBACK_ARCHIVE
USER_FLASHBACK_ARCHIVE_TABLES

SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...

SQL>
SQL> col FLASHBACK_ARCHIVE_NAME format A25
SQL> col ARCHIVE_TABLE_NAME format A20
SQL> col TABLE_NAME format A12
SQL> col OWNER_NAME format A10
SQL>
SQL> DESC dba_flashback_archive
```

Practice 11-1: Using Flashback Data Archive (continued)

```
 Name
Null?    Type
 -----------------------------------------------------------
----------------------------------------------------- -------
-----------------------------------------------------------
--------------
 OWNER_NAME
VARCHAR2(30)
 FLASHBACK_ARCHIVE_NAME
NOT NULL VARCHAR2(255)
 FLASHBACK_ARCHIVE#
NOT NULL NUMBER
 RETENTION_IN_DAYS
NOT NULL NUMBER
 CREATE_TIME
TIMESTAMP(9)
 LAST_PURGE_TIME
TIMESTAMP(9)
 STATUS
VARCHAR2(7)

SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...

SQL>
SQL> /*== To query the time when the flashback data archive(s)
have been created ==*/
SQL>
SQL> SELECT flashback_archive_name, create_time, status
  2  FROM   dba_flashback_archive
  3  /
Press [Enter] to continue ...

FLASHBACK_ARCHIVE_NAME    CREATE_TIME
STATUS
------------------------ -----------------------------------
---------------------------------------- -------
FLA1                        05-JUN-09 11.06.09.000000000 PM

SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...

SQL>
SQL> DESC dba_flashback_archive_ts
 Name
Null?    Type
 -----------------------------------------------------------
----------------------------------------------------- -------
-----------------------------------------------------------
--------------
 FLASHBACK_ARCHIVE_NAME
NOT NULL VARCHAR2(255)
```

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```
 FLASHBACK_ARCHIVE#
NOT NULL NUMBER
 TABLESPACE_NAME
NOT NULL VARCHAR2(30)
 QUOTA_IN_MB
VARCHAR2(40)
```

```
SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...

SQL>
SQL> /*== To list the tablespace(s), which are used for
flashback data archives ==*/
SQL>
SQL> SELECT *
  2  FROM   dba_flashback_archive_ts
  3  /
Press [Enter] to continue ...

FLASHBACK_ARCHIVE_NAME    FLASHBACK_ARCHIVE# TABLESPACE_NAME
QUOTA_IN_MB
------------------------ ------------------ ------------------
------------- ------------------------------------------
FLA1                                      1 FLA_TBS1
10

SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...

SQL>
SQL> DESC dba_flashback_archive_tables
 Name
Null?    Type
 --------------------------------------------------------------
----------------------------------------------------- -------
--------------------------------------------------------------
--------------
 TABLE_NAME
NOT NULL VARCHAR2(30)
 OWNER_NAME
NOT NULL VARCHAR2(30)
 FLASHBACK_ARCHIVE_NAME
NOT NULL VARCHAR2(255)
 ARCHIVE_TABLE_NAME
VARCHAR2(53)
 STATUS
VARCHAR2(8)

SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...
```

Practice 11-1: Using Flashback Data Archive (continued)

```
SQL>
SQL> /*== Query the table name(s), the owner name(s), and ==*/
SQL> /*== the internal "history" table name(s) of the
flashback data archive ==*/
SQL>
SQL> SELECT *
  2  FROM   dba_flashback_archive_tables
  3  /
Press [Enter] to continue ...
```

```
TABLE_NAME   OWNER_NAME FLASHBACK_ARCHIVE_NAME ARCHIVE_TABLE_NAME
-----------  ---------- ---------------------- ------------------
EMPLOYEES    HR         FLA1                   SYS_FBA_HIST_73137

SQL>
SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...

SQL> clear columns
SQL>
```

13) As the HR user (with the oracle_4U password), list the FLASHBACK_ARCHIVE
data dictionary tables, which are accessible to you. You can execute the
flada_list2 script, if you prefer to not enter the commands directly.

```
SQL> connect hr
Enter password: oracle_4U <<< not dislplayed
Connected.
SQL> @flada_list2

SQL> SELECT table_name
  2  FROM   dict
  3  WHERE  table_name LIKE '%FLASHBACK_ARCHIVE%'
  4  /
Press [Enter] to continue ...

TABLE_NAME
-----------------------------
USER_FLASHBACK_ARCHIVE
USER_FLASHBACK_ARCHIVE_TABLES

SQL> pause Press [Enter] to continue ...
Press [Enter] to continue ...

SQL> exit
$
```

14) To practice additional flashback data archive maintenance tasks, perform the
following steps: Log into SQL*Plus as the ARCHIVE_ADMIN user.

```
$ sqlplus ARCHIVE_ADMIN
Enter password: oracle_4U <<< not displayed
```

```
SQL>
```

15) Data in the flashback data archive is automatically purged when the retention time expires. However, you can also purge data explicitly with the following command to purge data older than two minutes:

```
ALTER FLASHBACK ARCHIVE fla1 PURGE BEFORE TIMESTAMP
(SYSTIMESTAMP - INTERVAL '2' MINUTE);
```

```
SQL> ALTER FLASHBACK ARCHIVE fla1 PURGE BEFORE
TIMESTAMP(SYSTIMESTAMP - INTERVAL '2' MINUTE);

Flashback archive altered.

SQL>
```

16) Execute the `flada_tbs2.sql` script to create an additional 10 MB tablespace as the SYS user.

```
SQL> @flada_tbs2
Connected.
SQL> set serveroutput on
SQL> -- set verify on
SQL> set term on
SQL> set lines 200
SQL> set pages 44
SQL> set pause on
SQL>
SQL> /*== Create another tablespace ==*/
SQL>
SQL> DROP TABLESPACE fla_tbs2 INCLUDING CONTENTS
  2  /
DROP TABLESPACE fla_tbs2 INCLUDING CONTENTS
*
ERROR at line 1:
ORA-00959: tablespace 'FLA_TBS2' does not exist


SQL>
SQL> CREATE SMALLFILE TABLESPACE fla_tbs2
  2   DATAFILE '$HOME/BACKUP/fla_tbs02.dbf'
  3   SIZE 10M REUSE AUTOEXTEND ON NEXT 640K MAXSIZE 32767M
  4   NOLOGGING EXTENT MANAGEMENT LOCAL SEGMENT SPACE
MANAGEMENT AUTO
  5  /

Tablespace created.

SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL>
```

Practice 11-1: Using Flashback Data Archive (continued)

17) As the ARCHIVE_ADMIN user, add 5 MB of the FLA_TBS2 tablespace to the FLA1 flashback data archive.

```
SQL> connect ARCHIVE_ADMIN
Enter password: oracle_4U <<< not displayed
Connected.
SQL> ALTER FLASHBACK ARCHIVE fla1 ADD TABLESPACE fla_tbs2
QUOTA 5M;

Flashback archive altered.

SQL>
```

18) All tables in one specific flashback data archive have the same retention time. Change the retention time of the FLA1 flashback data archive to two years.

```
SQL> ALTER FLASHBACK ARCHIVE fla1 MODIFY RETENTION 2 YEAR;

Flashback archive altered.

SQL>
```

19) As the ARCHIVE_ADMIN user, drop the FLA1 flashback data archive.
Note: Dropping a flashback data archive includes dropping the internal tamper-proofed history table. You cannot drop this table directly due to auditing and security requirements. Dropping a flashback data archive does not drop the tablespaces in which they are stored, because the tablespaces might contain other data.

```
SQL> DROP FLASHBACK ARCHIVE fla1;

Flashback archive dropped.
SQL>
```

20) Wait a minute or two and connect as SYS user; clean up your environment by executing the flada_cleanup.sql script.

```
SQL> @flada_cleanup
SQL> REM Execute this script script for training purposes only
SQL> REM Undo Cleanup for Flashback Data Archive
SQL> REM Execute script as SYSDBA
SQL>
SQL> set echo on
SQL> set serveroutput on
SQL> set term on
SQL> set lines 200
SQL> set pause on
SQL>
SQL> connect / as sysdba
Connected.
SQL> set echo off

Tablespace created.
```

Practice 11-1: Using Flashback Data Archive (continued)

```
SQL>
SQL> ALTER SYSTEM SET UNDO_TABLESPACE=undotbs1
  2  /

System altered.

SQL> DROP TABLESPACE fla_tbs1 INCLUDING CONTENTS
  2  /

Tablespace dropped.

SQL> DROP TABLESPACE fla_tbs2 INCLUDING CONTENTS
  2  /

Tablespace dropped.

SQL>
SQL> DROP TABLESPACE undotbs2 INCLUDING CONTENTS
  2  /

Tablespace dropped.

SQL> host rm -f $HOME/BACKUP/fla_tbs01.dbf

SQL> host rm -f $HOME/BACKUP/fla_tbs02.dbf

SQL> host rm -f $HOME/BACKUP/undotbs02.dbf

SQL> prompt Flashback Data Archive cleanup complete.
Flashback Data Archive cleanup complete.
SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL> exit
```

Note: If you execute the DROP command too quickly while internal processing is still occurring, you might receive an ORA-30013 error. Wait and try again.

Practice 11-2: Using the Recycle Bin

In this practice you use the recycle bin to restore dropped objects. You can do this with SQL commands or with Enterprise Manager. *For the former, perform steps 1 through 4. For the latter, perform step 1, and then steps 5 through 11.*

1) This workshop scenario simulates loss of data. Point to the `orcl` instance. To introduce the problem, change directory to `$HOME/labs` and run the `recyclebin_lab.sh` as shown:

```
$ cd $HOME/labs
$. oraenv
ORACLE_SID = [orcl] ? orcl

$ ./recyclebin_lab.sh
SQL> SQL>
Table dropped.

SQL> SQL> select * from hr.departments
                  *
ERROR at line 1:
ORA-00942: table or view does not exist


SQL> select * from hr.departments
                  *
ERROR at line 1:
ORA-00942: table or view does not exist


SQL> select * from hr.departments
                  *
ERROR at line 1:
ORA-00942: table or view does not exist
```

2) The lab script drops the `HR.DEPARTMENTS` table including indexes, restraints, and so on. Query the `DBA_RECYCLE_BIN` view to confirm this.

```
$ sqlplus / as sysdba
SQL> COL OWNER FORMAT A5
SQL> SELECT owner, original_name, droptime
FROM dba_recyclebin WHERE owner = 'HR';

OWNER ORIGINAL_NAME                      DROPTIME
----- --------------------------------- --------------------
HR    DEPT_ID_PK                        2009-06-06:15:31:05
HR    DEPARTMENTS                       2009-06-06:15:31:05
HR    DEPT_LOCATION_IX                  2009-06-06:15:31:04
```

3) Use Flashback Table to restore the dropped objects. You can use Flashback Table through Enterprise Manager or through SQL*Plus. To flash back the table using Enterprise Manager, go to step 5.

Practice 11-2: Using the Recycle Bin (continued)

```
SQL> FLASHBACK TABLE hr.departments TO BEFORE DROP;

Flashback complete.
SQL>
```

4) Perform a select operation against the HR.DEPARTMENTS table to confirm the success of the Flashback Table operation, then exit

```
SQL> SELECT * FROM hr.departments;

DEPARTMENT_ID DEPARTMENT_NAME              MANAGER_ID LOCATION_ID
------------- -------------------------- ---------- -----------
           10 Administration                    200        1700
           20 Marketing                         201        1800
           30 Purchasing                        114        1700
 . . .
SQL> exit
```

5) The HR.DEPARTMENTS table can also be flashed back using Enterprise Manager.

6) Log in as the SYS user with the oracle_4U password and connect as SYSDBA.

7) In EM, navigate to Schema > Tables.

8) Click the Recycle Bin button, enter HR in the Schema Name field and click Go.

9) Click the + icon before DEPARTMENTS, to see the dependant objects.

Recycle Bin

When you drop a table from a non-system, locally managed tablespace, Oracle does not immediately reclaim the space associated with the table. Oracle places the table and any associated objects in the Recycle Bin, where, in case the table was dropped in error, it can be recovered (Flashback Drop) at a later time.

Search

Schema Name: HR

Table: [   ] (Go)

Results

(Purge) (Flashback Drop)

Select All | Select N... | ... ... All | Collapse All

Select	Object Name	Schema	Recovery Scope	Tablespace	Drop Time	Create Time	Size	Operation
☐	▼ Recycle Bin							(View Content)
☑	▼ DEPARTMENTS	HR	TABLE	EXAMPLE	2009-06-06:15:36:53	2009-05-14:22:40:29	8	(View Content)
☐	▶ "BIN$a6nUbymfDf7gQLmLiSMWzA==$0"	HR	INDEX	EXAMPLE	2009-06-06:15:36:53	2009-05-14:22:40:29	8	(View Content)
☐	▶ "BIN$a6nUbymgDf7gQLmLiSMWzA==$0"	HR	INDEX	EXAMPLE	2009-06-06:15:36:53	2009-05-14:22:40:29	8	(View Content)

10) Select DEPARTMENTS from the list and click the Flashback Drop button.

Dropped Objects Selection — **Rename** — Review

Perform Object Level Recovery: Rename

Recovery Scope **Tables**
Operation Type **Flashback Dropped Tables**

(Cancel) (Back) Step 2 of 3 (Next)

Specify a new name for the dropped tables.

Table Owner	Table Name	New Name
HR	DEPARTMENTS	DEPARTMENT:

11) The Perform Object Level Recovery: Rename page allows you to rename the restored object. Accept the default or original name and click Next.

Perform Object Level Recovery: Review

Recovery Scope **Tables**
Operation Type **Flashback Dropped Tables**

(Cancel) (Show SQL) (Back) Step 3 of 3 (Submit)

The following shows the tables and dependent objects that will be flashed back.

Impact Analysis

The following tables will be flashed back.

1. Table Name:HR.DEPARTMENTS
   New Name:DEPARTMENTS
   The dependent objects that will be flashed back:
   INDEX:HR."BIN$a6nUbymfDf7gQLmLiSMWzA==$0"
   New Name:"BIN$a6nUbymfDf7gQLmLiSMWzA==$0"
   INDEX:HR."BIN$a6nUbymgDf7gQLmLiSMWzA==$0"
   New Name:"BIN$a6nUbymgDf7gQLmLiSMWzA==$0"

12) On the Review page, inspect the Impact Analysis. Note that the table and dependent objects are to be restored and note the names they will be restored to.

Practice 11-2: Using the Recycle Bin (continued)

Dropped Objects Selection — Rename — **Review**

SQL

OK

```
FLASHBACK TABLE HR."BIN$a6npM+E5uR/gQLmLiSMYDQ==$0" TO BEFORE DROP
```

13) Optionally, click the Show SQL button, review the SQL and click OK.

Perform Object Level Recovery: Review

Recovery Scope **Tables**
Operation Type **Flashback Dropped Tables**

Cancel   Show SQL   Back Step 3 of 3   Submit

The following shows the tables and dependent objects that will be flashed back.

Impact Analysis

The following tables will be flashed back.

1.Table Name:HR.DEPARTMENTS
New Name:DEPARTMENTS
The dependent objects that will be flashed back:
INDEX:HR.DEPT_LOCATION_IX
New Name:DEPT_LOCATION_IX
INDEX:HR.DEPT_ID_PK
New Name:DEPT_ID_PK

Return to Perform Recovery   Cancel   Show SQL   Back Step 3 of 3   Submit

Database | Setup | Preferences | Help | Logout

14) Click Submit.

Confirmation

The selected tables, HR.DEPARTMENTS, have been flashed back from the recycle bin.

OK

15) Click OK on the Confirmation page.

16) To view table data in EM:

a) Click the Tables breadcrumb.

b) Enter HR as Schema and click Go.

c) Select the DEPARTMENTS table, then the View Data Actions, and click Go to execute the action.

Edit   View   Delete With Options   Actions View Data   Go

Select	Schema △	Table Name	Tablespace	Partitioned	Rows	Last Analyze
○	HR	COUNTRIES	EXAMPLE	NO	25	May 14, 2009 10:40:28 PM GMT+07:00
◉	HR	DEPARTMENTS	EXAMPLE	NO	27	May 14, 2009 10:40:29 PM GMT+07:00

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Practice 11-2: Using the Recycle Bin (continued)

17) After confirming that the data are restored, click OK. Then exit EM.

Database Instance: orcl.us.oracle.com > Tables >   Logged in As SYS

View Data for Table: HR.DEPARTMENTS

(Refine Query) (OK)

Query SELECT "DEPARTMENT_ID", "DEPARTMENT_NAME", "MANAGER_ID",
"LOCATION_ID" FROM "HR"."DEPARTMENTS"

Result   ⊘ Previous 1-25 of 27 ✔ Next 2 ⊙

DEPARTMENT_ID	DEPARTMENT_NAME	MANAGER_ID	LOCATION_ID
10	Administration	200	1700
20	Marketing	201	1800
30	Purchasing	114	1700
40	Human Resources	203	2400

In this lesson you learn to flash back an entire database.

Background: In this scenario, the HR reorganization job runs prematurely, and you must undo its changes. The changes are such that you are not sure what tables are involved. So, you decide (now that flashback logging has been enabled) to use Flashback Database instead of performing a recovery.

Practice 12-1: Flashback Database

Flash back an entire database. Unless specified otherwise, you should log in as the SYS user as SYSDBA through SQL*Plus or Database Control.

1) Using Enterprise Manager, turn on flashback logging for your database (enable Flashback Database).

   a) In Database Control, click the Availability tab, and then the Recovery Settings link in the Backup/Recovery Setup region.

   b) Scroll down and select the Enable Flashback Database check box. Click Apply. On the Confirmation page, click Yes to proceed with the database shutdown.

Flash Recovery

This database is using a flash recovery area. The chart shows space used by each file type that is not reclaimable by Oracle. Performing backups to tertiary storage is one way to make space reclaimable. Usable Flash Recovery Area includes free and reclaimable space.

Flash Recovery Area Location   +FRA

Flash Recovery Area Size   10   GB

Flash Recovery Area Size must be set when the location is set.

Non-reclaimable Flash Recovery Area (GB)   1.68

Reclaimable Flash Recovery Area (MB)   6

Free Flash Recovery Area (GB)   8.31

☑ Enable Flashback Database*
Flashback database can be used for fast database point-in-time recovery, as it returns the database to a prior point-in-time without restoring files. Flashback is the preferred point-in-time recovery method in the recovery wizard when appropriate. The flash recovery area must be set to enable flashback database.

   c) On the Confirmation page, click Yes to restart your database.

   d) On the Restart Database: Specify Host and Target Database Credentials, ensure that oracle is entered as username and as password. Then click OK.

   e) Optionally, on the Restart Database: Confirmation page, click Show SQL, review the SQL and click Return.

Practice 12-1: Flashback Database (continued)

```
Show SQL                                                                    Return
                                                                             ⌐ᐟᵐ
                                                                            Return
SHUTDOWN immediate
STARTUP mount
ALTER DATABASE FLASHBACK ON
ALTER DATABASE OPEN READ WRITE

The startup command will use a temporary file as pfile with the following
init.ora parameters:

spfile='+DATA/orcl/spfileorcl.ora'
```

f) Click Yes on the Restart Database: Confirmation page.

g) Click Refresh and wait for the database to restart. (If you receive an internal error, just cllick OK and than again Refresh.) - You may need to click Refresh several times.

2) After the database has been restarted with flashback logging enabled, note the lowest SCN of the database

a) On the Database home page, click the Flashback Time link in the High Availability section. [45]

b) On the Recovery Settings page, at the bottom of the Flash Recovery section, note the Lowest SCN [[46r]] (1136492 in this example).

3) Alternatively, you can view and note the current SCN of the database by querying the V$DATABASE view.

Note: You will need the SCN later.

SCN: _____

a) Enter the following:

```
$ cd $HOME/labs
$ sqlplus / as sysdba
SQL> SELECT current_scn FROM v$database;

CURRENT_SCN
-----------
    1137367
```

4) Note the sum of the salaries in the HR.EMPLOYEES table and the count of the rows in the JOB_HISTORY table.

```
SQL> SELECT SUM(salary) FROM hr.employees;

SUM(SALARY)
-----------
```

```
    691416


SQL> SELECT COUNT(*) FROM hr.job_history;

  COUNT(*)
----------
        10
```

5) To perform some HR reorganization updates, .

   a) Connect as HR user with the oracle_4U password.

   b) Execute the flb_db_txn.sql script.

```
SQL> connect hr
Enter password: oracle_4U <<< not displayed
Connected.
SQL> @flb_db_txn.sql
SQL>
SQL> update employees set department_id = 90 where job_id =
'IT_PROG';

5 rows updated.

SQL>
SQL> update employees e set salary = least(e.salary,(select
(min_salary + max_salary)/2 * 1.10 from jobs j where j.job_id
= e.job_id)) where job_id not like 'AD_%';

103 rows updated.

SQL>
SQL> commit;

Commit complete.

SQL>
```

6) As the SYS user, note the current SCN in the database again, and also the salary sum
and the JOB_HISTORY row count.

Note that these values are different from what was queried in steps 2 and 3.

```
SQL> connect / as sysdba
Connected.
SQL> SELECT current_scn FROM v$database;

CURRENT_SCN
-----------
```

```
     1137586

SQL> SELECT SUM(salary) FROM hr.employees;

SUM(SALARY)
-----------
    679092.4

SQL> SELECT COUNT(*) FROM hr.job_history;

  COUNT(*)
----------
        15

SQL>
```

7) Using RMAN, flash back the database to the first SCN value noted in step 2 (1137367 in this example).

a) Shut down and then mount the database by entering the following:

```
SQL> SHUTDOWN IMMEDIATE
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> STARTUP MOUNT
ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337324 bytes
Variable Size             385878036 bytes
Database Buffers           88080384 bytes
Redo Buffers                5963776 bytes
Database mounted.
SQL> exit
```

b) If you have any RMAN open, close them. Then log in to RMAN again.

```
$ rman target / nocatalog
connected to target database: ORCL (DBID=1220535480, not open)
using target database control file instead of recovery catalog

RMAN>
```

c) At the RMAN prompt, enter the FLASHBACK DATABASE command, and supply the SCN number recorded in step 2:

```
RMAN> FLASHBACK DATABASE TO SCN=1137367;

Starting flashback at 2009-07-23:21:05:29
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=27 device type=DISK
```

Practice 12-1: Flashback Database (continued)

```
allocated channel: ORA_SBT_TAPE_1
channel ORA_SBT_TAPE_1: SID=28 device type=SBT_TAPE
channel ORA_SBT_TAPE_1: WARNING: Oracle Test Disk API


starting media recovery
media recovery complete, elapsed time: 00:00:03

Finished flashback at 2009-07-23:21:05:34

RMAN>
```

8) Before opening the database for read and write operations, verify that the database was flashed back to the correct SCN by looking at the contents of the tables and seeing that they are back to what was noted in step 3.

a) Logged into SQL*Plus as SYSDBA, enter the following coomand to open the database in read-only mode:

```
SQL> alter database open read only;
Database altered.
```

b) Enter the following at the SQL prompt to determine the salary sum for the EMPLOYEES table.

```
SQL> SELECT SUM(salary) FROM hr.employees;

SUM(SALARY)
-----------
     691416
```

9) Open the database for read and write opeations. You have to use the RESETLOGS keyword.

a) Shut down the database:

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

b) Start up the database in the MOUNT state:

```
SQL> startup mount
ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337324 bytes
Variable Size             385878036 bytes
Database Buffers           88080384 bytes
```

Practice 12-1: Flashback Database (continued)

```
Redo Buffers                    5963776 bytes
Database mounted.
SQL>
```

c) Open the database in read/write mode with resetlogs:

```
SQL> alter database open resetlogs;

Database altered.
```

(*The command might take a while to execute.*)

10) At this point you can familiarize yourself with the flashback-related V$ views. To see time values, alter your session to display hours, minutes, and seconds with any date values.

```
SQL> ALTER SESSION SET NLS_DATE_FORMAT="yyyy-mm-dd
hh24:mi:ss";
```

11) Query the V$FLASHBACK_DATABASE_LOG view and determine the lowest SCN that the database can be flashed back to. Record your answer here: _____

```
SQL> set wrap off
SQL> select * from v$FLASHBACK_DATABASE_LOG;

OLDEST_FLASHBACK_SCN OLDEST_FLASHBACK_TI RETENTION_TARGET
FLASHBACK_SIZE
-------------------- ------------------- ---------------- ----
----------
             1136492 2009-07-23 20:47:17             1440
16384000

SQL>
```

12) View the overhead associated with flashback logging and related operations by querying V$FLASHBACK_DATABASE_STAT. What is the average number of bytes of flashback data written per minute during this time interval?

```
SQL> select * from V$FLASHBACK_DATABASE_STAT;

truncating (as requested) before column
ESTIMATED_FLASHBACK_SIZE

OLDEST_FLASHBACK_SCN OLDEST_FLASHBACK_TI RETENTION_TARGET
FLASHBACK_SIZE
-------------------- ------------------- ---------------- ----
----------
             1136492 2009-07-23 20:47:17             1440
16384000

SQL> select * from V$FLASHBACK_DATABASE_STAT;
```

Practice 12-1: Flashback Database (continued)

```
truncating (as requested) before column
ESTIMATED_FLASHBACK_SIZE


BEGIN_TIME           END_TIME             FLASHBACK_DATA
DB_DATA  REDO_DATA
------------------- ------------------- -------------- -------
--- ----------
2009-07-23 21:07:56 2009-07-23 21:12:13        4538368
0    1372160
SQL>
```

In the example above, the answer is 4538368 / (21:07 – 21:12) which is
907673 bytes per minute. Your numbers may vary slightly.

13) Determine the current size of stored flashback data by querying
V$FLASHBACK_DATABASE_LOG. Record your answer here: _____ .

```
SQL> SELECT flashback_size FROM V$FLASHBACK_DATABASE_LOG;

FLASHBACK_SIZE
--------------
      24576000
```

Note: Your results will probably vary slightly from those shown here.

14) To turn off the flashback database functionality, execute the following command.

```
SQL> ALTER DATABASE FLASHBACK OFF;
Database altered.
SQL> exit
```

Note: The command might take a couple of minutes to execute.

In this practice, you use Automatic Memory Management to show that you no longer need to manually modify SGA_TARGET and PGA_AGGREGATE_TARGET. You observe the memory distribution when you run an expensive parallel query that consumes a lot of SGA memory.

Practice 13-1: Using Automatic Memory Management

In this practice, you use the various new memory management capabilities.

1) For your `orcl` database, navigate into the `labs` directory, turn off archiving, and stop Enterprise Manager Database Control.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$ cd ~/labs
$ ./orcl_to_noarchivelog.sh
Database closed.
Database dismounted.
ORACLE instance shut down.
ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337352 bytes
Variable Size             373295096 bytes
Database Buffers          100663296 bytes
Redo Buffers                5963776 bytes
Database mounted.

Database altered.


Database altered.

$ emctl stop dbconsole
Oracle Enterprise Manager 11g Database Control Release
11.2.0.0.2
Copyright (c) 1996, 2009 Oracle Corporation.  All rights
reserved.
https://edrsr37p1.us.oracle.com:1158/em/console/aboutApplicati
on
Stopping Oracle Enterprise Manager 11g Database Control ...
 ...   Stopped.
$
```

2) **Make a copy of your SPFILE**, logged in to SQL*Plus for the `orcl` instance as the SYS user with the `oracle_4U` password.

```
$ sqlplus / as sysdba
SQL> CREATE PFILE='/tmp/initorcl.ora.bak' FROM SPFILE;

File created.
SQL>
```

Practice 13-1: Using Automatic Memory Management (continued)

3) Still connected as the SYS user in SQL*Plus, set the following parameters to the given value <u>in your SPFILE only!</u> Use the amm_parameters.sql file located in your /home/oracle/labs directory.

```
_PX_use_large_pool = TRUE
_memory_broker_stat_interval = 5
_memory_management_tracing = 31
parallel_execution_message_size = 36864
parallel_max_servers = 200
parallel_adaptive_multi_user = FALSE
processes = 200
sga_target = 0
pga_aggregate_target = 0
memory_target = 300M
```

```
SQL> @amm_parameters
SQL> alter system set "_PX_use_large_pool" = TRUE
SCOPE=SPFILE;

System altered.

SQL> alter system set "_memory_broker_stat_interval" = 5
SCOPE=SPFILE;

System altered.

SQL> alter system set "_memory_management_tracing" = 31
SCOPE=SPFILE;

System altered.

SQL> alter system set "parallel_execution_message_size" =
36864 SCOPE=SPFILE;

System altered.

SQL> alter system set "parallel_max_servers" = 200
SCOPE=SPFILE;

System altered.

SQL> alter system set "parallel_adaptive_multi_user" = FALSE
SCOPE=SPFILE;

System altered.

SQL> alter system set "processes" = 200 SCOPE=SPFILE;

System altered.

SQL> alter system set "pga_aggregate_target" = 0 SCOPE=SPFILE;
```

Practice 13-1: Using Automatic Memory Management (continued)

```
System altered.

SQL> alter system set "sga_target" = 0 SCOPE=SPFILE;

System altered.

SQL> alter system set "memory_target" = 300M SCOPE=SPFILE;

System altered.

SQL>
```

4) Execute the amm_setup.sql script.

a) Drop and recreate the TBSSGA and MYTEMP tablespaces and the AMM DBA user for whom they are defaults. Then press Enter to continue.

```
SQL> @amm_setup.sql
SQL> REM "************************* "
SQL> REM "For training purposes ONLY, execute as the oracle OS
user
SQL>
SQL> set echo on
SQL> set serveroutput on
SQL> set term on
SQL> set lines 200
SQL> set pages 44
SQL> set pause on pause "Press [Enter] to continue..."
SQL>
SQL> drop tablespace tbssga including contents and datafiles;
drop tablespace tbssga including contents and datafiles
*
ERROR at line 1:
ORA-00959: tablespace 'TBSSGA' does not exist


SQL>
SQL> create tablespace tbssga datafile '+DATA' size 20m;

Tablespace created.

SQL>
SQL> drop tablespace mytemp including contents and datafiles;
drop tablespace mytemp including contents and datafiles
*
ERROR at line 1:
ORA-00959: tablespace 'MYTEMP' does not exist

```

Practice 13-1: Using Automatic Memory Management (continued)

```
SQL>
SQL> create temporary tablespace mytemp tempfile '+DATA' size
40m reuse;

Tablespace created.
SQL>
SQL> drop user amm cascade;
drop user amm cascade
            *
ERROR at line 1:
ORA-01918: user 'AMM' does not exist


SQL>
SQL> create user amm identified by "oracle_4U'
  2  default tablespace tbssga
  3  temporary tablespace mytemp;

User created.

SQL>
SQL> grant connect,resource,dba to amm;

Grant succeeded.
SQL> pause Press [Enter] to continue...
Press [Enter] to continue...
```

b) To view the current memory components, query the
   V$MEMORY_DYNAMIC_COMPONENTS view by pressing Enter to continue the
   script.

```
SQL>
SQL>
SQL> SELECT substr(COMPONENT, 0, 10) COMP, CURRENT_SIZE CS,
USER_SPECIFIED_SIZE US
  2     FROM v$memory_dynamic_components
  3     WHERE CURRENT_SIZE!=0;
Press [Enter] to continue...
```

c) View the query result by pressing Enter to continue the script.

```
SQL> column COMP format a10
SQL>
SQL> SELECT substr(COMPONENT, 0, 10) COMP, CURRENT_SIZE CS,
USER_SPECIFIED_SIZE US
  2     FROM v$memory_dynamic_components
  3     WHERE CURRENT_SIZE!=0;
Press [Enter] to continue...


COMP                CS         US
---------- ---------- ----------
```

Practice 13-1: Using Automatic Memory Management (continued)

```
shared poo   167772160          0
large pool     4194304          0
java pool      4194304          0
SGA Target   289406976          0
DEFAULT bu   104857600          0
PGA Target   192937984          0

6 rows selected.

SQL> pause Press [Enter] to continue...
Press [Enter] to continue...

SQL>
```

5) Log in as the AMM user with the oracle_4U password, recreate the TABSGA table and insert rows by pressing Enter to continue the script.

```
SQL> connect amm
Enter password: oracle_4U <<< not displayed
Connected.
SQL> @amm_setup2.sql
SQL> REM "**************************"
SQL> REM "For training purposes ONLY
SQL> REM  Connected as the AMM user with the oracle_4U
password
SQL> set serveroutput on
SQL> set term on
SQL> set lines 200
SQL> set pages 44
SQL> set pause on pause "Press [Enter] to continue..."
SQL> drop table tabsga purge;
drop table tabsga purge
           *
ERROR at line 1:
ORA-00942: table or view does not exist


SQL>
SQL> create table tabsga(a number, b number) tablespace
tbssga;

Table created.

SQL>
SQL> begin
  2    for i in 1..100000 loop
  3      insert into tabsga values (i, i);
  4    end loop;
  5  end;
  6  /
```

Practice 13-1: Using Automatic Memory Management (continued)

```
PL/SQL procedure successfully completed.

SQL> commit;

Commit complete.

SQL> pause Press [Enter] to continue...
Press [Enter] to continue...
```

a) Modify the TABSGA table to "parallel 64", create a TESTPGA procedure (which creates a workload) by pressing Enter to continue the script.

```
SQL>
SQL> alter table tabsga parallel 64;

Table altered.

SQL>
SQL> create or replace procedure testpga( psize number ) as
  2  begin
  3  declare
  4  TYPE nAllotment_tabtyp   IS TABLE OF char(2048) INDEX BY
BINARY_INTEGER;
  5  myarray nAllotment_tabtyp;
  6  begin
  7    for i in 1..psize loop
  8       myarray(i) := to_char(i);
  9    end loop;
 10  end;
 11  end;
 12  /

Procedure created.
SQL> pause Press [Enter] to continue...
Press [Enter] to continue...
```

b) Confirm that there are no errors and query the dynamic memory components again by pressing Enter to continue the script.

```
SQL> show errors
No errors.
SQL>
SQL> SELECT substr(COMPONENT, 0, 10) COMP, CURRENT_SIZE CS,
USER_SPECIFIED_SIZE US
  2    FROM v$memory_dynamic_components
  3   WHERE CURRENT_SIZE!=0;
Press [Enter] to continue...
```

c) To view the query results, press Enter to continue the script.

```
COMP                 CS         US
---------- ---------- ----------
```

Practice 13-1: Using Automatic Memory Management (continued)

```
shared poo   167772160            0
large pool     4194304            0
java pool      4194304            0
SGA Target   289406976            0
DEFAULT bu   104857600            0
PGA Target   192937984            0

6 rows selected.

SQL>
SQL> pause Press [Enter] to exit the script...
Press [Enter] to exit the script...
```

d) Exit the script, but remain in the SQL*Plus session.

```
SQL> set pause off
SQL>
```

6) Connect as SYSDBA in your SQL*Plus session, shut down and start your database instance and then connect again as the AMM user with the oracle_4U password:

```
SQL> connect / as sysdba
Connected.
SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL>
SQL> STARTUP
ORACLE instance started.

Total System Global Area   313860096 bytes
Fixed Size                   1336204 bytes
Variable Size              209718388 bytes
Database Buffers            96468992 bytes
Redo Buffers                6336512 bytes
Database mounted.
Database opened.
SQL>
SQL> connect amm
Enter password: oracle_4U <<< not displayed
Connected.
SQL>
```

7) As the AMM user, determine the current settings for the various memory buffers as well as the list of resized operations that were done since you started your instance.

a) You can use the amm_components.sql script for that purpose.

```
SQL> @amm_components.sql
SQL> set serveroutput on
SQL> set term on
```

Practice 13-1: Using Automatic Memory Management (continued)

```
SQL> set lines 200
SQL> set pages 100
SQL> set heading on
SQL> column comp format a18
SQL> column final_size format 999999999
SQL> column oper_type format a9
SQL> set pause on pause "Press [Enter] to continue..."
SQL>
SQL> SELECT substr(COMPONENT, 0, 18) COMP, CURRENT_SIZE CS,
USER_SPECIFIED_SIZE US
  2   FROM v$memory_dynamic_components
  3  WHERE CURRENT_SIZE!=0;
Press [Enter] to continue...
```

b) To view the query result, press Enter to continue the script.

```
COMP                         CS         US
------------------ ---------- ----------
shared pool          83886080          0
large pool            4194304          0
java pool             4194304          0
SGA Target          188743680          0
DEFAULT buffer cac   88080384          0
PGA Target          125829120          0
6 rows selected.

SQL> pause Press [Enter] to continue...
Press [Enter] to continue...
```

c) View the memory components (ordered by descending START_TIME) by pressing Enter to continue the script.

```
 SQL> SELECT substr(COMPONENT,0,20) comp, FINAL_SIZE,
OPER_TYPE, OPER_MODE, status
  2   FROM v$memory_resize_ops
  3  ORDER BY  START_TIME desc;
Press [Enter] to continue...
```

d) To view the query result, press Enter to continue the script.

```
COMP               FINAL_SIZE OPER_TYPE OPER_MODE STATUS
------------------ ---------- --------- --------- ---------
shared pool          83886080 GROW      IMMEDIATE COMPLETE
DEFAULT buffer cac   88080384 SHRINK    IMMEDIATE COMPLETE
DEFAULT buffer cac   92274688 SHRINK    IMMEDIATE COMPLETE
shared pool          79691776 GROW      IMMEDIATE COMPLETE
large pool            4194304 GROW      IMMEDIATE COMPLETE
java pool             4194304 STATIC              COMPLETE
streams pool                0 STATIC              COMPLETE
SGA Target          188743680 STATIC              COMPLETE
PGA Target          125829120 STATIC              COMPLETE
DEFAULT buffer cac   96468992 STATIC    IMMEDIATE COMPLETE
```

Practice 13-1: Using Automatic Memory Management (continued)

```
DEFAULT buffer cac  100663296 STATIC     IMMEDIATE COMPLETE
ASM Buffer Cache            0 STATIC               COMPLETE
DEFAULT buffer cac  104857600 STATIC               COMPLETE
DEFAULT buffer cac  104857600 STATIC     IMMEDIATE COMPLETE
DEFAULT 2K buffer          0 STATIC                COMPLETE
DEFAULT 4K buffer          0 STATIC                COMPLETE
DEFAULT 8K buffer          0 STATIC                COMPLETE
DEFAULT 16K buffer         0 STATIC                COMPLETE
DEFAULT 32K buffer         0 STATIC                COMPLETE
KEEP buffer cache          0 STATIC                COMPLETE
RECYCLE buffer cac         0 STATIC                COMPLETE
large pool           4194304 STATIC                COMPLETE
shared pool         67108864 STATIC                COMPLETE
shared pool         71303168 GROW       IMMEDIATE COMPLETE
shared pool         75497472 GROW       IMMEDIATE COMPLETE
DEFAULT buffer cac   96468992 INITIALIZ IMMEDIATE COMPLETE
                              ING
26 rows selected.
SQL> pause Press [Enter] to exit the script...
Press [Enter] to exit the script...
```

```
SQL> set pause off
SQL>
SQL>
```

8) Remain connected as the AMM user in your SQL*Plus session and execute the following query. Immediately after that, determine the component sizes and resized operations. You can use query1.sql script for that purpose. What do you observe?
```
select /*+ PARALLEL(s 24) */ count(*) from (select /*+
parallel(s 24) */ * from tabsga s group by a);
```

a) Execute the amm_query1.sql script. You can see that the large pool has a much bigger size while the buffer cache is smaller. This memory transfer was automatically done by the system.

```
SQL> @amm_query1.sql
SQL> select /*+ PARALLEL(s 24) */ count(*) from (select /*+
parallel(s 24) */ * from tabsga s group by a);

  COUNT(*)
----------
    100000

SQL>
SQL> column COMP format a12
SQL>
SQL> select substr(COMPONENT, 0, 10) COMP, CURRENT_SIZE CS,
USER_SPECIFIED_SIZE US from v$memory_dynamic_components where
CURRENT_SIZE!=0;
```

Practice 13-1: Using Automatic Memory Management (continued)

```
COMP                 CS         US
------------ ---------- ----------
shared poo     88080384          0
large pool     83886080          0
java pool       4194304          0
SGA Target    188743680          0
DEFAULT bu      4194304          0
PGA Target    125829120          0

6 rows selected.

SQL>
SQL> select substr(COMPONENT, 0, 10) COMP, FINAL_SIZE,
OPER_TYPE, OPER_MODE, status from v$memory_resize_ops order by
START_TIME;

COMP         FINAL_SIZE OPER_TYPE OPER_MODE STATUS
------------ ---------- --------- --------- ---------
shared poo     67108864 STATIC              COMPLETE
shared poo     71303168 GROW      IMMEDIATE COMPLETE
shared poo     75497472 GROW      IMMEDIATE COMPLETE
large pool      4194304 GROW      IMMEDIATE COMPLETE
large pool      4194304 STATIC              COMPLETE
java pool       4194304 STATIC              COMPLETE
streams po            0 STATIC              COMPLETE
SGA Target    188743680 STATIC              COMPLETE
ASM Buffer            0 STATIC              COMPLETE
DEFAULT bu    104857600 STATIC    IMMEDIATE COMPLETE
DEFAULT bu    104857600 STATIC              COMPLETE
DEFAULT bu    100663296 STATIC    IMMEDIATE COMPLETE
DEFAULT bu     96468992 STATIC    IMMEDIATE COMPLETE
DEFAULT bu     96468992 INITIALIZ IMMEDIATE COMPLETE
                        ING

DEFAULT 2K            0 STATIC              COMPLETE
DEFAULT 4K            0 STATIC              COMPLETE
DEFAULT 8K            0 STATIC              COMPLETE
DEFAULT 16            0 STATIC              COMPLETE
DEFAULT 32            0 STATIC              COMPLETE
KEEP buffe            0 STATIC              COMPLETE
RECYCLE bu            0 STATIC              COMPLETE
PGA Target    125829120 STATIC              COMPLETE
DEFAULT bu     92274688 SHRINK    IMMEDIATE COMPLETE
shared poo     79691776 GROW      IMMEDIATE COMPLETE
DEFAULT bu     88080384 SHRINK    IMMEDIATE COMPLETE
shared poo     83886080 GROW      IMMEDIATE COMPLETE
DEFAULT bu     83886080 SHRINK    DEFERRED  COMPLETE
shared poo     88080384 GROW      DEFERRED  COMPLETE
DEFAULT bu     79691776 SHRINK    IMMEDIATE COMPLETE
large pool      8388608 GROW      IMMEDIATE COMPLETE
```

Practice 13-1: Using Automatic Memory Management (continued)

```
DEFAULT bu     67108864 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     71303168 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     75497472 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     62914560 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     58720256 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     54525952 SHRINK     IMMEDIATE COMPLETE
large pool     12582912 GROW       IMMEDIATE COMPLETE
large pool     16777216 GROW       IMMEDIATE COMPLETE
large pool     20971520 GROW       IMMEDIATE COMPLETE
large pool     29360128 GROW       IMMEDIATE COMPLETE
large pool     33554432 GROW       IMMEDIATE COMPLETE
large pool     25165824 GROW       IMMEDIATE COMPLETE
DEFAULT bu     29360128 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     25165824 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     20971520 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     16777216 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     16777216 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     12582912 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu      8388608 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     33554432 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     37748736 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     41943040 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     46137344 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     50331648 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     54525952 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu      4194304 SHRINK     IMMEDIATE COMPLETE
large pool     79691776 GROW       IMMEDIATE COMPLETE
large pool     75497472 GROW       IMMEDIATE COMPLETE
large pool     71303168 GROW       IMMEDIATE COMPLETE
large pool     71303168 GROW       IMMEDIATE COMPLETE
large pool     67108864 GROW       IMMEDIATE COMPLETE
large pool     62914560 GROW       IMMEDIATE COMPLETE
large pool     58720256 GROW       IMMEDIATE COMPLETE
large pool     54525952 GROW       IMMEDIATE COMPLETE
large pool     50331648 GROW       IMMEDIATE COMPLETE
large pool     46137344 GROW       IMMEDIATE COMPLETE
large pool     41943040 GROW       IMMEDIATE COMPLETE
large pool     37748736 GROW       IMMEDIATE COMPLETE
large pool     33554432 GROW       IMMEDIATE COMPLETE
large pool     83886080 GROW       IMMEDIATE COMPLETE

70 rows selected.
SQL>
SQL>
```

9) Redo the same thing as in the previous step, but this time use the following query.
    You can use `amm_query2.sql` script for that purpose. What do you observe?

    Possible Answer: The same trend continues.

```
SQL> @amm_query2.sql
```

Practice 13-1: Using Automatic Memory Management (continued)

```
SQL> select /*+ PARALLEL(s 25) */ count(*) from (select /*+
parallel(s 25) */ * from tabsga s group by a);

  COUNT(*)
----------
    100000

SQL>
SQL> column COMP format a12
SQL>
SQL> select substr(COMPONENT, 0, 10) COMP, CURRENT_SIZE CS,
USER_SPECIFIED_SIZE US from v$memory_dynamic_components where
CURRENT_SIZE!=0;


COMP                 CS         US
------------ ---------- ----------
shared poo     88080384          0
large pool     83886080          0
java pool       4194304          0
SGA Target    188743680          0
DEFAULT bu      4194304          0
PGA Target    125829120          0

6 rows selected.

SQL>
SQL> select substr(COMPONENT, 0, 10) COMP, FINAL_SIZE,
OPER_TYPE, OPER_MODE, status from v$memory_resize_ops order by
START_TIME;

COMP         FINAL_SIZE OPER_TYPE OPER_MODE STATUS
------------ ---------- --------- --------- ---------
shared poo     67108864 STATIC              COMPLETE
shared poo     71303168 GROW      IMMEDIATE COMPLETE
shared poo     75497472 GROW      IMMEDIATE COMPLETE
large pool      4194304 GROW      IMMEDIATE COMPLETE
large pool      4194304 STATIC              COMPLETE
java pool       4194304 STATIC              COMPLETE
streams po            0 STATIC              COMPLETE
SGA Target    188743680 STATIC              COMPLETE
ASM Buffer            0 STATIC              COMPLETE
DEFAULT bu    104857600 STATIC    IMMEDIATE COMPLETE
DEFAULT bu    104857600 STATIC              COMPLETE
DEFAULT bu    100663296 STATIC    IMMEDIATE COMPLETE
DEFAULT bu     96468992 STATIC    IMMEDIATE COMPLETE
DEFAULT bu     96468992 INITIALIZ IMMEDIATE COMPLETE
                        ING

DEFAULT 2K            0 STATIC              COMPLETE
```

Practice 13-1: Using Automatic Memory Management (continued)

```
DEFAULT 4K           0 STATIC              COMPLETE
DEFAULT 8K           0 STATIC              COMPLETE
DEFAULT 16           0 STATIC              COMPLETE
DEFAULT 32           0 STATIC              COMPLETE
KEEP buffe           0 STATIC              COMPLETE
RECYCLE bu           0 STATIC              COMPLETE
PGA Target   125829120 STATIC              COMPLETE
DEFAULT bu    92274688 SHRINK    IMMEDIATE COMPLETE
shared poo    79691776 GROW      IMMEDIATE COMPLETE
DEFAULT bu    88080384 SHRINK    IMMEDIATE COMPLETE
shared poo    83886080 GROW      IMMEDIATE COMPLETE
DEFAULT bu    83886080 SHRINK    DEFERRED  COMPLETE
shared poo    88080384 GROW      DEFERRED  COMPLETE
DEFAULT bu    79691776 SHRINK    IMMEDIATE COMPLETE
large pool     8388608 GROW      IMMEDIATE COMPLETE
DEFAULT bu    67108864 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    71303168 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    75497472 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    62914560 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    58720256 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    54525952 SHRINK    IMMEDIATE COMPLETE
large pool    12582912 GROW      IMMEDIATE COMPLETE
large pool    16777216 GROW      IMMEDIATE COMPLETE
large pool    20971520 GROW      IMMEDIATE COMPLETE
large pool    29360128 GROW      IMMEDIATE COMPLETE
large pool    33554432 GROW      IMMEDIATE COMPLETE
large pool    25165824 GROW      IMMEDIATE COMPLETE
DEFAULT bu    29360128 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    25165824 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    20971520 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    16777216 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    16777216 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    12582912 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu     8388608 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    33554432 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    37748736 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    41943040 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    46137344 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    50331648 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    54525952 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu     4194304 SHRINK    IMMEDIATE COMPLETE
large pool    79691776 GROW      IMMEDIATE COMPLETE
large pool    75497472 GROW      IMMEDIATE COMPLETE
large pool    71303168 GROW      IMMEDIATE COMPLETE
large pool    71303168 GROW      IMMEDIATE COMPLETE
large pool    67108864 GROW      IMMEDIATE COMPLETE
large pool    62914560 GROW      IMMEDIATE COMPLETE
large pool    58720256 GROW      IMMEDIATE COMPLETE
large pool    54525952 GROW      IMMEDIATE COMPLETE
large pool    50331648 GROW      IMMEDIATE COMPLETE
```

Practice 13-1: Using Automatic Memory Management (continued)

```
large pool      46137344 GROW        IMMEDIATE COMPLETE
large pool      41943040 GROW        IMMEDIATE COMPLETE
large pool      37748736 GROW        IMMEDIATE COMPLETE
large pool      33554432 GROW        IMMEDIATE COMPLETE
large pool      83886080 GROW        IMMEDIATE COMPLETE

70 rows selected.
SQL>
```

10) Still connected as the AMM user from your SQL*Plus session, execute the following command and, immediately afterward, determine the memory component sizes and the list of resize operations. You can use amm_query3.sql for that purpose. What do you observe?

Possible Answer: The same style of growing and shrinking of the memory components.

```
SQL> @amm_query3.sql
SQL> exec testpga(500000);

PL/SQL procedure successfully completed.

SQL>
SQL> column COMP format a12
SQL>
SQL> select substr(COMPONENT, 0, 10) COMP, CURRENT_SIZE CS,
USER_SPECIFIED_SIZE US from v$memory_dynamic_components where
CURRENT_SIZE!=0;

COMP                CS         US
------------ ---------- ----------

shared poo    88080384          0
large pool    83886080          0
java pool      4194304          0
SGA Target   188743680          0
DEFAULT bu     4194304          0
PGA Target   125829120          0

6 rows selected.

SQL>
SQL> select substr(COMPONENT, 0, 10) COMP, FINAL_SIZE,
OPER_TYPE, OPER_MODE, status from v$memory_resize_ops order by
START_TIME;

COMP          FINAL_SIZE OPER_TYPE OPER_MODE STATUS
------------ ---------- --------- --------- ---------
DEFAULT bu     96468992 INITIALIZ IMMEDIATE COMPLETE
                        ING
```

Practice 13-1: Using Automatic Memory Management (continued)

```
RECYCLE bu           0 STATIC              COMPLETE
KEEP buffe           0 STATIC              COMPLETE
DEFAULT 32           0 STATIC              COMPLETE
shared poo    75497472 GROW      IMMEDIATE COMPLETE
shared poo    71303168 GROW      IMMEDIATE COMPLETE
shared poo    67108864 STATIC              COMPLETE
large pool     4194304 STATIC              COMPLETE
large pool     4194304 GROW      IMMEDIATE COMPLETE
java pool      4194304 STATIC              COMPLETE
streams po           0 STATIC              COMPLETE
SGA Target   188743680 STATIC              COMPLETE
PGA Target   125829120 STATIC              COMPLETE
DEFAULT bu    96468992 STATIC    IMMEDIATE COMPLETE
DEFAULT bu   100663296 STATIC    IMMEDIATE COMPLETE
ASM Buffer           0 STATIC              COMPLETE
DEFAULT bu   104857600 STATIC              COMPLETE
DEFAULT bu   104857600 STATIC    IMMEDIATE COMPLETE
DEFAULT 2K           0 STATIC              COMPLETE
DEFAULT 4K           0 STATIC              COMPLETE
DEFAULT 8K           0 STATIC              COMPLETE
DEFAULT 16           0 STATIC              COMPLETE
DEFAULT bu    92274688 SHRINK    IMMEDIATE COMPLETE
shared poo    79691776 GROW      IMMEDIATE COMPLETE
DEFAULT bu    88080384 SHRINK    IMMEDIATE COMPLETE
shared poo    83886080 GROW      IMMEDIATE COMPLETE
shared poo    88080384 GROW      DEFERRED  COMPLETE
DEFAULT bu    83886080 SHRINK    DEFERRED  COMPLETE
DEFAULT bu    79691776 SHRINK    IMMEDIATE COMPLETE
large pool     8388608 GROW      IMMEDIATE COMPLETE
DEFAULT bu    75497472 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    71303168 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    67108864 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    62914560 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    58720256 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    54525952 SHRINK    IMMEDIATE COMPLETE
large pool    12582912 GROW      IMMEDIATE COMPLETE
large pool    16777216 GROW      IMMEDIATE COMPLETE
large pool    20971520 GROW      IMMEDIATE COMPLETE
large pool    25165824 GROW      IMMEDIATE COMPLETE
large pool    29360128 GROW      IMMEDIATE COMPLETE
large pool    33554432 GROW      IMMEDIATE COMPLETE
DEFAULT bu    37748736 SHRINK    IMMEDIATE COMPLETE
large pool    75497472 GROW      IMMEDIATE COMPLETE
DEFAULT bu    46137344 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    50331648 SHRINK    IMMEDIATE COMPLETE
DEFAULT bu    54525952 SHRINK    IMMEDIATE COMPLETE
large pool    83886080 GROW      IMMEDIATE COMPLETE
large pool    79691776 GROW      IMMEDIATE COMPLETE
DEFAULT bu     4194304 SHRINK    IMMEDIATE COMPLETE
```

Practice 13-1: Using Automatic Memory Management (continued)

```
DEFAULT bu      8388608 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     12582912 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     16777216 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     16777216 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     20971520 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     25165824 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     29360128 SHRINK     IMMEDIATE COMPLETE
DEFAULT bu     33554432 SHRINK     IMMEDIATE COMPLETE
large pool     33554432 GROW       IMMEDIATE COMPLETE
large pool     37748736 GROW       IMMEDIATE COMPLETE
large pool     41943040 GROW       IMMEDIATE COMPLETE
large pool     46137344 GROW       IMMEDIATE COMPLETE
large pool     50331648 GROW       IMMEDIATE COMPLETE
large pool     54525952 GROW       IMMEDIATE COMPLETE
large pool     58720256 GROW       IMMEDIATE COMPLETE
large pool     62914560 GROW       IMMEDIATE COMPLETE
large pool     67108864 GROW       IMMEDIATE COMPLETE
large pool     71303168 GROW       IMMEDIATE COMPLETE
large pool     71303168 GROW       IMMEDIATE COMPLETE
DEFAULT bu     41943040 SHRINK     IMMEDIATE COMPLETE

70 rows selected.
```

```
SQL> exit
$
```

11) From a terminal window, restart Enterprise Manager Database Control.

```
$ emctl start dbconsole

Oracle Enterprise Manager 11g Database Control Release
11.2.0.1.0
Copyright (c) 1996, 2009 Oracle Corporation.  All rights
reserved.
https://edrsr37p1.us.oracle.com:1158/em/console/aboutApplicati
on
Starting Oracle Enterprise Manager 11g Database Control
.............. started.
--------------------------------------------------------------
----
Logs are generated in directory
/u01/app/oracle/product/11.2.0/dbhome_1/edrsr37p1.us.oracle.co
m_orcl/sysman/log
$
```

12) In Enterprise Manager look at the memory variations that happened during this lab.
What do you observe?

a) Logged into Enterprise Manager as the SYSDBA, click the Server tab.

Practice 13-1: Using Automatic Memory Management (continued)

13) On the Server tabbed page, click Memory Advisors in the Database Configuration section.

14) On the Memory Advisors page, look at the first two graphics.

15) You should see modifications of the memory components in the second graph, that the large pool grew and shrank.
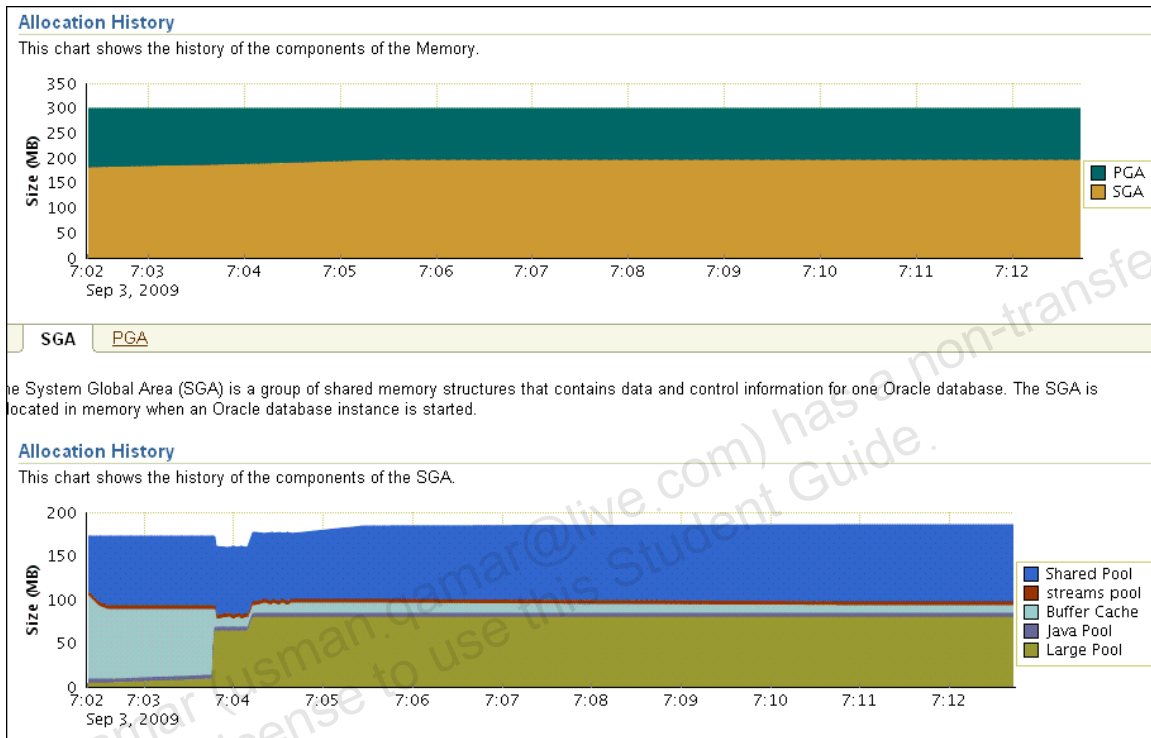
16) Logout and exit from Enterprise Manager.

17) To clean up your environment, shut down your database instance, restore the original SPFILE, turn on archiving and restart your orcl database instance. To do all that, execute the amm_cleanup.sh script.

```
$ cd ~/labs
$ ./amm_cleanup.sh
Oracle Enterprise Manager 11g Database Control Release
11.2.0.1.0
Copyright (c) 1996, 2009 Oracle Corporation.  All rights
reserved.
https://edrsr37p1.us.oracle.com:1158/em/console/aboutApplicati
on
Stopping Oracle Enterprise Manager 11g Database Control ...
 ...  Stopped.

SQL*Plus: Release 11.2.0.1.0 Production on Thu Sep 3 19:21:43
2009

Copyright (c) 1982, 2009, Oracle.  All rights reserved.
```

Practice 13-1: Using Automatic Memory Management (continued)

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

SQL> SQL>
User dropped.

SQL>
Tablespace dropped.

SQL>
Tablespace dropped.

SQL> SQL> Database closed.
Database dismounted.
ORACLE instance shut down.
SQL>
File created.

SQL> SQL> ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337352 bytes
Variable Size             373295096 bytes
Database Buffers          100663296 bytes
Redo Buffers                5963776 bytes
Database mounted.
SQL>
Database altered.

SQL>
Database altered.

SQL> Disconnected from Oracle Database 11g Enterprise Edition
Release 11.2.0.1.0 - Production
With the Partitioning, Automatic Storage Management, OLAP,
Data Mining
and Real Application Testing options
Oracle Enterprise Manager 11g Database Control Release
11.2.0.1.0
Copyright (c) 1996, 2009 Oracle Corporation.  All rights
reserved.
https://edrsr37p1.us.oracle.com:1158/em/console/aboutApplicati
on
```

Practice 13-1: Using Automatic Memory Management (continued)

```
Starting Oracle Enterprise Manager 11g Database Control
............... started.
-----------------------------------------------------------------
----
Logs are generated in directory
/u01/app/oracle/product/11.2.0/dbhome_1/edrsr37p1.us.oracle.co
m_orcl/sysman/log
$
```

Practice 14-1: Monitoring Services

In your database there are several running applications. You want to monitor the resources that are being used by each application. Create a service configuration for each application or application function that uses your database.

In this practice, you create the following configuration in the `orcl` database:

Service Name	Usage	Response Time (sec)– Warning/Critical
SERV1	Client service	0.4, 1.0

1) Use the DBMS_SERVICE package to create a service called SERV1. Then make sure that you add your service name to your tnsnames.ora file.

   a) The recommended method for adding a service name to the tnsnames.ora file is to use Net Manager. For this exercise, execute the sv1_add.sh script. Review the tnsnames.ora file at $ORACLE_HOME/network/admin to confirm that the following lines are included. Substitute the output of the hostname command for <hostname> below.

```
SERV1 =
  (DESCRIPTION =
  (ADDRESS = (PROTOCOL = TCP)
    (HOST = <hostname>.ua.oracle.com)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = SERV1.example.com)
    )
  )
```

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$ cd /home/oracle/labs
$ ./sv1_add.sh
edrsr37p1.us.oracle.com
$
```

   b) Use the DBMS_SERVICE.CREATE_SERVICE procedure to create a service. (The command is entered on one line.)

```
$ sqlplus / as sysdba
```

```
SQL> EXEC
DBMS_SERVICE.CREATE_SERVICE('SERV1','SERV1.example.com')

PL/SQL procedure successfully completed.

SQL> exit;
```

2) After you have created your services, try connecting to your database by using your service name. What happens? Why?

Answer: You cannot connect using your service because although it is defined, it is not started on your instance. You can verify this by looking at the SERVICE_NAME initialization parameter and by looking at the services known to the listener.

```
$ lsnrctl services
LSNRCTL for Linux: Version 11.2.0.1.0 - Production on 26-JUL-
2009 16:23:46

Copyright (c) 1991, 2009, Oracle.  All rights reserved.

Connecting to (ADDRESS=(PROTOCOL=tcp)(HOST=)(PORT=1521))
Services Summary...
Service "+ASM" has 1 instance(s).
  Instance "+ASM", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "DEDICATED" established:10098 refused:0 state:ready
         LOCAL SERVER
Service "orcl.us.oracle.com" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "DEDICATED" established:3657 refused:0 state:ready
         LOCAL SERVER
Service "orclXDB.us.oracle.com" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "D000" established:0 refused:0 current:0 max:1022
state:ready
         DISPATCHER <machine: edrsr37p1.us.oracle.com, pid:
6610>

(ADDRESS=(PROTOCOL=tcp)(HOST=edrsr37p1.us.oracle.com)(PORT=296
69))
Service "rcat.example.com" has 1 instance(s).
  Instance "rcat", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "DEDICATED" established:3 refused:0 state:ready
         LOCAL SERVER
Service "rcatXDB.example.com" has 1 instance(s).
```

Practice 14-1: Monitoring Services (continued)

```
  Instance "rcat", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "D000" established:0 refused:0 current:0 max:1022
state:ready
         DISPATCHER <machine: edrsr37p1.us.oracle.com, pid:
20809>

(ADDRESS=(PROTOCOL=tcp)(HOST=edrsr37p1.us.oracle.com)(PORT=620
66))
The command completed successfully
$
```

```
$ sqlplus / as sysdba

SQL> show parameter service

NAME                            TYPE        VALUE
------------------------------  ----------  ----------------
service_names                   string      orcl.oracle.com
```

```
SQL> connect system@SERV1
Enter password: oracle_4U <<< not displayed
ERROR:
ORA-12514: TNS:listener does not currently know of service
requested in connect descriptor

Warning: You are no longer connected to ORACLE.
SQL>
```

3) How would you make sure that you can connect using your service? Do it and connect to your instance by using your service.

Answer: You must start your service on your instance.

```
$ connect / as sysdba
Connected.

SQL> show parameter service

NAME                            TYPE        VALUE
------------------------------  ----------  ----------------
service_names                   string      orcl.us.oracle.com

SQL> EXEC DBMS_SERVICE.START_SERVICE('SERV1')

PL/SQL procedure successfully completed.

SQL> show parameter service

NAME                            TYPE        VALUE
------------------------------  ----------  --------------------
```

Practice 14-1: Monitoring Services (continued)

```
service_names               string       SERV1.us.oracle.com

SQL> host lsnrctl services
LSNRCTL for Linux: Version 11.2.0.1.0 - Production on 26-JUL-
2009 16:30:36

Copyright (c) 1991, 2009, Oracle.  All rights reserved.

Connecting to (ADDRESS=(PROTOCOL=tcp)(HOST=)(PORT=1521))
Services Summary...
Service "+ASM" has 1 instance(s).
  Instance "+ASM", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "DEDICATED" established:10105 refused:0 state:ready
         LOCAL SERVER
Service "SERV1.example.com" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "DEDICATED" established:0 refused:0 state:ready
         LOCAL SERVER
Service "orcl.us.oracle.com" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "DEDICATED" established:0 refused:0 state:ready
         LOCAL SERVER
Service "orclXDB.us.oracle.com" has 1 instance(s).
  Instance "orcl", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "D000" established:0 refused:0 current:0 max:1022
state:ready
        DISPATCHER <machine: edrsr37p1.us.oracle.com, pid:
6610>

(ADDRESS=(PROTOCOL=tcp)(HOST=edrsr37p1.us.oracle.com)(PORT=296
69))
Service "rcat.example.com" has 1 instance(s).
  Instance "rcat", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "DEDICATED" established:3 refused:0 state:ready
         LOCAL SERVER
Service "rcatXDB.example.com" has 1 instance(s).
  Instance "rcat", status READY, has 1 handler(s) for this
service...
    Handler(s):
      "D000" established:0 refused:0 current:0 max:1022
state:ready
```

Practice 14-1: Monitoring Services (continued)

```
            DISPATCHER <machine: edrsr37p1.us.oracle.com, pid:
20809>

(ADDRESS=(PROTOCOL=tcp)(HOST=edrsr37p1.us.oracle.com)(PORT=620
66))
The command completed successfully

SQL>
```

```
SQL> connect system@SERV1
Enter password: oracle_4U <<< not displayed

Connected.
SQL> exit
```

4) Execute the `sv1_load.sh` script as SYSDBA. This script creates a new `SV_USER`
   user. Then you connect to your instance as this user and the `SERV1` service. Create
   workload activity by executing the `sv1_load2.sql` script. If this script finishes
   before you completed the next step, then use the `sv1_sel.sql` script to executes the
   following query:

   `SELECT COUNT(*) FROM DBA_OBJECTS,DBA_OBJECTS,DBA_OBJECTS`

```
$ cd ~/labs
$ ./sv1_load.sh

SQL> SQL> SQL> SQL> SQL> drop user sv_user cascade
            *
ERROR at line 1:
ORA-01918: user 'SV_USER' does not exist


SQL> SQL>   2     3
User created.

SQL> SQL>
Grant succeeded.
$
```

Note: Do not wait for the script to complete before proceeding to the next step.

```
$ sqlplus sv_user@SERV1
Enter password: oracle_4U <<< not displayed
Connected.

SQL> @sv1_load2.sql
SQL> DECLARE
  2  t number;
  3  BEGIN
  4  for i in 1..2000 loop
  5    select count(*) into t from dba_objects;
  6  end loop;
```

```
7   END;
8   /
```

5) After the execution starts, access the EM Top Consumers page from the Performance tabbed page, and check if SERV1 is using more resources. Also, check the statistics on your service with V$SERVICE_STATS from a SQL*Plus session connected as SYSDBA.

   a) On the home page, click the Performance tab. Towards the bottom of the Performance page, click the Services tab.
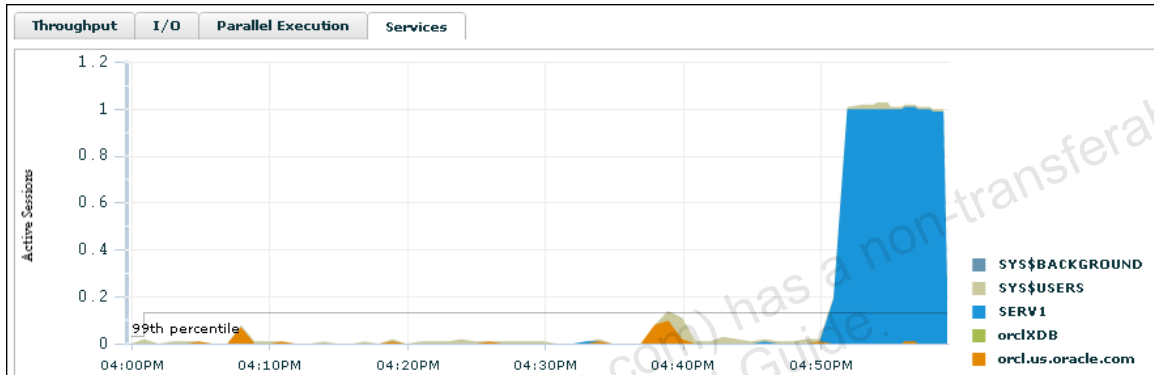
An Active Session graph with the activity aggregated by service name is displayed. The network service name of each connection is recorded as a separate service. So all the connections made without a service name are aggregated, as are all the connections made as SERV1.

   b) Click the Top Consumers link in the Additional Monitoring Links section. Refresh the Top Consumers Overview page several times.

Practice 14-1: Monitoring Services (continued)
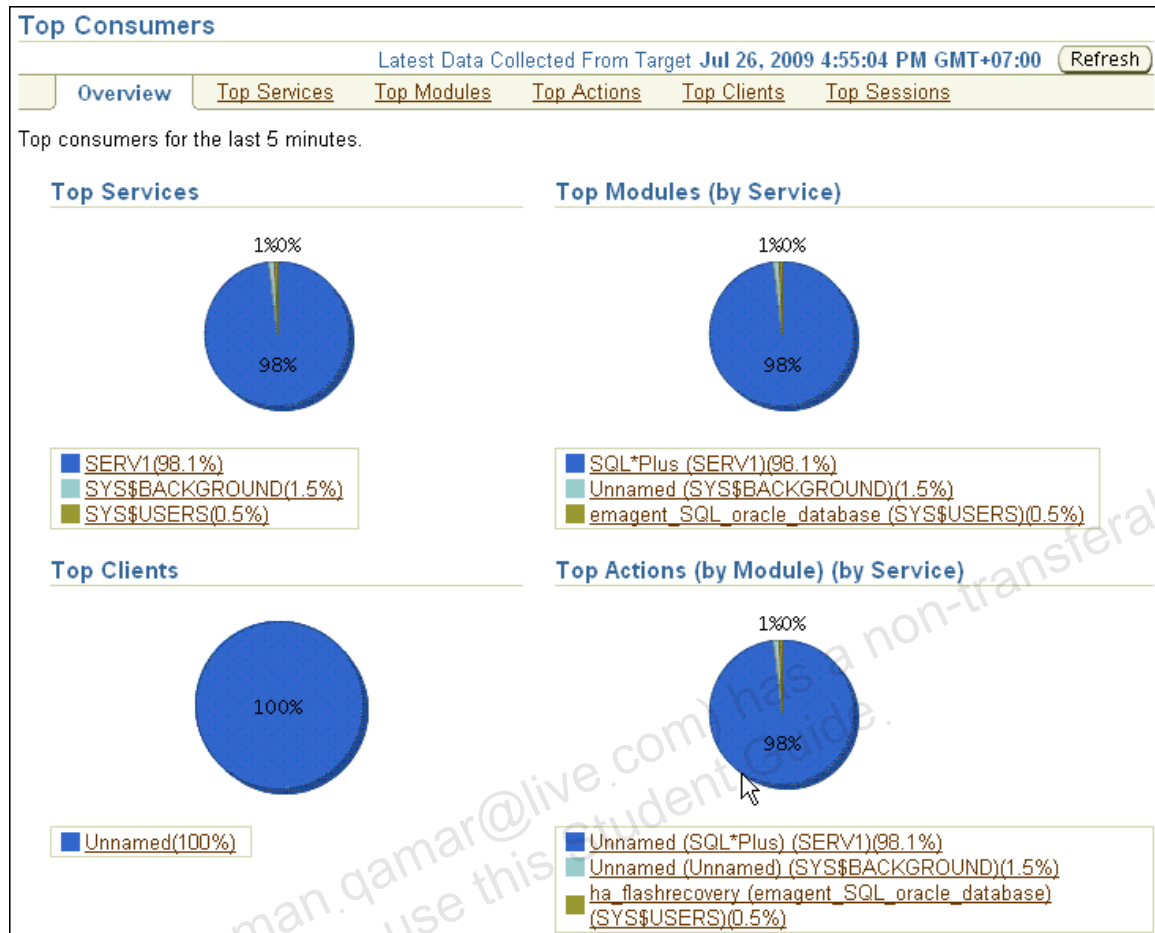
The names and number of services listed in the Top Services Graph depends on the number and type of connections to the database.

c) You can also see the detailed statistics by navigating to the Top Services tab > SERV1 link > Statistics tab.

Practice 14-1: Monitoring Services (continued)
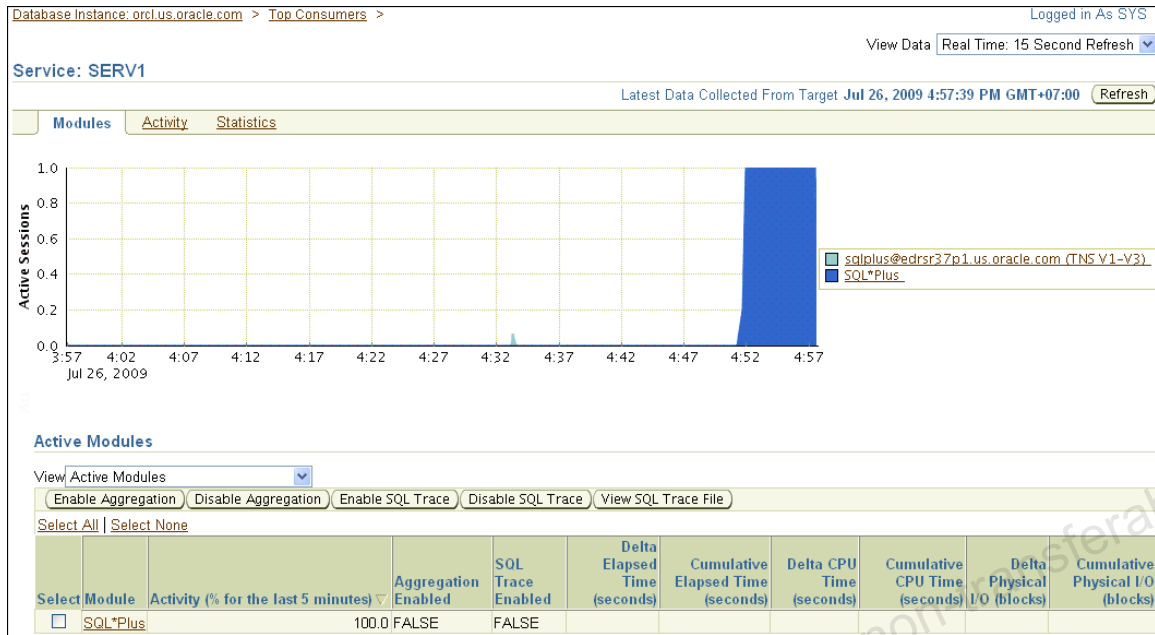
6) If the `sv1_load2.sql` script finishes before you completed this step, then use the `sv1_sel.sql` script to continue creating a workload. – When you completed the tasks, make sure that you stop your running workload by pressing Ctrl + C in your terminal window.

```
SQL> @sv1_sel.sql
SQL> select count(*) from dba_objects,dba_objects,dba_objects
                                                            *
ERROR at line 1:
ORA-01013: user requested cancel of current operation

SQL> exit
```

By default, Automatic SQL Tuning executes automatically during each nightly maintenance window. For this practice, you simulate the execution of Automatic SQL Tuning, and explore its results

Practice 15-1: Using Automatic SQL Tuning

In this practice, you manually launch Automatic SQL Tuning to automatically tune a small application workload. You then investigate the outcomes and configuration possibilities.

1) In EM, navigate to Server > Automated Maintenance Tasks (in the Oracle Scheduler section).

   a) To check if the task settings are enabled, click Configure, (no matter if the status is Enabled or Disabled).

   Database Instance: orcl.example.com >
   Automated Maintenance Tasks
   Status **Disabled** (Configure)
   ☑ **TIP** If the status is Disabled, there are no future windows.
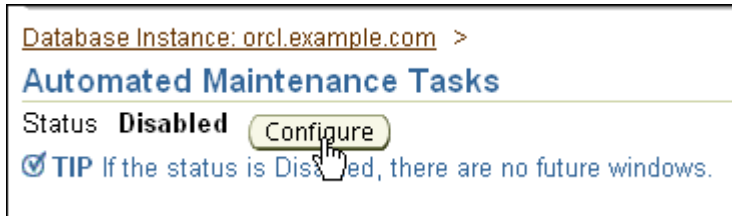
   b) Toggle Enabled and Disabled, then click Show SQL when the Global Status is Enabled.

   (Show SQL) (Revert) (Apply)
   Show SQL
   Automated Maintenance Tasks Configuration
   Global Status ⊙ Enabled ○ Disabled
   Task Settings
   Optimizer Statistics Gathering ⊙ Enabled ○ Disabled (Configure)
   Segment Advisor ⊙ Enabled ○ Disabled
   Automatic SQL Tuning ⊙ Enabled ○ Disabled (Configure)
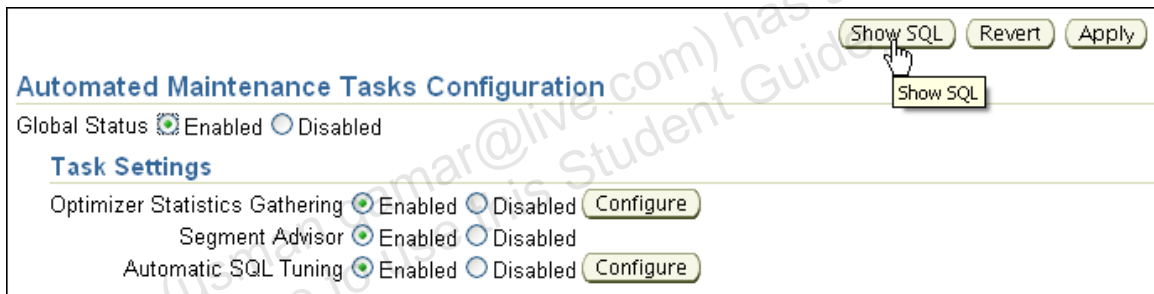
   c) Review the command and click Return.

   ```
   BEGIN
   dbms_auto_task_admin.enable();
   END;
   ```

   d) On the Automated Maintenance Tasks Configuration page, click Apply.

   e) Click the Configure button next to Automatic SQL Tuning.

   f) Select Yes for "Automatic Implementation of SQL Profiles" and click Show SQL.

   Automatic SQL Tuning Settings

   (Show SQL) (Revert) (Apply)
   Show SQL

   Maximum Time Spent Per SQL During Tuning (sec) [1200]
   Automatic Implementation of SQL Profiles ⊙ Yes ○ No
   Maximum SQL Profiles Implemented Per Execution [20]
   Maximum SQL Profiles Implemented (Overall) [10000]
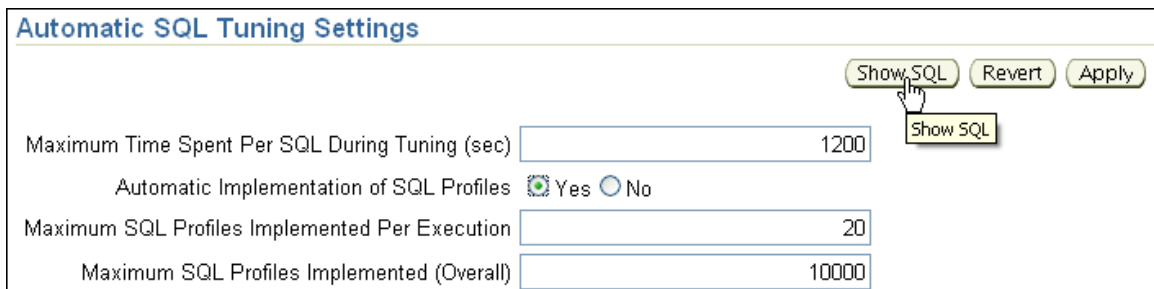
   g) Review the command and click Return.

Practice 15-1: Using Automatic SQL Tuning (continued)


```
BEGIN
dbms_sqltune.set_auto_tuning_task_parameter( 'ACCEPT_SQL_PROFILES', 'TRUE');
END;
```

 h) On the Automatic SQL Tuning Settings page, click Apply.

 You should receive a success message.

2) In a terminal window connected as the oracle user, point to the ORCL instance, review and execute the ast_setup.sh script .This script creates the AST user, turns off automatic maintenance tasks, and drops any existing profiles on queries executed by the AST user.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$ cat ast_setup.sh
#!/bin/bash
#  For training only - execute as oracle OS user

sqlplus / as sysdba <<EOF!
set echo on

drop user ast cascade;
create user ast identified by "oracle_4U";
grant dba to ast;

alter system flush shared_pool;
--
-- Turn off AUTOTASK
--
alter system set "_enable_automatic_maintenance"=0;

--
-- Clear out old executions of auto-sqltune
--
exec
dbms_sqltune.reset_tuning_task('SYS_AUTO_SQL_TUNING_TASK');

--
-- Drop any profiles on AST queries
--
declare
  cursor prof_names is
    select name from dba_sql_profiles where sql_text like
'%AST%';
begin
  for prof_rec in prof_names loop
    dbms_sqltune.drop_sql_profile(prof_rec.name);
  end loop;
end;
/
```

Practice 15-1: Using Automatic SQL Tuning (continued)

```
EOF!
$
```

```
$ ./ast_setup.sh

SQL> SQL> SQL> drop user ast cascade
              *
ERROR at line 1:
ORA-01918: user 'AST' does not exist

SQL>
User created.

SQL>
Grant succeeded.

SQL> SQL>
System altered.

SQL> SQL> SQL> SQL>
System altered.

SQL> SQL> SQL> SQL> SQL>
PL/SQL procedure successfully completed.

SQL> SQL> SQL> SQL> SQL>    2    3    4    5    6    7    8
9
PL/SQL procedure successfully completed.

SQL> SQL>
$
```

3) In preparation for the practice, you should log in as the AST user with the oracle_4U password and execute a workload. Execute the ast_workload_stream.sql script. This script executes, multiple times a query that is not correctly optimized. The query in question uses hints that force the optimizer to pick a suboptimal execution plan. The script executes for approximately 30 to 60 seconds. (O*utput has been reduced to minimize clutter.*)

```
$ sqlplus ast
Enter password: oracle_4U <<< not displayed
SQL> @ast_workload_stream.sql
Sun Aug  2 23:31:33 GMT-7 2009
no rows selected
no rows selected
no rows selected
.
.
.
no rows selected
no rows selected
```

Practice 15-1: Using Automatic SQL Tuning (continued)

```
Sun Aug  2 23:31:55 GMT-7 2009
SQL> exit
$
```

4) Automatic SQL Tuning is implemented using an automated task that runs during maintenance windows. However, you are not going to wait for the next maintenance window to open. This might take too long. Instead, you will force the opening of your next maintenance window now. This will automatically trigger the Automatic SQL Tuning task. Review and execute the ast_run.sh script to do that. The script's execution takes about ten minutes (most likely).

```
$ cat ast_run.sh
#!/bin/bash
# For training only - execute as oracle OS user
date

sqlplus / as sysdba <<EOF!
set echo on
set serveroutput on

exec dbms_workload_repository.create_snapshot;

variable window varchar2(20);
begin
 select upper(to_char(sysdate,'fmday'))||'_WINDOW' into
:window from dual;
end;
/
print window;

--
-- Open the corresponding maintenance window, but with other
clients disabled
--
alter system set "_enable_automatic_maintenance"=1
/
exec dbms_auto_task_admin.disable( -
   'auto optimizer stats collection', null, :window);

exec dbms_auto_task_admin.disable( -
   'auto space advisor', null, :window);

exec dbms_scheduler.open_window(:window, null, true);

--
-- Close the maintenance window when sqltune is done
--
exec dbms_lock.sleep(60);

declare
  running number;
```

```
begin
  loop
    select count(*)
    into   running
    from   dba_advisor_executions
    where  task_name = 'SYS_AUTO_SQL_TUNING_TASK' and
           status = 'EXECUTING';
    if (running = 0) then
      exit;
    end if;
    dbms_lock.sleep(60);
  end loop;
  dbms_scheduler.close_window(:window);
end;
/
alter system set "_enable_automatic_maintenance"=0
/

-- Re-enable the other guys so they look like they are enabled
in EM.
-- Still they will be disabled because we have set the
underscore.
--

exec dbms_auto_task_admin.enable( -
  'auto optimizer stats collection', null, :window);

exec dbms_auto_task_admin.enable( -
  'auto space advisor', null, :window);

EOF!

date

$
```

```
$ ./ast_run.sh
Sun Aug  2 23:42:54 GMT-7 2009

SQL> SQL> SQL> SQL>
PL/SQL procedure successfully completed.

SQL> SQL> SQL>    2    3    4
PL/SQL procedure successfully completed.

SQL>
WINDOW
------------------------------
SUNDAY_WINDOW

SQL> SQL> SQL> SQL> SQL>    2
```

```
System altered.

SQL> >
PL/SQL procedure successfully completed.

SQL> SQL> >
PL/SQL procedure successfully completed.

SQL> SQL>
PL/SQL procedure successfully completed.

SQL> SQL> SQL> SQL> SQL>
PL/SQL procedure successfully completed.

SQL> SQL>   2    3    4    5    6    7    8    9   10   11
 12   13   14   15   16   17
PL/SQL procedure successfully completed.

SQL>    2
System altered.

SQL> SQL> SQL> SQL> SQL> SQL> >
PL/SQL procedure successfully completed.

SQL> SQL> >
PL/SQL procedure successfully completed.

SQL> SQL>
Sun Aug  2 23:43:57 GMT-7 2009
$
```

Some of your output, like the WINDOW, may look different.

5) Execute the `ast_workload_stream.sh` script again. What do you observe?

   a) You should see that the execution time for `ast_workload_stream.sh` is much faster than the original execution. This is probably due to the fact that Automatic SQL Tuning implemented a profile for your statement automatically.

```
$ sqlplus ast
Enter password: oracle_4U <<< not displayed
SQL> @ast_workload_stream.sql
Sun Aug  2 23:48:54 GMT-7 2009
no rows selected
no rows selected
no rows selected
.
.
.
no rows selected
no rows selected

Sun Aug  2 23:49:16 GMT-7 2009
```

```
SQL> exit
$
```

6) Logged in as the AST user, force the creation of an AWR snapshot.

```
$ sqlplus ast
Enter password: oracle_4U <<< not displayed
SQL> set echo on
SQL> exec dbms_workload_repository.create_snapshot;
PL/SQL procedure successfully completed.

SQL> exit
$
```

7) How can you confirm that a SQL Profile was automatically implemented?

   a) In Enterprise Manager, navigate to Server > Automated Maintenance Tasks (Oracle Scheduler) > Automatic SQL Tuning.

   b) On the Automatic SQL Tuning summary page, view the tuning results.

The task has already run in one maintenance window and has results ready to be viewed.
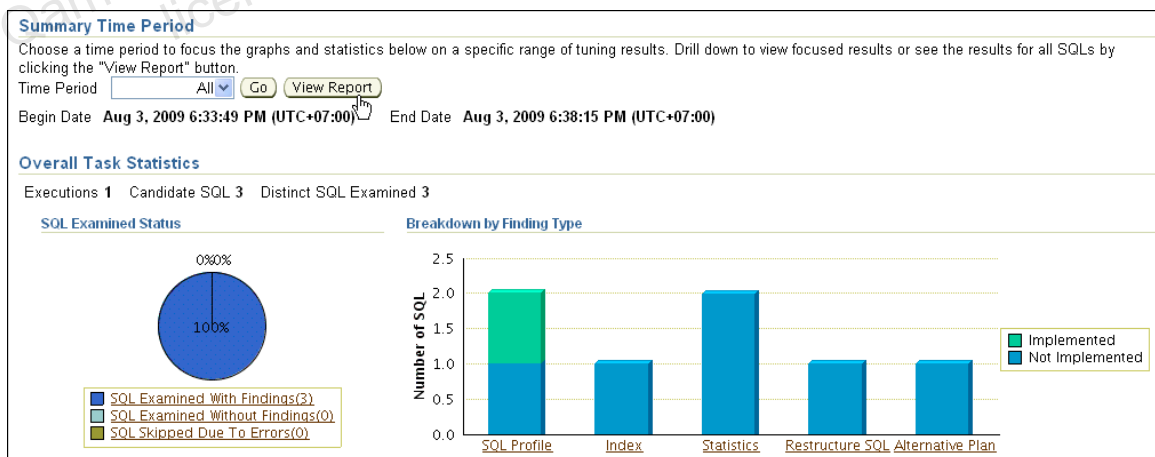
   c) Look at the graphs on the Automatic SQL Tuning Result Summary page. (*If you do not see any graphs, return to step 5, execute the work load twice, then continue with step 6 and 7.*)

   d) Focus on understanding the pie chart and the bar graph next to it. You should be able to get a feeling for the general findings breakdown, as well as the number of SQL profiles implemented by the task.

Practice 15-1: Using Automatic SQL Tuning (continued)

e) Click View Report to see a detailed SQL-level report.

f) Find and select the SQL that ran in the AST schema. Note the green check mark meaning that the profile was implemented.

g) Click the View Recommendations button.

h) Click the Compare Explain Plans eyeglass icon for the SQL Profile entry.

Practice 15-1: Using Automatic SQL Tuning (continued)

i) Scroll down the page.

Original Explain Plan (Annotated)

○ Indicates an adjustment from the original plan by the SQL Tuning Advisor

Plan Hash Value   4005616876

Expand All | Collapse All

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
▽ SELECT STATEMENT	0			6		0.013	○ 893	11	○ 269,312,608	○ 885
▽ HASH GROUP BY	1			5		0.013	○ 893	11	○ 269,312,608	○ 885
▽ NESTED LOOPS	2			4		0.013	○ 892	11	○ 236,425,824	○ 885
TABLE ACCESS FULL	3	SH.CUSTOMERS	TABLE	1		0.005	○ 405	5	○ 21,682,460	○ 404
▽ PARTITION RANGE ALL	4			3		0.008	○ 488	6	○ 214,743,360	○ 481
TABLE ACCESS FULL	5	SH.SALES	TABLE	2		0.008	○ 488	6	○ 214,743,360	○ 481

New Explain Plan With SQL Profile

Plan Hash Value   3070788227

Expand All | Collapse All

Operation	Line ID	Object	Object Type	Order	Rows	Bytes	Cost	Time	CPU Cost	I/O Cost
▽ SELECT STATEMENT	0			8		0.013	55	1	33,327,052	54
▽ HASH GROUP BY	1			7		0.013	55	1	33,327,052	54
▽ NESTED LOOPS	2			6		0.013	54	1	440,260	54
▽ PARTITION RANGE ALL	3			4		0.008	54	1	438,310	54
▽ TABLE ACCESS BY LOCAL INDEX ROWID	4	SH.SALES	TABLE	3		0.008	54	1	438,310	54
▽ BITMAP CONVERSION TO ROWIDS	5			2						
BITMAP INDEX RANGE SCAN	6	SH.SALES_CUST_BIX	INDEX (BITMAP)	1						
INDEX UNIQUE SCAN	7	SH.CUSTOMERS_PK	INDEX (UNIQUE)	5		0.005	0	1	1,950	0

j) Look at the old and new explain plans for the query.

k) Then click the "Recommendations for SQL ID" locator link (the last of the breadcrumbs on top of the page) to return to the previous screen.

SQL Text

select /*+ USE_NL(s c) FULL(s) FULL(c) AST */ c.cust_id, sum(s.quantity_sold) from sh.sales s, sh.customers c where s.cust_id = c.cust_id and c.cust_id < 2 group by c.cust_id

l) Investigate a SQL profile. While still on the "Recommendations for SQL_ID" page, click the SQL text to go to the SQL Details page for this SQL.

Statistics   Activity   Plan   Plan Control ⓘ   **Tuning History**   SQL Monitoring

SQL Tuning History

The following SQL tuning tasks provide the recommendations to tune this SQL statement.

Advisor Task Name	Advisor Task Owner	Task Completion
SYS_AUTO_SQL_TUNING_TASK	SYS	Aug 3, 2009 6:34:13 PM

ADDM Findings for this SQL during historic period

Finding Name	Occurrences (during selected historical period)

Practice 15-1: Using Automatic SQL Tuning (continued)

m) On the SQL Details - Tuning History page note the link to
   SYS_AUTO_SQL_TUNING_TASK that is there to show that the SQL was tuned
   by this tuning task.

n) Click the Plan Control tab.

| Statistics | Activity | Plan | Plan Control ⓘ | Tuning History | SQL Monitoring |

SQL Profiles and SQL Patches

A SQL Profile contains additional information(auxillary statistics) that aids the optimizer to select the optimal execution plan of a particular SQL statement. A SQL Patch is automatically generated to workaround an error or performance problem for a single SQL statement.

(Change Category) (Delete) (Disable/Enable)

Select	Name	Type	Category	Status	Created
⊙	SYS_SQLPROF_0122e0099ab30000	AUTO	DEFAULT	ENABLED	Aug 3, 2009 6:34:01 PM

SQL Plan Baseline

A SQL Plan Baseline is an execution plan deemed to have acceptable performance for a given SQL statement.

Select	Name	Fix	Accept	Auto Purge	Enabled	Created

o) Note that a profile was created automatically for this SQL. The type of AUTO
   means it was automatically created.

p) Click the Statistics tab to take a look at the execution history for this SQL.

Plan Hash Value [4005616876 ▼]

| ⓘ | Tuning History | SQL Monitoring |

he SQL statement for that time interval. Use the   View [Elapsed Time Per Execution ▼]

■ Wait
■ User I/O
■ CPU
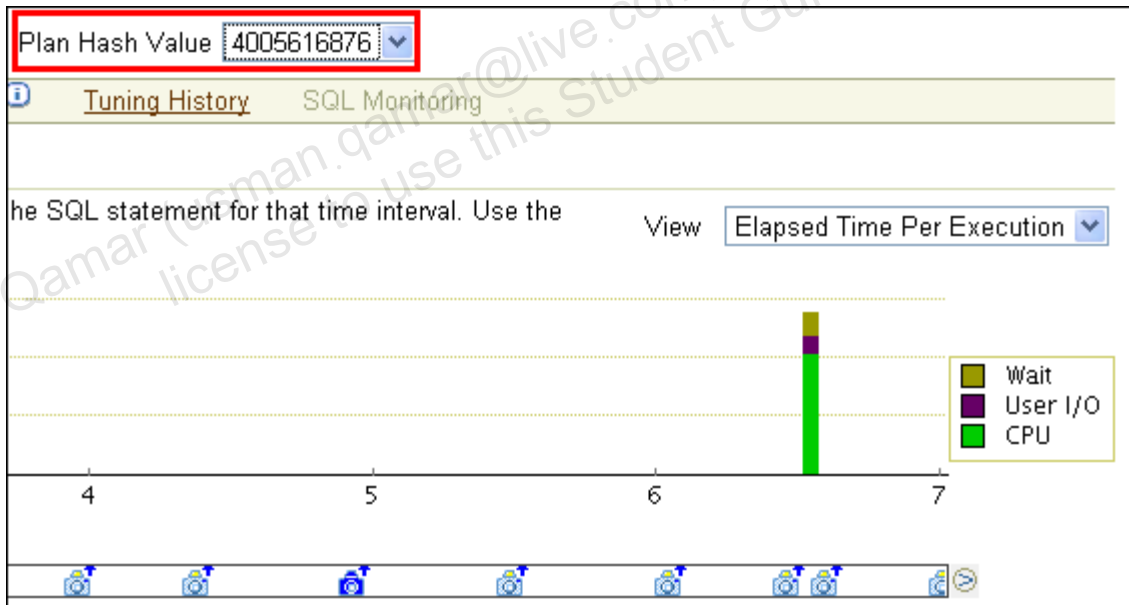
q) Depending on the speed of your machine, you may not see two hash values. If
   that is the case, ignore this step and the following one. Select Real Time: Manual
   Refresh from the View Data and then each of possible two Plan Hash Values from
   the corresponding drop-down list. Choose one after the other and wait for the
   page to refresh each time.

Practice 15-1: Using Automatic SQL Tuning (continued)

r) Depending on the speed of your environment, you should see one statement with a relatively high elapsed time per execution, and one with very low elapsed time per execution. This shows the improved plan. If you select All from the Plan Hash Values drop-down list, you might not be able to see the execution corresponding to the statement after tuning on the Summary graph. This might be because the workload was too short to execute.

8) Generate a text report for more in-depth information. From the command line, execute `ast_task_report.sh` script. What do you observe?

a) Notice the first queries that fetch execution name and object number from the advisor schema, followed by the final query that gets the text report. In the text report, look for the section about the SQL profile finding and peruse the Validation Results section. This shows you the execution statistics observed during test-execute and allows you to get more of a feeling about the profile's quality. You can also use the `report_auto_tuning_task` API to get reports that span multiple executions of the task.

```
$ cat ast_task_report.sh
#!/bin/bash
# For training only - execute as oracle OS user

sqlplus / as sysdba <<EOF!
set echo on
set long 1000000000
set longchunksize 1000
set serveroutput on

--
-- Check the execution names
--
alter session set nls_date_format = 'MM/DD/YYYY HH24:MI:SS';

select execution_name, status, execution_start
 from   dba_advisor_executions
 where  task_name = 'SYS_AUTO_SQL_TUNING_TASK'
 order by execution_start;

variable last_exec varchar2(30);

begin
  select max(execution_name) keep (dense_rank last order by
execution_start)
  into   :last_exec
  from   dba_advisor_executions
  where  task_name = 'SYS_AUTO_SQL_TUNING_TASK';
end;
/

print :last_exec

--
```

Practice 15-1: Using Automatic SQL Tuning (continued)

```
-- Find the object ID for query AST with sql_id by9m5m597zh19
--
variable obj_id number;

begin
  select object_id
  into   :obj_id
  from   dba_advisor_objects
  where  task_name = 'SYS_AUTO_SQL_TUNING_TASK' and
         execution_name = :last_exec and
         type = 'SQL' and
         attr1 = 'by9m5m597zh19';
end;
/

print :obj_id

--
-- Get a text report to drill down on this one query
--
set pagesize 0
select dbms_sqltune.report_auto_tuning_task(
  :last_exec, :last_exec, 'TEXT', 'TYPICAL', 'ALL', :obj_id)
from dual;

EOF!

$
```

```
$ ./ast_task_report.sh

SQL> SQL> SQL> SQL> SQL> SQL> SQL> SQL> SQL>
Session altered.

SQL> SQL>    2    3    4
EXECUTION_NAME                     STATUS      EXECUTION_START
------------------------------ ----------- --------------------
EXEC_176                           COMPLETED   08/03/2009 18:33:49

SQL> SQL> SQL> SQL>    2    3    4    5    6    7
PL/SQL procedure successfully completed.

SQL> SQL>
LAST_EXEC
-------------------------------
EXEC_176

SQL> SQL> SQL> SQL> SQL> SQL> SQL>    2    3    4    5    6
7    8    9   10
PL/SQL procedure successfully completed.
```

Practice 15-1: Using Automatic SQL Tuning (continued)

```
SQL> SQL>
    OBJ_ID
----------
         3

SQL> SQL> SQL> SQL> SQL> SQL>   2    3  GENERAL INFORMATION
SECTION
-------------------------------------------------------------
-----------------
Tuning Task Name                          :
SYS_AUTO_SQL_TUNING_TASK
Tuning Task Owner                         : SYS
Workload Type                             : Automatic High-Load
SQL Workload
Scope                                     : COMPREHENSIVE
Global Time Limit(seconds)                : 3600
Per-SQL Time Limit(seconds)               : 1200
Completion Status                         : COMPLETED
Started at                                : 08/03/2009 18:33:49
Completed at                              : 08/03/2009 18:34:13
Number of Candidate SQLs                  : 3
Cumulative Elapsed Time of SQL (s)        : 53

-------------------------------------------------------------
-----------------
Object ID  : 3
Schema Name: AST
SQL ID     : by9m5m597zh19
SQL Text   : select /*+ USE_NL(s c) FULL(s) FULL(c) AST */
c.cust_id,
             sum(s.quantity_sold) from sh.sales s,
sh.customers c where
             s.cust_id = c.cust_id and c.cust_id < 2 group by
c.cust_id

-------------------------------------------------------------
-----------------
FINDINGS SECTION (2 findings)
-------------------------------------------------------------
-----------------

1- SQL Profile Finding (see explain plans section below)
----------------------------------------------------------
  A potentially better execution plan was found for this
statement.
  SQL profile "SYS_SQLPROF_0122e0099ab30000" was created
automatically for
  this statement.

  Recommendation (estimated benefit: 98.47%)
  --------------------------------------------
```

```
   - An automatically-created SQL profile is present on the
system.
    Name:    SYS_SQLPROF_0122e0099ab30000
    Status: ENABLED

  Validation results
  ------------------
  The SQL profile was tested by executing both its plan and
the original plan
  and measuring their respective execution statistics. A plan
may have been
  only partially executed if the other could be run to
completion in less time.


                          Original Plan  With SQL Profile  %
Improved
                          -------------  -----------------_-
--------
  Completion Status:        COMPLETE           COMPLETE
  Elapsed Time(us):          191076              208
99.89 %
  CPU Time(us):              160775              200
99.87 %
  User I/O Time(us):            0                 0
  Buffer Gets:               2541                39
98.46 %
  Physical Read Requests:       0                 0
  Physical Write Requests:      0                 0
  Physical Read Bytes:          0                 0
  Physical Write Bytes:         0                 0
  Rows Processed:               0                 0
  Fetches:                      0                 0
  Executions:                   1                 1

  Notes
  -----
  1. The original plan was first executed to warm the buffer
cache.
  2. Statistics for original plan were averaged over next 4
executions.
  3. The SQL profile plan was first executed to warm the
buffer cache.
  4. Statistics for the SQL profile plan were averaged over
next 9 executions.

2- Index Finding (see explain plans section below)
---------------------------------------------------
  The execution plan of this statement can be improved by
creating one or more
  indices.

  Recommendation (estimated benefit: 90.98%)
```

```
   ---------------------------------------------
   - Consider running the Access Advisor to improve the
physical schema design
     or creating the recommended index.
     create index SH.IDX$$_00010001 on SH.SALES("CUST_ID");

  Rationale
  ---------
     Creating the recommended indices significantly improves
the execution plan
     of this statement. However, it might be preferable to run
"Access Advisor"
     using a representative SQL workload as opposed to a single
statement. This
     will allow to get comprehensive index recommendations
which takes into
     account index maintenance overhead and additional space
consumption.

-------------------------------------------------------------
-----------------
EXPLAIN PLANS SECTION
-------------------------------------------------------------
-----------------

1- Original With Adjusted Cost
------------------------------
Plan hash value: 4005616876

-------------------------------------------------------------
------------------
------------------
| Id  | Operation            | Name      | Rows  | Bytes |
Cost (%CPU)| Time
   | Pstart| Pstop |
-------------------------------------------------------------
------------------
------------------
|   0 | SELECT STATEMENT     |           |   1 |    13 |
893   (1)| 00:00:1
1 |       |       |
|   1 |  HASH GROUP BY       |           |   1 |    13 |
893   (1)| 00:00:1
1 |       |       |
|   2 |   NESTED LOOPS       |           |   1 |    13 |
892   (1)| 00:00:1
1 |       |       |
|*  3 |    TABLE ACCESS FULL | CUSTOMERS |   1 |     5 |
405   (1)| 00:00:0
5 |       |       |
|   4 |    PARTITION RANGE ALL|          |   1 |     8 |
488   (2)| 00:00:0
```

```
6 |      1 |     28 |
|*  5 |       TABLE ACCESS FULL | SALES       |     1 |      8 |
488   (2)| 00:00:0
6 |      1 |     28 |
----------------------------------------------------------------
-----------------
------------------

Predicate Information (identified by operation id):
-------------------------------------------------------

   3 - filter("C"."CUST_ID"<2)
   5 - filter("S"."CUST_ID"<2 AND "S"."CUST_ID"="C"."CUST_ID")

2- Using SQL Profile
--------------------
Plan hash value: 3070788227


----------------------------------------------------------------
-----------------
--------------------------------------------
| Id  | Operation                                    | Name
| Rows  | Bytes |
Cost (%CPU)| Time      | Pstart| Pstop |
----------------------------------------------------------------
-----------------
--------------------------------------------
|   0 | SELECT STATEMENT                             |
|     1 |    13 |
    55  (2)| 00:00:01 |       |       |
|   1 |   HASH GROUP BY                              |
|     1 |    13 |
    55  (2)| 00:00:01 |       |       |
|   2 |    NESTED LOOPS                              |
|     1 |    13 |
    54  (0)| 00:00:01 |       |       |
|   3 |     PARTITION RANGE ALL                      |
|     1 |     8 |
    54  (0)| 00:00:01 |     1 |    28 |
|   4 |      TABLE ACCESS BY LOCAL INDEX ROWID| SALES
|     1 |     8 |
    54  (0)| 00:00:01 |     1 |    28 |
|   5 |       BITMAP CONVERSION TO ROWIDS     |
|       |       |
|       |       |       |
|*  6 |        BITMAP INDEX RANGE SCAN        | SALES_CUST_BIX
|       |       |
|       |       |     1 |    28 |
|*  7 |      INDEX UNIQUE SCAN                        | CUSTOMERS_PK
|     1 |     5 |
     0   (0)| 00:00:01 |       |       |
```

```
--------------------------------------------------------------
-----------------
---------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   6 - access("S"."CUST_ID"<2)
       filter("S"."CUST_ID"<2)
   7 - access("S"."CUST_ID"="C"."CUST_ID")
       filter("C"."CUST_ID"<2)

3- Using New Indices
--------------------
Plan hash value: 1871796534


--------------------------------------------------------------
-----------------
---------------------------------------
| Id  | Operation                                  | Name
| Rows  | Bytes |
Cost (%CPU)| Time       | Pstart| Pstop  |
--------------------------------------------------------------
-----------------
---------------------------------------
|   0 | SELECT STATEMENT                           |
|    1 |    13 |
    5   (0)| 00:00:01 |        |        |
|   1 |   SORT GROUP BY NOSORT                      |
|    1 |    13 |
    5   (0)| 00:00:01 |        |        |
|   2 |    NESTED LOOPS                             |
|      |       |
          |        |       |        |
|   3 |     NESTED LOOPS                            |
|    1 |    13 |
    5   (0)| 00:00:01 |        |        |
|*  4 |      INDEX RANGE SCAN                       | CUSTOMERS_PK
|    1 |     5 |
    2   (0)| 00:00:01 |        |        |
|*  5 |      INDEX RANGE SCAN                       | IDX$$_00010001
|    1 |       |
    2   (0)| 00:00:01 |        |        |
|   6 |     TABLE ACCESS BY GLOBAL INDEX ROWID| SALES
|    1 |     8 |
    3   (0)| 00:00:01 | ROWID | ROWID |
--------------------------------------------------------------
-----------------
---------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
```

Practice 15-1: Using Automatic SQL Tuning (continued)

```
     4 - access("C"."CUST_ID"<2)
     5 - access("S"."CUST_ID"="C"."CUST_ID")
          filter("S"."CUST_ID"<2)


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

SQL> SQL>
$
```

9) Investigate how to configure Automatic SQL Tuning with Enterprise Manager.

    a) Logged into Enterprise Manager as the SYS user, navigate to Server > Automated Maintenance Tasks.

    b) The chart here shows times in the past when each client was executed, and times in the future when they are scheduled to run again.
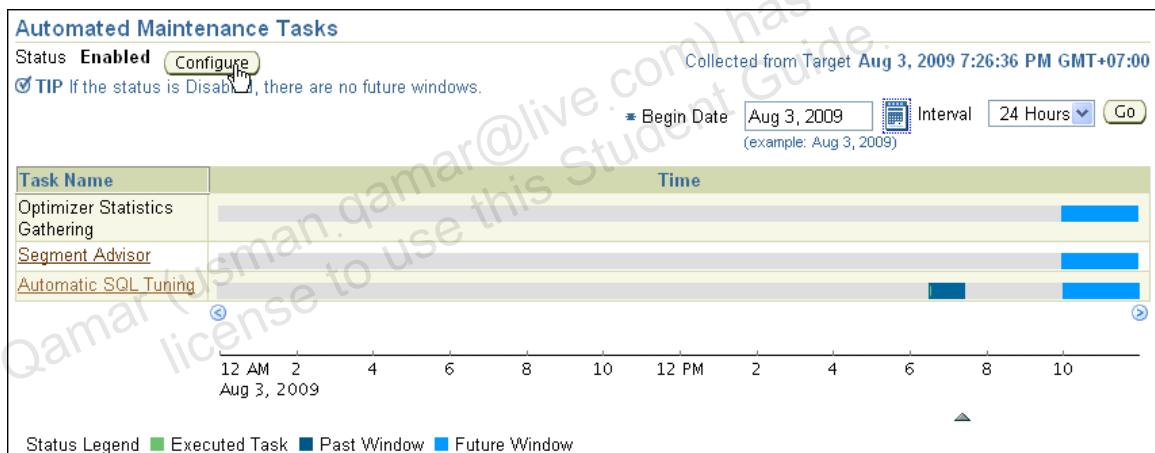
    c) Modify the graph's begin and end points with the widgets in the upper right.

    d) Click the Configure button.

Practice 15-1: Using Automatic SQL Tuning (continued)

On the Automated Maintenance Tasks Configuration page, you can disable individual clients and change which windows they run in.

e) Disable the Automatic SQL Tuning client entirely and click Show SQL.

```
BEGIN
dbms_auto_task_admin.disable(client_name => 'sql tuning advisor',
operation => NULL, window_name => NULL);
END;
```

f) Review the commands and then click Return.

g) On the Automated Maintenance Tasks Configuration page, click Apply. You should receive a success message.

h) Click the Automated Maintenance Tasks locator link.

Task Name
Optimizer Statistics Gathering
Segment Advisor
Automatic SQL Tuning ⊘

i) Notice the forbidden sign right next to the task name.

j) Click Configure.

Show SQL   Revert   Apply

Automated Maintenance Tasks Configuration

Global Status ⦿ Enabled ◯ Disabled

Task Settings

Optimizer Statistics Gathering ⦿ Enabled ◯ Disabled Configure
Segment Advisor ⦿ Enabled ◯ Disabled
Automatic SQL Tuning ⦿ Enabled ◯ Disabled Configure

k) Enable the task again.

```
BEGIN
dbms_auto_task_admin.enable(client_name => 'sql tuning advisor',
operation => NULL, window_name => NULL);
END;
```

l) Optionally, click Show SQl, review the commands and then click Return.

m) Then click Apply to enable Automatic SQL Tuning. You should receive a success message.

n) Navigate to the Automatic SQL Tuning page. If you are on the Automated Maintenance Tasks Configuration page, click the Configure button for Automatic SQL Tuning.

Practice 15-1: Using Automatic SQL Tuning (continued)

Automatic SQL Tuning Settings

[Show SQL] [Revert] [Apply]

Maximum Time Spent Per SQL During Tuning (sec)	1200
Automatic Implementation of SQL Profiles	○ Yes ◉ No
Maximum SQL Profiles Implemented Per Execution	20
Maximum SQL Profiles Implemented (Overall)	10000

o) On the Automatic SQL Tuning Settings page, select No in front of the "Automatic Implementation of SQL Profiles" field, and click Show SQL.

```
BEGIN
dbms_sqltune.set_auto_tuning_task_parameter( 'ACCEPT_SQL_PROFILES',
'FALSE');
END;
```

p) Review the command, click Return, and then click Apply. You should receive a success message.

10) OPTIONAL: You can investigate how to configure Automatic SQL Tuning using PL/SQL looking at the following script: ast_manual_config.sh and script. **Note:** In your case, the task executes quickly because the workload to take into account is really small. However, you could use the ast_interrupt_task.sh script from another session to stop the task, should it last too long.

You received complaints that certain batch jobs are using too many system resources and that a specific user is known to start data warehouse processes during regular business hours. You decide to use the Database Resource Manager for better system-resource utilization and control.

Your first effort to balance the situation includes creating an APPUSER consumer group and assigning it to the default DEFAULT_PLAN resource plan. You then map a couple of Oracle users and your major OS user to resource groups. Activate the resource plan and test your assignments. Regularly click Show SQL to review all statements that are new to you.

Practice 16-1: Managing Resources

In this practice, you create an APPUSER consumer group and assign it to the default DEFAULT_PLAN resource plan. Then you map a couple of Oracle users and your major OS user to resource groups. Activate the resource plan and test your assignments.

Log in as the SYS user (with oracle_4U password, connect as SYSDBA) and perform the necessary tasks through Enterprise Manager Database Control or through SQL*Plus. All scripts for this practice are in the /home/oracle/labs directory.

Whenever you open a new terminal window, execute the oraenv script to set environment variables for the orcl database.

1) Using Enterprise Manager Database Control, create a resource group called APPUSER. At this point, do not add users to the group.

   a) In Enterprise Manager, select Server > Consumer Groups (in the Resource Manager section).

   b) On the Consumer Groups page, click the Create button.

   c) Enter APPUSER as Consumer Group and ensure that the Scheduling Policy is set to Round Robin.

Question 1: What does the ROUND-ROBIN parameter value mean?

Possible Answer: ROUND-ROBIN indicates that CPU resources are fairly allocated to the APPUSER consumer group, according to the active resource plan directives.

   d) Optionally, click Show SQL, review the statements, and then click Return

Practice 16-1: Managing Resources (continued)

```
Show SQL
                                                              Return

BEGIN
dbms_resource_manager.clear_pending_area();
dbms_resource_manager.create_pending_area();
dbms_resource_manager.create_consumer_group(consumer_group => ?, comment => ? ,
cpu_mth => ?);
dbms_resource_manager.submit_pending_area();
END;
```

The bind variables are not displayed for security reasons.

e) On the Create Resource Consumer Group page, click OK to create the consumer group.

f) A confirmation message appears and the new consumer group is displayed. After confirming its creation, click the "Database Instance:orcl.us.oracle.com" link.

Database Instance: orcl.us.oracle.com >   Logged in As SYS

ⓘ **Confirmation**
The object has been created successfully

Consumer Groups

Search

Object Name [   ] (Go)

By default, the search returns all uppercase matches beginning with the string you entered. To run an exact or case-sensitive match, double quote the search string. You can use the wildcard symbol (%) in a double quoted string.

(Create)

(Edit) (View) (Delete) Actions [Create Like ▾] (Go)

Select	Consumer Group △	Mandatory	Description
◉	APPUSER	NO	
○	AUTO_TASK_CONSUMER_GROUP	NO	System maintenance task consumer group
○	BATCH_GROUP	NO	Consumer group for batch operations
○	DEFAULT_CONSUMER_GROUP	YES	Consumer group for users not assigned to any consumer group

2) Add the APPUSER and LOW_GROUP consumer groups to the DEFAULT_PLAN resource plan. Change the level 3 CPU resource allocation percentages: 60% for the APPUSER consumer group and 40% for the LOW_GROUP consumer group.

a) In Enterprise Manager, select Server > Plans.

b) On the Resource Plans page, select DEFAULT_PLAN and click the Edit button.

c) Click Modify.

d) On the Select Groups/Subplans page, move APPUSER and LOW_GROUP to the "Resource Allocations."

Practice 16-1: Managing Resources (continued)
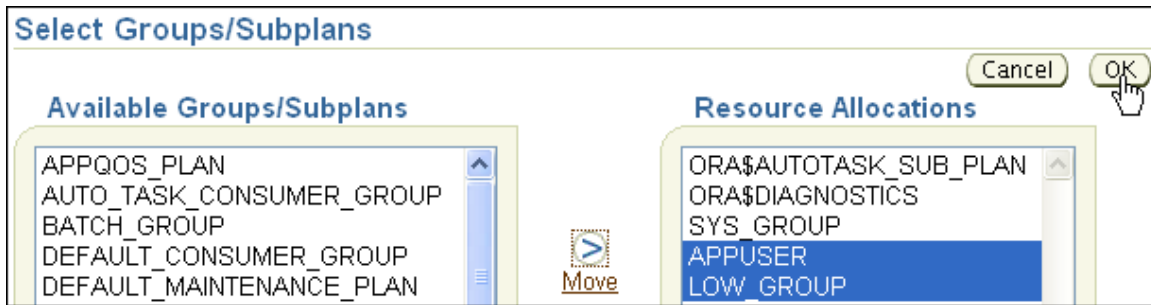
e) Click OK.

f) Enter 60 for APPUSER Level 3 and 40 for LOW_GROUP Level 3.

g) Click Show SQL.

```
DECLARE
spfileValue VARCHAR2(1000);
scopeValue VARCHAR2(10) := 'MEMORY';
planName VARCHAR2(100) :=?;
BEGIN
dbms_resource_manager.clear_pending_area();
dbms_resource_manager.create_pending_area();
dbms_resource_manager.create_plan_directive(
    plan => ?,
    group_or_subplan => ?,
    comment => ?,
    mgmt_p1 => ?, mgmt_p2 => ?, mgmt_p3 => ?, mgmt_p4 => ?,
    mgmt_p5 => ?, mgmt_p6 => ?, mgmt_p7 => ?, mgmt_p8 => ? ,
    parallel_degree_limit_p1 => ? ,
    switch_io_reqs => ? ,
  switch_io_megabytes => ?
,
    active_sess_pool_p1 => ?,
    queueing_p1 => ?,
    switch_group => ?,
    switch_time => ?,
    switch_estimate => case ? when 'false' then false when
'true' then true else false end,
    max_est_exec_time => ?,
    undo_pool => ? ,
    max_idle_time => ?,
    max_idle_blocker_time => ?,
    switch_for_call => case ? when 'false' then false when
'true' then true else false end

);
dbms_resource_manager.create_plan_directive(
    plan => ?,
    group_or_subplan => ?,
    comment => ?,
    mgmt_p1 => ?, mgmt_p2 => ?, mgmt_p3 => ?, mgmt_p4 => ?,
    mgmt_p5 => ?, mgmt_p6 => ?, mgmt_p7 => ?, mgmt_p8 => ? ,
```

Practice 16-1: Managing Resources (continued)

```
      parallel_degree_limit_p1 => ? ,
      switch_io_reqs => ? ,
   switch_io_megabytes => ?
,
    active_sess_pool_p1 => ?,
    queueing_p1 => ?,
    switch_group => ?,
    switch_time => ?,
    switch_estimate => case ? when 'false' then false when
'true' then true else false end,
    max_est_exec_time => ?,
    undo_pool => ? ,
    max_idle_time => ?,
    max_idle_blocker_time => ?,
    switch_for_call => case ? when 'false' then false when
'true' then true else false end

);
dbms_resource_manager.submit_pending_area();
select value into spfileValue from v$parameter where name =
'spfile';
IF spfileValue IS NOT NULL then
EXECUTE IMMEDIATE
'alter system set resource_manager_plan = '||planName||' scope
=BOTH';
END IF;
dbms_resource_manager.switch_plan( plan_name => ? , sid => ? ,
allow_scheduler_plan_switches => FALSE );
END;
```

h) Review the code, then click Return.

Group/Subplan	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
APPUSER			60				
LOW_GROUP			40				
ORA$AUTOTASK_SUB_PLAN		5					
ORA$DIAGNOSTICS		5					
OTHER_GROUPS		90					
SYS_GROUP	95						

General   Parallelism   Session Pool   Undo Pool   Threshold   Idle Time

i) On the Edit Resource Plan: DEAFULT_PLAN page, click Apply to assign the
    APPUSER and the LOW_GROUP consumer groups to the DEFAULT_PLAN
    resource plan. (You activate this plan later.)

j) You should receive a message, that your update was successful.

Practice 16-1: Managing Resources (continued)

3) Configure Consumer Group Mappings, so that the HR Oracle user belongs to the APPUSER consumer group, and the SCOTT user to the LOW_GROUP consumer group. For the SCOTT user, confirm that his ORACLE_USER attribute has a higher priority than the CLIENT_OS_USER attribute.

a) In Enterprise Manager, select Server > Consumer Group Mappings.

b) Select Oracle User and click the "Add Rule for Selected Type" button.

Select	Priority △ View		Value	Consumer Group
○	1 Service Module and Action		No Mappings Specified	
○	2 Service and Module		No Mappings Specified	
○	3 Module and Action		No Mappings Specified	
○	4 Module		No Mappings Specified	
○	5 Service		No Mappings Specified	
◉	6 Oracle User		SYS, SYSTEM	SYS_GROUP

c) On the Consumer Group Mappings page, ensure that APPUSER is selected as "Selected Consumer Group."

Consumer Group Mappings

Cancel   OK

Use a mapping rule to automatically assign sessions to specific consumer groups by setting up mappings between session attributes and consumer groups.

Selected Consumer Group   APPUSER

Oracle User

Available Oracle User		Selected Oracle User
ANONYMOUS	⊳	HR
APEX_030200	Move	

d) Move the HR user into the Selected Oracle User region, and then click OK.

e) You should receive a success message. On the Consumer Group Mappings General page, click Show SQL.

Practice 16-1: Managing Resources (continued)

```
Show SQL
                                                              Return

BEGIN
dbms_resource_manager.clear_pending_area();
dbms_resource_manager.create_pending_area();
dbms_resource_manager.set_consumer_group_mapping(
    dbms_resource_manager.oracle_user,
    'HR',
    'APPUSER'
);
dbms_resource_manager.submit_pending_area();
END;
```

f) Review the statements and click Return.

g) Click Apply to assign the HR user to the APPUSER consumer group.

�(i) **Update Message**
Consumer Group Mappings has been modified successfully

Consumer Group Mappings

Show SQL   Revert   Apply

General | Priorities
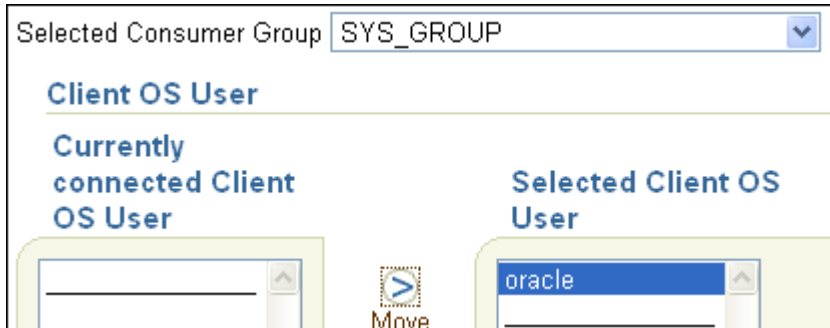
Create rules to enable the resource manager to automatically assign sessions to consumer groups

View All

Add Rule for Selected Type

Select	Priority △	View	Value		Consumer Group	Remove
○	1	Service Module and Action	No Mappings Specified			
○	2	Service and Module	No Mappings Specified			
○	3	Module and Action	No Mappings Specified			
○	4	Module	No Mappings Specified			
○	5	Service	No Mappings Specified			
◉	6	Oracle User	HR	✎	APPUSER	✎
			SYS, SYSTEM	✎	SYS_GROUP	✎

h) Select Oracle User again, and click the "Add Rule for Selected Type" button.

Practice 16-1: Managing Resources (continued)

i) Select LOW_GROUP from the Selected Consumer Group drop-down list, and move SCOTT into the Selected Oracle User area, and then click OK.

j) You should receive a success message (but do not yet apply your changes.) On the Consumer Group Mappings page, click the Priorities tab.

k) Confirm that "Oracle User" has a higher priority than "Client OS User."

l) Click Apply to assign the SCOTT user to the LOW_GROUP consumer group.

You should receive a success message.

4) Configure Consumer Group Mappings so that the oracle OS user belongs to the SYS_GROUP consumer group.

a) Return to the Consumer Group Mappings –General page.

b) Select Client OS User and click the "Add Rule for Selected Type" button.

Practice 16-1: Managing Resources (continued)
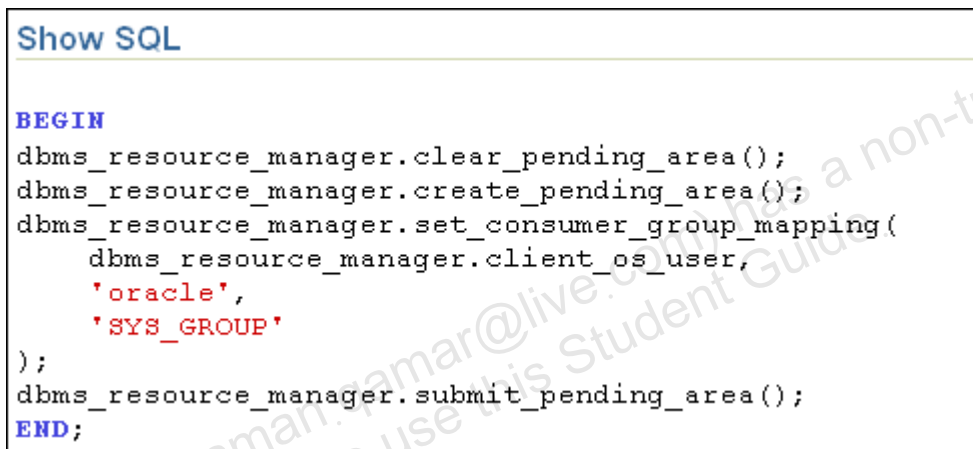
c) Select SYS_GROUP from the Selected Consumer Group drop-down list, move oracle into the Selected Client OS User area, and click OK.

You should receive a success message.


```
Show SQL


BEGIN
dbms_resource_manager.clear_pending_area();
dbms_resource_manager.create_pending_area();
dbms_resource_manager.set_consumer_group_mapping(
    dbms_resource_manager.client_os_user,
    'oracle',
    'SYS_GROUP'
);
dbms_resource_manager.submit_pending_area();
END;
```

d) Optionally, click Show SQL, review the statements, and click Return.

Practice 16-1: Managing Resources (continued)

e) Click Apply to assign the `oracle` OS user to the `SYS_GROUP` consumer group.

You should receive a success message.

5) Assign the `PM` Oracle user to the following consumer groups: `APPUSER`, `LOW_GROUP`, and `SYS_GROUP`.

a) In Enterprise Manager, select Server > Users (in the Security section).

b) Select the `PM` user and click the Edit button.

Practice 16-1: Managing Resources (continued)

c) Click the Consumer Groups Privileges tab. If you see an error regarding the password for the PM user, enter `oracle_4U` in both the password fields.

d) Click the Edit List button.

e) Move the `APPUSER`, `LOW_GROUP`, and `SYS_GROUP` consumer groups to Selected Consumer Groups and click OK.

f) Click Show SQL.

Practice 16-1: Managing Resources (continued)

```
Show SQL
                                                        (Return)
BEGIN
    dbms_resource_manager_privs.grant_switch_consumer_group(
        grantee_name => 'PM',
        consumer_group => 'APPUSER',
        grant_option => FALSE
    );
END;
BEGIN
    dbms_resource_manager_privs.grant_switch_consumer_group(
        grantee_name => 'PM',
        consumer_group => 'LOW_GROUP',
        grant_option => FALSE
    );
END;
BEGIN
    dbms_resource_manager_privs.grant_switch_consumer_group(
        grantee_name => 'PM',
        consumer_group => 'SYS_GROUP',
        grant_option => FALSE
    );
END;
```

g) Review the statements and click Return.

h) Click Apply to assign the PM user to these consumer groups.

You should receive a success message.

6) Activate the DEFAULT_PLAN resource plan.

a) In Enterprise Manager, select Server > Plans.

b) On the Resource Plans page, select DEFAULT_PLAN, select Activate from the Actions drop-down list, and click Go.

```
▣ Confirmation

   Are you sure you want to activate Resource Plan DEFAULT_PLAN?

                                                  (No)  (Yes)
```

c) Click Yes to confirm your activation.

You should see a success message.

7) Test the consumer group mappings. Start two SQL*Plus sessions: the first with the system/oracle_4U@orcl connect string and the second with the scott/oracle_4U@orcl connect string.

a) As the oracle user in a terminal window, execute the oraenv script to set environment variables for the orcl database.

Practice 16-1: Managing Resources (continued)

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$
```

Your output may be different depending on your previously executed tasks.

b) To start a SQL*Plus session with the `system/oracle_4U@orcl` connect
    string and to set your SQL prompt to "FIRST," enter:

```
$ sqlplus system@orcl
Enter password: oracle_4U <<< not displayed

SQL> SET SQLPROMPT "FIRST>"
FIRST>
```

c) As the `oracle` user in a terminal window, execute the `oraenv` script to set
    environment variables for the `orcl` database.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$
```

Your output may be different depending on your previously executed tasks.

d) To start a SQL*Plus session with the `scott/oracle_4U@orcl` connect string
    and to set your SQL prompt to "SECOND," enter:

```
$ sqlplus scott@orcl
Enter password: oracle_4U <<< not displayed

SQL> SET SQLPROMPT "SECOND>"
SECOND>
```

e) In your `FIRST` SQL*Plus session, enter:

```
FIRST>@query_rsc_groups.sql

SCHEMANAME                     RESOURCE_CONSUMER_GROUP
------------------------------ ------------------------------
--
DBSNMP                         OTHER_GROUPS
DBSNMP                         OTHER_GROUPS
DBSNMP                         OTHER_GROUPS
SCOTT                          LOW_GROUP

FIRST>
```

f) *Question:* To which consumer group does the SCOTT user belong?

    Answer: SCOTT is in the LOW_GROUP consumer group.

    Note: Your output for this step (and the following steps) may not look exactly
    like the output shown. The information of concern here is for the specific users
    being mentioned.

Practice 16-1: Managing Resources (continued)

g) In the SECOND terminal window, connect as the PM user with the oracle_4U password:

```
SECOND>connect pm@orcl
Enter password: oracle_4U <<< not displayed

Connected.
SECOND>
```

h) In your FIRST SQL*Plus session, enter "/" to execute the previous SQL statement again.

```
FIRST>/

SCHEMANAME                    RESOURCE_CONSUMER_GROUP
---------------------------- ------------------------------
-
DBSNMP                        OTHER_GROUPS
DBSNMP                        OTHER_GROUPS
DBSNMP                        OTHER_GROUPS
PM                            SYS_GROUP

FIRST>
```

i) *Question:* To which consumer group does the PM user belong?

   Answer: PM is in the SYS_GROUP consumer group.

j) In the SECOND terminal window, connect as the OE user with the oracle_4U password::

```
SECOND>connect oe@orcl
Enter password: oracle_4U <<< not displayed

Connected.
SECOND>
```

k) In your FIRST SQL*Plus session, enter "/" to execute the previous SQL statement again.

```
FIRST>/

SCHEMANAME                    RESOURCE_CONSUMER_GROUP
---------------------------- ------------------------------
DBSNMP                        OTHER_GROUPS
DBSNMP                        OTHER_GROUPS
DBSNMP                        OTHER_GROUPS
OE                            OTHER_GROUPS

FIRST> exit
```

l) Exit both the SQL*Plus sessions.
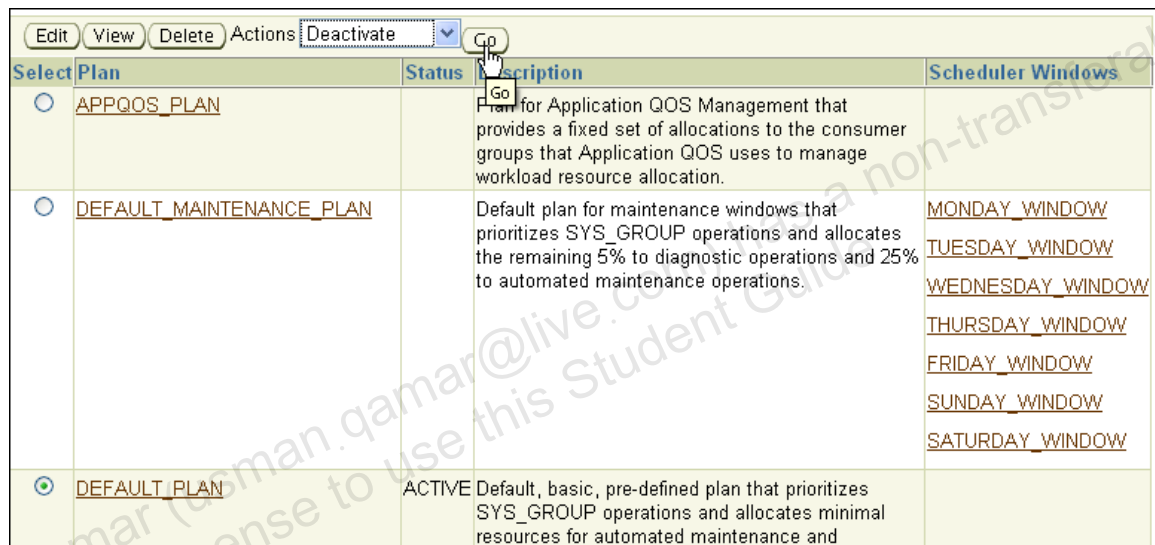
Practice 16-1: Managing Resources (continued)

m) *Question:* When testing your `OE` Oracle user, you notice that `OE` is in the `OTHER_GROUPS` consumer group. Why is that?

Possible Answer: The `OE` user is not explicitly assigned to another consumer resource group.

8) Revert to your original configuration by deactivating the `DEFAULT_PLAN` resource group, locking accounts, undoing all consumer group mappings, and finally by deleting the `APPUSER` resource group.

a) To deactivate the `DEFAULT_PLAN` resource plan in Enterprise Manager, select Server > Plans.

b) On the Resource Plans page, select the `DEFAULT_PLAN`, select Deactivate from the Actions drop-down list, and click Go.

c) Click Yes to confirm your deactivation.

You should receive a success message.

d) To reconfigure or undo all consumer group mappings, review and execute the `rsc_cleanup.sh` script from your working directory:

```
$ cat rsc_cleanup.sh
# Oracle Database 11g: Administration Workshop II
# Oracle Server Technologies - Curriculum Development
#
# ***Training purposes only***
# ***Not appropriate for production use***
#
# This script supports the Resource Manager practice session.
#   Start this script connected as OS user: oracle.

sqlplus "/ as sysdba" << EOF
```

Practice 16-1: Managing Resources (continued)

```
PROMPT undo lab step 5

BEGIN
    dbms_resource_manager_privs.revoke_switch_consumer_group(
        revokee_name => 'PM',
        consumer_group => 'APPUSER'
    );
END;
/
BEGIN
    dbms_resource_manager_privs.revoke_switch_consumer_group(
        revokee_name => 'PM',
        consumer_group => 'LOW_GROUP'
    );
END;
/
BEGIN
    dbms_resource_manager_privs.revoke_switch_consumer_group(
        revokee_name => 'PM',
        consumer_group => 'SYS_GROUP'
    );
END;
/
PROMPT undo lab step 4

BEGIN
dbms_resource_manager.clear_pending_area();
dbms_resource_manager.create_pending_area();
dbms_resource_manager.set_consumer_group_mapping(
    dbms_resource_manager.client_os_user,
    'ORACLE',
    NULL
);
dbms_resource_manager.submit_pending_area();
END;
/
PROMPT  undo lab step 3

BEGIN
dbms_resource_manager.clear_pending_area();
dbms_resource_manager.create_pending_area();
dbms_resource_manager.set_consumer_group_mapping(
    dbms_resource_manager.oracle_user,
    'HR',
    NULL
);
dbms_resource_manager.set_consumer_group_mapping(
    dbms_resource_manager.oracle_user,
    'SCOTT',
    NULL
);
```

Practice 16-1: Managing Resources (continued)

```
dbms_resource_manager.set_consumer_group_mapping(
    dbms_resource_manager.oracle_user,
    'SYS',
    NULL
);
dbms_resource_manager.set_consumer_group_mapping(
    dbms_resource_manager.oracle_user,
    'SYSTEM',
    NULL
);
dbms_resource_manager.submit_pending_area();
END;
/
PROMPT  undo lab step 2

BEGIN
dbms_resource_manager.clear_pending_area();
dbms_resource_manager.create_pending_area();
dbms_resource_manager.delete_plan_directive('DEFAULT_PLAN',
'APPUSER');
dbms_resource_manager.delete_plan_directive('DEFAULT_PLAN',
'LOW_GROUP');
dbms_resource_manager.submit_pending_area();
dbms_resource_manager.switch_plan( plan_name => '', sid =>
'orcl', allow_scheduler_plan_switches => FALSE );
END;
/
exit
EOF
```

```
$ ./rsc_cleanup.sh

SQL> SQL> SQL> undo lab step 5
SQL> SQL>   2    3    4    5    6    7
PL/SQL procedure successfully completed.

SQL>   2    3    4    5    6    7
PL/SQL procedure successfully completed.

SQL>   2    3    4    5    6    7
PL/SQL procedure successfully completed.

SQL> undo lab step 4
SQL> SQL>   2    3    4    5    6    7    8    9   10   11
PL/SQL procedure successfully completed.

SQL> undo lab step 3
SQL> SQL>   2    3    4    5    6    7    8    9   10   11
12   13   14   15   16   17   18   19   20   21   22   23   24
25   26
```

Practice 16-1: Managing Resources (continued)

```
PL/SQL procedure successfully completed.

SQL> undo lab step 2
SQL> SQL>   2    3    4    5    6    7    8    9
PL/SQL procedure successfully completed.

$
```

e) To delete the `APPUSER` resource group in Enterprise Manager, select Server > Consumer Groups.

f) On the Consumer Groups page, select `APPUSER` and click the Delete button.

g) Confirm your deletion by clicking Yes.

You should receive a success message.

h) Exit Enterprise Manager and close all terminal windows.

In these practices, you explore Oracle Scheduler capabilities.

Practice 17-1: Creating Scheduler Components

In this practice, you use Enterprise Manager Database Control to create Scheduler objects in the ORCL database instance and automate tasks.

While logged in to the database as the HR user in Database Control, create a simple job that runs a SQL script:

- General:

  Name: CREATE_LOG_TABLE_JOB
  Owner: HR
  Description: Create the SESSION_HISTORY table for the next part of this practice
  Logging Level: RUNS
  Command Type: PL/SQL
  PL/SQL Block: BEGIN execute immediate('create table session_history(snap_time TIMESTAMP WITH LOCAL TIME ZONE, num_sessions NUMBER)'); END;

- Schedule:

  Repeating: Do not Repeat
  Start: Immediately

- Options:
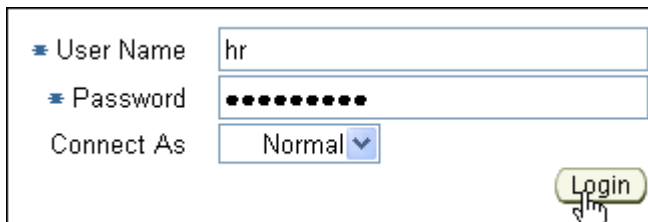
  No special options

1) As the SYS user, grant CONNECT, RESOURCE, and DBA roles to the HR user.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl

$ sqlplus / as sysdba
Connected.
SQL> grant connect, resource, dba to hr;
Grant succeeded.
```

2) Log in to Enterprise Manager Database Control as the HR user with the oracle_4U password.

3) To create a job, navigate to Server > Jobs (in the Oracle Scheduler region).

   a) On the Scheduler Jobs page, click the Create button.

   b) On the Create Job - General page, enter and confirm the following values:

   Name: CREATE_LOG_TABLE_JOB
   Schema: HR

Enabled: `Yes`

Description: Create the `SESSION_HISTORY` table

Logging Level: `Log job runs only (RUNS)`

Command Type: PL/SQL Block

PL/SQL Block:

```
begin
    execute immediate
    ('create table session_history(
      snap_time TIMESTAMP WITH LOCAL TIME ZONE,
      num_sessions NUMBER)');
end;
```


c) On the Schedule folder tab, enter and confirm the following values:

Timezone: *Your_local_timezone*

Repeating: `Do not Repeat`

Start: `Immediately`

Practice 17-1: Creating Scheduler Components (continued)

d) Click Show SQL if you want to view the SQL statement defining your job.

```
BEGIN
sys.dbms_scheduler.create_job(
job_name => '"HR"."CREATE_LOG_TABLE_JOB"',
job_type => 'PLSQL_BLOCK',
job_action => 'begin
    execute immediate
    (''create table session_history(
      snap_time TIMESTAMP WITH LOCAL TIME ZONE,
      num_sessions NUMBER)'');
end;
',
start_date => systimestamp at time zone 'Etc/GMT-7',
job_class => '"DEFAULT_JOB_CLASS"',
comments => 'Create the SESSION_HISTORY table',
auto_drop => FALSE,
enabled => TRUE);
END;
```

e) Review the statements (Your time zone might be different.) and click Return.

f) Click OK to create the job.

Practice 17-1: Creating Scheduler Components (continued)

g) If the job does not appear on the Scheduler Jobs page, click the Refresh button until it succeeds. – Also, you may not see it "running", but already with the Last Run Status of SUCCEEDED.

4) Create a program called LOG_SESS_COUNT_PRGM that logs the current number of database sessions into a table. Use the following code:

```
DECLARE
sess_count    NUMBER;
BEGIN
SELECT COUNT(*) INTO sess_count FROM V$SESSION;
INSERT INTO session_history VALUES (systimestamp,
sess_count);
COMMIT;
END;
```

a) Logged into Enterprise Manager as the HR user, naviagate to Server > Programs or click the Programs in the Related Links section on the Scheduler Jobs page.

b) On the Scheduler Programs page, click the Create button.

c) On the Create Program page, enter and confirm the following values:

> Name: LOG_SESS_COUNT_PRGM
> Schema: HR
> Enabled: Yes

Type: PLSQL_BLOCK
Source:

```
DECLARE
sess_count    NUMBER;
BEGIN
SELECT COUNT(*) INTO sess_count FROM V$SESSION;
INSERT INTO session_history VALUES (systimestamp,
sess_count);
COMMIT;
END;
```

Create Program

Show SQL   Cancel   OK

Show SQL

* Name LOG_SESS_COUNT_PRGM

Schema HR

Enabled ⦿ Yes ◯ No

Description

Type PLSQL_BLOCK ▾

* Source
```
DECLARE
sess_count   NUMBER;
BEGIN
SELECT COUNT(*) INTO sess_count FROM V$SESSION;
INSERT INTO session_history VALUES (systimestamp, sess_count);
COMMIT;
END;
```

d) Click Show SQL.

```
BEGIN
DBMS_SCHEDULER.CREATE_PROGRAM(
program_name=>'"HR"."LOG_SESS_COUNT_PRGM"',
program_action=>'DECLARE
sess_count    NUMBER;
BEGIN
SELECT COUNT(*) INTO sess_count FROM V$SESSION;
INSERT INTO session_history VALUES (systimestamp, sess_count);
COMMIT;
END;
',
program_type=>'PLSQL_BLOCK',
number_of_arguments=>0,
comments=>'',
enabled=>TRUE);
END;
```

e) Review the statements, and then click Return.

f) Click OK to create the program.

Practice 17-1: Creating Scheduler Components (continued)

○	LOG_SESS_COUNT_PRGM	HR	✔	PLSQL_BLOCK

You should see the program on the Scheduler Programs page.

5) Create a schedule named SESS_UPDATE_SCHED owned by HR that executes every three seconds. Use SQL*Plus and the DBMS_SCHEDULER.CREATE_SCHEDULE procedure to create the schedule.

```
BEGIN
  DBMS_SCHEDULER.CREATE_SCHEDULE (
    schedule_name => 'SESS_UPDATE_SCHED',
    start_date => SYSTIMESTAMP,
    repeat_interval => 'FREQ=SECONDLY;INTERVAL=3',
    comments => 'Every three seconds');
END;
/
```

Return to Enterprise Manager Database Control and verify that the SESS_UPDATE_SCHED schedule was created.

Hint: You may have to refresh the page for the Schedule to appear.

a) In a terminal window, enter:

```
$ sqlplus hr
Enter password: oracle_4U <<< not displayed
```

b) In your SQL*Plus session, enter:

```
BEGIN
  DBMS_SCHEDULER.CREATE_SCHEDULE (
    schedule_name => 'SESS_UPDATE_SCHED',
    start_date => SYSTIMESTAMP,
    repeat_interval => 'FREQ=SECONDLY;INTERVAL=3',
    comments => 'Every three seconds');
END;
/
PL/SQL procedure successfully completed.
```

c) In Enterprise Manager, select Server > Schedules.

d) Verify that the SESS_UPDATE_SCHED schedule has been created. (You may have to refresh the page for the Schedule to appear.)

6) Using Enterprise Manager Database Control, create a job named LOG_SESSIONS_JOB that uses the LOG_SESS_COUNT_PRGM program and the SESS_UPDATE_SCHED schedule. Make sure that the job uses FULL logging.

a) In Enterprise Manager, select Server > Jobs, and then click the Create button.

b) On the Create Job page, enter and confirm the following values:

> Name: LOG_SESSIONS_JOB
> Owner: HR
> Enabled: Yes
> Description: Count sessions with HR.LOG_SESS_COUNT_PRGM
> Logging level: Log everything (FULL)

c) Click Change Command Type, and on the Select Command Option page, select Program Name, and enter HR.LOG_SESS_COUNT_PRGM in the field next to it, or use the Lookup (flashlight) icon to select the program.

d) Click OK.

Practice 17-1: Creating Scheduler Components (continued)

e) Back on the Create Job page, click the Schedule tab.

f) Change the Schedule Type to "Use Pre-Defined Schedule," and select the HR.SESS_UPDATE_SCHED schedule by using the flashlight icon.

g) Click Show SQL.

```
BEGIN
sys.dbms_scheduler.create_job(
job_name => '"HR"."LOG_SESSIONS_JOB"',
program_name => '"HR"."LOG_SESS_COUNT_PRGM"',
schedule_name => '"HR"."SESS_UPDATE_SCHED"',
job_class => '"DEFAULT_JOB_CLASS"',
comments => 'Count sessions with HR.LOG_SESS_COUNT_PRGM',
auto_drop => FALSE,
enabled => FALSE);
sys.dbms_scheduler.set_attribute( name => '"HR"."LOG_SESSIONS_JOB"',
attribute => 'logging_level', value => DBMS_SCHEDULER.LOGGING_FULL);
sys.dbms_scheduler.enable( '"HR"."LOG_SESSIONS_JOB"' );
END;
```

h) Review the statements and then click Return.

i) On the Create Job page, click OK to create the job.

You should receive a success message and see the job on the Scheduler Jobs page.

Select	Name	Schema	Scheduled Date	Last Run Date	Last Run Status	Enabled	Job Class	Previous Runs
●	MGMT_STATS_CONFIG_JOB	ORACLE_OCM	Aug 1, 2009 1:01:01 AM -07:00	Not Scheduled	SCHEDULED	✓	DEFAULT_JOB_CLASS	0
○	MGMT_CONFIG_JOB	ORACLE_OCM	MAINTENANCE_WINDOW_GROUP	Jul 30, 2009 8:00:07 AM -07:00	SCHEDULED	✓	DEFAULT_JOB_CLASS	1
○	RLM$SCHDNEGACTION	EXFSYS	Jul 31, 2009 3:37:27 PM +07:00	Jul 31, 2009 2:39:50 PM +07:00	SCHEDULED	✓	DEFAULT_JOB_CLASS	6
○	RLM$EVTCLEANUP	EXFSYS	Jul 31, 2009 1:11:30 AM -07:00	Jul 31, 2009 12:39:50 AM -07:00	SCHEDULED	✓	DEFAULT_JOB_CLASS	6
○	LOG_SESSIONS_JOB	HR	Jul 31, 2009 3:05:34 PM +07:00	Jul 31, 2009 3:05:31 PM +07:00	SCHEDULED	✓	DEFAULT_JOB_CLASS	29

Note that it quicly accumulates previous runs, because it executes every three seconds.

7) In your SQL*Plus session, check the `HR.SESSION_HISTORY` table for rows.

a) Enter:

```
SQL> SELECT * FROM SESSION_HISTORY ORDER BY snap_time;
```

Your result looks different but the second values should be three seconds apart:

```
SNAP_TIME
-------------------------------------------------------------
NUM_SESSIONS
------------
31-JUL-09 03.07.55.101299 PM
          41
```

Practice 17-1: Creating Scheduler Components (continued)

```
31-JUL-09 03.07.58.099194 PM
              41
```

Question: If there are rows in the table, are the time stamps three seconds apart?

Answer: Yes, there are rows. Yes, the time stamps are three seconds apart.

8) Use Enterprise Manager Database Control to alter the SESS_UPDATE_SCHED schedule from every three seconds to every three minutes. Then use SQL*Plus to verify that the rows are now being added every three minutes: query the HR.SESSION_HISTORY table, ordered by the SNAP_TIME column.

    a) In Enterprise Manager, select Server > Schedules.

    b) Click the SESS_UPDATE_SCHED link.

    c) On the View Schedule page, click Edit.

    d) Change the description to "Every three minutes."

    e) Change Available to Start to Immediately.

    f) Change the value in the Repeat drop-down list from By Seconds to **By Minutes**.

    g) Ensure that the interval is 3 and then click Show SQL.

Practice 17-1: Creating Scheduler Components (continued)

```
BEGIN
sys.dbms_scheduler.set_attribute( name => '"HR"."SESS_UPDATE_SCHED"', attribute =>
'repeat_interval', value => 'FREQ=MINUTELY;INTERVAL=3');
sys.dbms_scheduler.set_attribute( name => '"HR"."SESS_UPDATE_SCHED"', attribute =>
'start_date', value => systimestamp at time zone '+7:00');
sys.dbms_scheduler.set_attribute( name => '"HR"."SESS_UPDATE_SCHED"', attribute =>
'comments', value => 'Every three minutes');
END;
```

h) Review the statements, click Return, and then click Apply.

You should receive a success message.

9) In your SQL*Plus session, query the HR.SESSION_HISTORY table, ordered by the SNAP_TIME column. (Wait for three minutes after you update the schedule.) Enter:

```
SQL> SELECT * FROM HR.SESSION_HISTORY ORDER BY snap_time;
```

Your result looks different (but the minute values should be three minutes apart):

```
SNAP_TIME
-----------------------------------------------------------------
NUM_SESSIONS
------------
31-JUL-09 03.10.39.185103 PM
          41

31-JUL-09 03.13.38.927866 PM
          41
```

10) **This is your mandatory cleanup task.** Use Enterprise Manager to drop the LOG_SESSIONS_JOB and CREATE_LOG_TABLE_JOB jobs, the LOG_SESS_COUNT_PRGM program, and the SESS_UPDATE_SCHED schedule. Use SQL*Plus to drop the SESSION_HISTORY table, and exit from your session.

Note: Make sure that you do not delete the wrong schedule.

a) In Enterprise Manager, select Server > Jobs.

Practice 17-1: Creating Scheduler Components (continued)

Select	Name	Schema	Scheduled Date	Last Run Date	Last Run Status
○	MGMT_STATS_CONFIG_JOB	ORACLE_OCM	Aug 1, 2009 1:01:01 AM -07:00	Not Scheduled	SCHEDULED
○	MGMT_CONFIG_JOB	ORACLE_OCM	MAINTENANCE_WINDOW_GROUP	Jul 30, 2009 8:00:07 AM -07:00	SCHEDULED
○	RLM$SCHDNEGACTION	EXFSYS	Jul 31, 2009 3:37:27 PM +07:00	Jul 31, 2009 2:39:50 PM +07:00	SCHEDULED
○	RLM$EVTCLEANUP	EXFSYS	Jul 31, 2009 1:11:30 AM -07:00	Jul 31, 2009 12:39:50 AM -07:00	SCHEDULED
◉	LOG_SESSIONS_JOB	HR	Jul 31, 2009 3:05:34 PM +07:00	Jul 31, 2009 3:05:31 PM +07:00	SCHEDULED
○	CREATE_LOG_TABLE_JOB	HR	Not Scheduled	Jul 31, 2009	SUCCEEDED

Buttons: View Job Definition | Edit Job Definition | Delete | Run Now | Create Like

b) With the `LOG_SESSIONS_JOB` job selected, click the Delete button.

Confirmation

Are you sure you want to delete Job HR.LOG_SESSIONS_JOB?

◉ Drop the job and stop any running instance.
○ If there is a running instance of this job, it will not be dropped.

No   Yes

c) Select "Drop the job and stop any running instance," and then click Yes.

d) Go back to the Scheduler Jobs page, select `CREATE_LOG_TABLE_JOB`, and click Delete. Select "Drop the job and stop any running instance," and then click Yes.

e) Click the Database Instance breadcrumb at the upper-left corner of the page to return to the Server page. Then click Programs.

◉	LOG_SESS_COUNT_PRGM	HR	✔	PLSQL_BLOCK

View   Edit   Delete   Create Like ▾   Go
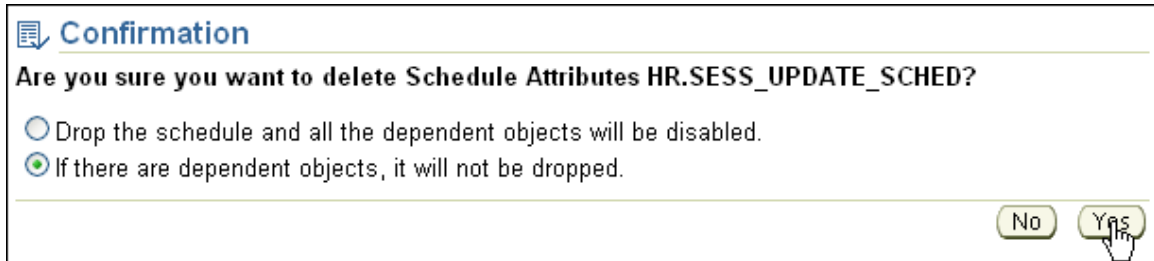
f) With the `LOG_SESS_COUNT_PRGM` program selected, click the Delete button. Click Yes to confirm.

g) Click Schedules in the Related Links section

h) With the SESS_UPDATE_SCHED schedule selected, click the Delete button.
   Make sure that you do not delete the wrong schedule.

📋 **Confirmation**

Are you sure you want to delete Schedule Attributes HR.SESS_UPDATE_SCHED?

○ Drop the schedule and all the dependent objects will be disabled.
◉ If there are dependent objects, it will not be dropped.

(No) (Yes)

i) Select "If there are dependent objects, it will not be dropped," and then click Yes
   to confirm.

j) In your SQL*Plus session as the HR user, delete the SESSION_HISTORY table,
   and then exit the session. Enter:

```
SQL> DROP TABLE session_history PURGE;
Table dropped.

SQL> EXIT
```

Practice 17-2: Creating Lightweight Scheduler Jobs

In this optional practice, you create and run a lightweight scheduler job. View the metadata for a lightweight scheduler job. Navigate to your $HOME/labs directory.

1) Create a job template for the lightweight job. The template must be a PL/SQL procedure or a PL/SQL block. Run the cr_test_log.sql script to create the test_log table. Then run prog_1.sql. The prog_1.sql script in the $HOME/labs directory creates a job template.
   Note: The job template has a subset of the attributes of a scheduler program. Most of the attributes of a template cannot be changed for the job.

   a) Navigate to the labs directory.

```
$ cd ~/labs
$
```

   b) Execute the cr_test_log.sql and prog_1.sql scripts as the system user. The password for the system user is oracle_4U.

```
$ sqlplus system
Enter password: oracle_4U <<< not displayed

SQL> @cr_test_log.sql
SQL> -- cleanup previous runs
SQL> -- you will see an error the first time this script is
run
SQL> drop table system.test_log;
drop table system.test_log
                *
ERROR at line 1:
ORA-00942: table or view does not exist


SQL>
SQL> -- create a table to hold timing information
SQL>
SQL> create table system.test_log
  2  (job_type        VARCHAR2(10),
  3   timemark        VARCHAR2(10),
  4   act_time        TIMESTAMP with TIME ZONE)
  5  /

Table created.
```

```
SQL> @prog_1.sql
SQL> REM For training only
SQL> set echo on
SQL>
SQL> BEGIN
  2  -- This will produce an error the first
  3  -- time it is run since PROG_1 does not exist
  4
```

```
  5  DBMS_SCHEDULER.DROP_PROGRAM (
  6     program_name            => '"SYSTEM"."PROG_1"');
  7  END;
  8  /
BEGIN
*
ERROR at line 1:
ORA-27476: "SYSTEM.PROG_1" does not exist
ORA-06512: at "SYS.DBMS_ISCHED", line 27
ORA-06512: at "SYS.DBMS_SCHEDULER", line 61
ORA-06512: at line 5


SQL> BEGIN
  2  DBMS_SCHEDULER.CREATE_PROGRAM(
  3  program_name=>'"SYSTEM"."PROG_1"'
  4  ,program_action=>'DECLARE
  5   time_now DATE;
  6  BEGIN
  7   INSERT INTO test_log
VALUES(''LWT'',''DONE'',SYSTIMESTAMP);
  8  END;'
  9  , program_type=>'PLSQL_BLOCK'
 10  , number_of_arguments=>0,
 11  comments=>'Insert a timestamp into the test_log'
 12  ,enabled=>TRUE);
 13  END;
 14  /
.
PL/SQL procedure successfully completed.
SQL>
```

2) Create a lightweight job, using the PL/SQL API. The job will run the my_prog template daily with an interval of 2, starting immediately.
    Note: EM does not expose the JOB_STYLE setting at this time.

    a) Logged into SQL*Plus as the system user, execute the my_lwt_job.sql script.

```
SQL> @my_lwt_job.sql
SQL> REM For training only
SQL> set echo on
SQL> BEGIN
  2     -- the drop procedure will give and error the first
time
  3     -- this script is run
  4     sys.DBMS_SCHEDULER.DROP_JOB('my_lwt_job');
  5  END;
  6  /
BEGIN
*
```

```
ERROR at line 1:
ORA-27475: "SYSTEM.MY_LWT_JOB" must be a job
ORA-06512: at "SYS.DBMS_ISCHED", line 213
ORA-06512: at "SYS.DBMS_SCHEDULER", line 651
ORA-06512: at line 4


SQL>
SQL> DECLARE
  2      jobname VARCHAR2(30);
  3  BEGIN
  4  -- Create the Job
  5  jobname := 'my_lwt_job';
  6  sys.dbms_scheduler.create_job(
  7      job_name => '"SYSTEM"."MY_LWT_JOB"',
  8      program_name => '"SYSTEM"."PROG_1"',
  9      job_class => '"DEFAULT_JOB_CLASS"',
 10      job_style => 'LIGHTWEIGHT',
 11      repeat_interval => 'FREQ=DAILY;INTERVAL=2',
 12      comments => 'Lightweight job',
 13      enabled => TRUE);
 14  END;
 15  /

PL/SQL procedure successfully completed.

SQL>
```

3) Check the Scheduler metadata views USER_SCHEDULER_JOBS, _PROGRAMS, DBA_JOBS. Select JOB_NAME, JOB_STYLE, and PROGRAM_NAME from USER_SCHEDULER_JOBS.

```
SQL> COL program_name format a12
SQL> SELECT job_name, job_style, program_name FROM
USER_SCHEDULER_JOBS;

JOB_NAME                            JOB_STYLE   PROGRAM_NAME
------------------------------ ----------- ------------
MY_LWT_JOB                          LIGHTWEIGHT PROG_1
```

4) Check the Enterprise Manager Scheduler Jobs page, find the MY_LWT_JOB, and view the attributes.

a) Log into Enterprise Manager as the SYSTEM user with the oracle_4U password.

```
* User Name    system
* Password     ●●●●●●●●●
Connect As     Normal ▾
                        Login
```

b) Navigate to the Scheduler Jobs page. Then click the History tab.

c) View the history of MY_LWT_JOB.

```
All    Running    History

                                                    Purge All Logs

View Job Status   Purge Log   View Job Definition        ⊘ Previous  1-25 of 156  ▾  Next 25 ⊗

                                                            Run Duration
Select  Status  Name          Schema        Completion Date ▽        (minutes)
  ⊙       ✓     MY_LWT_JOB    SYSTEM        Jul 31, 2009 4:02:48 PM +07:00   0.0
```

d) Click the Job Name to view the job attributes.

```
General                        Schedule                  Options
       Name MY_LWT_JOB                Repeat By Days             Raise Events None
     Schema SYSTEM                   Interval
    Enabled TRUE                     (Days)   2                Maximum Run
Description None                     Repeat                     Duration None
                                     Time                       (minutes)
    Logging No logging (OFF)                                        Priority
      Level                        Available Jul 31, 2009      Schedule Limit None
  Job Class DEFAULT_JOB_CLASS       to Start 4:02:48 PM        (minutes)
  Auto Drop TRUE                            Etc/GMT-7           Maximum None
Restartable FALSE                        Not                      Runs
Destination                          Available                 Maximum None
                                       After                   Failures
 Credential                                                   Job Weight None
       Name                                                     Instance TRUE
                                                              Stickiness For use in RAC. If instance_stickiness is set to
                                                                         TRUE, the Oracle Scheduler will attempt to
                                                                         execute the job on the same instance as the
                                                                         previous run
```

e) Click OK.

5) On the Scheduler Jobs, All page, delete the MY_LWT_JOB job

a) Navigate to the Scheduler Jobs, All page, select the MY_LWT_JOB job and click Delete.

Practice 17-2: Creating Lightweight Scheduler Jobs (continued)

| | | All | Running | History | | | | | | |

Select	Name	Schema	Scheduled Date	Last Run Date	Last Run Status	Enabled	Job Class	Previous Runs
○	MGMT_STATS_CONFIG_JOB	ORACLE_OCM	Aug 1, 2009 1:01:01 AM -07:00	Not Scheduled	SCHEDULED	✔	DEFAULT_JOB_CLASS	0
○	MGMT_CONFIG_JOB	ORACLE_OCM	MAINTENANCE_WINDOW_GROUP	Jul 30, 2009 8:00:07 AM -07:00	SCHEDULED	✔	DEFAULT_JOB_CLASS	1
○	RLM$SCHDNEGACTION	EXFSYS	Jul 31, 2009 4:35:03 PM +07:00	Jul 31, 2009 3:37:27 PM +07:00	SCHEDULED	✔	DEFAULT_JOB_CLASS	7
○	RLM$EVTCLEANUP	EXFSYS	Jul 31, 2009 2:11:30 AM -07:00	Jul 31, 2009 1:11:30 AM -07:00	SCHEDULED	✔	DEFAULT_JOB_CLASS	7
◉	MY_LWT_JOB	SYSTEM	Aug 2, 2009 4:02:48 PM +07:00	Jul 31, 2009 4:02:48 PM +07:00	SCHEDULED	✔	DEFAULT_JOB_CLASS	1

(Toolbar: View Job Definition | Edit Job Definition | Delete | Run Now | Create Like)

b) On the Confirmation page, select "Drop the job and any running instance." Click Yes.

Confirmation

Are you sure you want to delete Job SYSTEM.MY_LWT_JOB?

◉ Drop the job and stop any running instance.
○ If there is a running instance of this job, it will not be dropped.

(No) (Yes)

Practice 17-3: Monitoring the Scheduler

Background: Because your job tasks are regularly increasing, you decide to automate routine tasks. You first monitor existing scheduler elements, and then you create scheduler components and test them.

In this practice, use Enterprise Manager Database Control to define and monitor the Scheduler and automate tasks. Click Show SQL regularly to review all statements that are new to you.

Log in as the SYS user (with oracle_4U password, connect as SYSDBA) or as HR user (with oracle_4U password, connect as Normal), as indicated. Perform the necessary tasks either through Enterprise Manager Database Control or through SQL*Plus. All scripts for this practice are in the /home/oracle/labs directory.

1) Log in to Enterprise Manager Database Control as the SYS user with the oracle_4U password, connect as SYSDBA, and check the following roles for the HR user:

- CONNECT role
- RESOURCE role
- DBA role

Because you are going to use the HR user to administer jobs through Database Control, you need to make sure that HR is registered as a possible administrator.

a) In Enterprise Manager, naviaget to Server > Users (in the Security section).

b) On the Users page, select the HR user and click Edit.

c) On the Edit User page, click the Roles tab.

d) If the roles are not yet selected, then click the Edit List button on the right side of the page. On the Modify Roles page, make sure that the DBA, CONNECT, and RESOURCE roles are selected. Click OK, then click Apply.

e) Click the Setup link in the upper-right region of the page.

Practice 17-3: Monitoring the Scheduler (continued)

f) On the Enterprise Manager Configuration page, click the Administrators link.

g) On the Administrators page, click the Create button.

Practice 17-3: Monitoring the Scheduler (continued)

Create Administrator: Properties

                                                 (Cancel) (Review)

        * Name   HR

    E-mail Address

                  Specify one or more e-mail addresses separated by a comma or space. If you are entering these for the first time, they will be used to create a default 24x7 notification schedule for this Administrator.

  Administrator Privilege View on all targets

                         ☑ Grant SELECT_CATALOG_ROLE

h) On the Create Administrators: Properties page, enter HR as Name, ensure that the Grant SELECT_CATALOG_ROLE is selected and click Review.

i) On the Create Administrator HR: Review page, click the Finish button.

You should receive a success message

ORACLE Enterprise Manager 11g
Database Control

Setup Preferences Help Logout

Database

Enterprise Manager Configuration | Management Services and Repository | Agents

Overview of Setup

Administrators

Notification Methods

Patching Setup

Blackouts

Management Pack Access

Monitoring Templates

Corrective Action Library

Confirmation
Administrator HR was created successfully

Administrators
Administrators are database users who can login to Enterprise Manager to perform management tasks like set Blackouts, email notification schedules.

Page Refreshed Jul 31, 2009 4:55:16 PM (Refresh)
GMT+07:00

Search   (Go)

(View) (Edit) (Subscribe to Rules) (Delete) | (Create)

Select	Name	Access
⦿	HR	Administrator
○	SYS	Super Administrator
	SYSMAN	Repository Owner
○	SYSTEM	Super Administrator

j) Click the Logout link at the upper-right corner of the page.

2) Log in to Enterprise Manager Database Control as the HR user. On the Server tabbed page, click the Jobs link in the Database Scheduler region. Are there any jobs?

a) Click the Login button to log in as the HR user.

b) Enter HR as username, `oracle_4U` as password, Connect As `Normal`, and click Login.

c) In Enterprise Manager, navigate to Server > Jobs.

Practice 17-3: Monitoring the Scheduler (continued)

Question: Are there any jobs?

Possible Answer: There are some jobs.

3) Click Programs in the Related Links section.

Question: Are there any existing programs?

Practice 17-3: Monitoring the Scheduler (continued)

Answer: There are some existing programs.

4) Click Schedules in the Related Links section.

Question: Are there any existing schedules?

Answer: There are three schedules: BSLN_MAINTAIN_STATS_SCHED, FILE_WATCHER_SCHEDULE and DAILY_PURGE_SCHEDULE.

5) Click Windows in the Related Links section. Review the Scheduler Windows page in Enterprise Manager. Are there any existing windows? Which resource plan is associated with each window?

Practice 17-3: Monitoring the Scheduler (continued)

Question 1: Are there any existing windows? Are any enabled?

Answer: There are several windows. All are enabled except WEEKNIGHT_WINDOW and WEEKEND_WINDOW.

6) Click the MONDAY_WINDOW link. Answer the questions, then click OK.

```
Database Instance: orcl.example.com  >  Scheduler Windows  >          Logged in As HR
View Window: MONDAY_WINDOW
                                                              Edit    OK
                                                                      OK
        Name MONDAY_WINDOW
Resource Plan DEFAULT_MAINTENANCE_PLAN
     Enabled TRUE
    Priority LOW
 Description Monday window for maintenance tasks

  Schedule

          Repeat By Weeks
  Interval (Weeks) 1
    Days of Week Monday
    Repeat Time Hour:10 Minute:00 Second:00 PM
   Duration (min) 4 hour(s) 0 minute(s)
Available to Start
Not Available After
```

Question 1: At which time does this window open?

Possible Answer: 10 PM

Question 2: For how long does it stay open?

Possible Answer: for 4 hours

7) Click Job Classes in the Related Links section and review them.

Practice 17-3: Monitoring the Scheduler (continued)

Question 1: Are there any existing job classes?

Possible Answer: There are many job classes.

Question 2: Which resource consumer group is associated with the
DEFAULT_JOB_CLASS job class?

Possible Answer: None.

8) On the Scheduler Job classes page, click the ORA$AT_JCURG_OS link.

Question 1: Which resource consumer group is associated with the job class?

Possible Answer: ORA$AT_JCURG_OS is associated with
ORA$AUTOTASK_URGENT_GROUP.

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Practice 17-3: Monitoring the Scheduler (continued)

Question 2: For which task is this job class used?

Possible Answer: For automatic optimizer statistics collection

9) Click OK, and then exit Enterprise Manager.

Background: To prepare for an upcoming merger, you want to set the warning and critical thresholds to a lower value than the default. Ensure that you receive early warnings to give you more time to react. When you finish your test case, drop the tablespace that you used.

Practice 18-1: Managing Storage

Access the `orcl` database as the SYS user (with the `oracle_4U` password, connect as SYSDBA) and perform the necessary tasks through Enterprise Manager Database Control or through SQL*Plus. All scripts for this practice are in the `/home/oracle/labs` directory.

1) Using the DBMS_SERVER_ALERT.SET_THRESHOLD procedure, reset the databasewide threshold values for the Tablespace Space Usage metric. Connect to a SQL*Plus session and execute the following procedure:

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$ cd ~/labs
$ sqlplus / as sysdba
SQL> exec DBMS_SERVER_ALERT.SET_THRESHOLD(-
dbms_server_alert.tablespace_pct_full,-
NULL,NULL,NULL,NULL,1,1,NULL,-
dbms_server_alert.object_type_tablespace,NULL);
> > >
PL/SQL procedure successfully completed.

SQL>
```

2) From your SQL*Plus session, check the databasewide threshold values for the Tablespace Space Usage metric using the following command:

```
SQL> SELECT warning_value,critical_value
FROM   dba_thresholds
WHERE  metrics_name='Tablespace Space Usage'
AND    object_name IS NULL;

WARNING_VALUE
-----------------------------------------------------------------------
CRITICAL_VALUE
-----------------------------------------------------------------------
85
97
```

3) Create a new tablespace called TBSALERT with a 120 MB file called `tbsalert.dbf`. Make sure that this tablespace is locally managed and uses Automatic Segment Space Management. Do *not* make it autoextensible, and do *not* specify any thresholds for this tablespace. Use Enterprise Manager Database Control to create it. If this tablespace already exists in your database, drop it first, including its files.

   a) Logged into Enterprise Manager as the SYS user, navigate to Server > Tablespaces.

Practice 18-1: Managing Storage (continued)

b). Click the Create button.

c) Enter TBSALERT as the name, and click the Add button in the Datafiles region.

d) Enter or confirm the following values, then click Continue

Name	Value
Storage Type	Automatic Storage Management
Disk Group	DATA
Template	DATAFILE
Alias name	tbsalert
File Size	120 MB
Reuse Existing File	TRUE
AUTOEXTEND	FALSE

Practice 18-1: Managing Storage (continued)

e)   Click Continue

f)   On the Crate tablespace page, click Show SQL.

g)   Review the SQL and then click Return.

Practice 18-1: Managing Storage (continued)

h) Click OK to create the tablespace. You should receive a success message.

Select	Name △	Allocated Size(MB)	Space Used(MB)	Allocated Space Used(%)	Auto Extend	Allocated Free Space(MB)	Status	Datafiles	Type	Extent Management	Segment Management
●	EXAMPLE	100.0	78.8		78.8 YES	21.2	✔	1	PERMANENT	LOCAL	AUTO
○	SYSAUX	590.0	556.6		94.3 YES	33.4	✔	1	PERMANENT	LOCAL	AUTO
○	SYSTEM	680.0	675.6		99.3 YES	4.4	✔	1	PERMANENT	LOCAL	MANUAL
○	TBSALERT	120.0	1.0		0.8 NO	119.0	✔	1	PERMANENT	LOCAL	AUTO
○	TEMP	28.0	0.0		0.0 YES	28.0	✔	1	TEMPORARY	LOCAL	MANUAL
○	UNDOTBS1	105.0	8.6		8.2 YES	96.4	✔	1	UNDO	LOCAL	MANUAL
○	USERS	7.5	4.1		54.2 YES	3.4	✔	1	PERMANENT	LOCAL	AUTO

4) In Enterprise Manager, change the Tablespace Space Usage thresholds of the TBSALERT tablespace. Set its warning level to 55 percent and its critical level to 70 percent.

a) On the Tablespaces page, select TBSALERT, click Edit, and then click Thresholds.

Practice 18-1: Managing Storage (continued)

b) Select Specify Thresholds, and enter 55 as Warning (%) and 70 as Critical (%) under the Space Used section. Then click Show SQL.

```
Database Instance: orcl.example.com  >  Tablespaces  >  Edit Tablespace: TBSALERT  >          Logged in As SYS
Show SQL
                                                                                        Return
BEGIN DBMS_SERVER_ALERT.SET_THRESHOLD(9000,4,'55',4,'70',1,1,NULL,5,'TBSALERT'); END;
```

c) Review the statement and click Return.

d) On the Edit Tablespace: TBSALERT, click Apply to modify the threshold values.

You should receive a success message.

5) Return to your SQL*Plus session and check the new threshold values for the TBSALERT tablespace. In your SQL*Plus session, enter:

```
SQL> select warning_value,critical_value
from dba_thresholds
where metrics_name='Tablespace Space Usage' and
object_name='TBSALERT';

WARNING_VALUE
----------------------------------------------------------------
CRITICAL_VALUE
----------------------------------------------------------------
55
70
```

6) In your SQL*Plus session, query the reason and resolution columns from DBA_ALERT_HISTORY for the TBSALERT tablespace.

```
SQL> select reason,resolution
from dba_alert_history
where object_name='TBSALERT';
```

The result should be (if you are repeating this practice, look at the last row):

```
REASON
RESOLUT
----------------------------------------------------------  ----
---
Threshold is updated on metrics "Tablespace Space Usage"
cleared
SQL> exit
$
```

Practice 18-1: Managing Storage (continued)

7) From the `labs` directory, review and execute the `seg_advsr_setup.sh` script that creates and populates new tables in the TBSALERT tablespace.

```
$ cd ~/labs
$ cat seg_advsr_setup.sh

#!/bin/sh
# For training only, execute as oracle OS user

sqlplus /nolog <<EOF
connect / as sysdba
alter system set disk_asynch_io = FALSE scope = spfile;
shutdown immediate;
startup
set echo on
create table employees1 tablespace tbsalert as select * from
hr.employees;
create table employees2 tablespace tbsalert as select * from
hr.employees;
create table employees3 tablespace tbsalert as select * from
hr.employees;
create table employees4 tablespace tbsalert as select * from
hr.employees;
create table employees5 tablespace tbsalert as select * from
hr.employees;

alter table employees1 enable row movement;
alter table employees2 enable row movement;
alter table employees3 enable row movement;
alter table employees4 enable row movement;
alter table employees5 enable row movement;

BEGIN
FOR i in 1..10 LOOP
    insert into employees1 select * from employees1;
    insert into employees2 select * from employees2;
    insert into employees3 select * from employees3;
    insert into employees4 select * from employees4;
    insert into employees5 select * from employees5;
    commit;
 END LOOP;
END;
/
insert into employees1 select * from employees1;
insert into employees2 select * from employees2;
insert into employees3 select * from employees3;
commit;
exit
EOF
$
```

```
$ ./seg_advsr_setup.sh

SQL> Connected.
SQL>
System altered.
```

Practice 18-1: Managing Storage (continued)

```
SQL> Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337324 bytes
Variable Size             385878036 bytes
Database Buffers           88080384 bytes
Redo Buffers                5963776 bytes
Database mounted.
Database opened.
SQL> SQL>
Table created.
SQL>
Table created.
SQL>
Table created.
SQL>
Table created.
SQL>
Table created.
SQL> SQL>
Table altered.
SQL>
Table altered.
SQL>
Table altered.
SQL>
Table altered.
SQL>
Table altered.
SQL> SQL>    2    3    4    5    6    7    8    9   10   11
PL/SQL procedure successfully completed.
SQL>
109568 rows created.
SQL>
109568 rows created.
SQL>
109568 rows created.
SQL>
Commit complete.
SQL>
```

8) Check the fullness level of the TBSALERT tablespace by using Database Control or SQL*Plus. The current level should be around 60%. Wait a few minutes and check that the warning level is reached for the TBSALERT tablespace. (*If you are too fast and receive erros, just use your browser's Refresh button, or select your destintion again.*)

a) Logged into SQL*Plus as the SYS user, enter:

```
$ sqlplus / as sysdba
```

Practice 18-1: Managing Storage (continued)

```
SQL> select sum(bytes) *100 /125829120
        from dba_extents
        where tablespace_name='TBSALERT';


SUM(BYTES)*100/125829120
------------------------
                      60
SQL>
```

b) Enter the following query. Your results should be similar to the following:

```
SQL> select reason
from dba_outstanding_alerts
where object_name='TBSALERT';


REASON
----------------------------------------------------------------
Tablespace [TBSALERT] is [60 percent] full
SQL>
```

Note: If your result is: no rows selected, wait a little longer and repeat the query.

c) In Enterprise Manager on the Tablespaces page, see Used (%).

Select	Name △	Allocated Size(MB)	Space Used(MB)	Allocated Space Used(%)		Auto Extend	Allocated Free Space(MB)	Status
⦿	EXAMPLE	100.0	78.8		78.8	YES	21.2	✓
○	SYSAUX	590.0	556.6		94.3	YES	33.4	✓
○	SYSTEM	680.0	675.6		99.3	YES	4.4	✓
○	TBSALERT	120.0	73.0		60.8	NO	47.0	✓

d) Navigate to the Database home page. You should see the new alert in the Space Summary section. It might take several minutes for the alert to appear.

Space Summary

Database Size (GB)		1.465
Problem Tablespaces	⚠	1
Segment Advisor Recommendations		0
Policy Violations	✓	0
Dump Area Used (%)		87

9) In your SQL*Plus session, execute the inserts below to add more data to TBSALERT. Wait a few moments and view the critical level in both the database and Database Control. Verify that TBSALERT fullness is around 75%.

a) Execute the following commands:

Practice 18-1: Managing Storage (continued)

```
SQL> insert into employees4 select * from employees4;
109568 rows created.
SQL> commit;
SQL> insert into employees5 select * from employees5;
109568 rows created.
SQL> commit;
SQL>
```

b) Wait a few minutes and view the critical level in both the database and Database Control. Verify that TBSALERT fullness is around 75%. In SQL*Plus, enter:

```
SQL> select sum(bytes) *100 /125829120
from dba_extents
where tablespace_name='TBSALERT';

SUM(BYTES)*100/125829120
------------------------
                      75
```

c) Check the outstanding alrets. You may need to wait a few minutes.

```
SQL> select reason, message_level
from dba_outstanding_alerts
where object_name='TBSALERT';

REASON                                             MESSAGE_LEVEL
-------------------------------------------------- -------------

Tablespace [TBSALERT] is [75 percent] full              1
```

d) In Enterprise Manager,navigate to Server > Tablespaces page, amd review Used (%).

Select	Name △	Allocated Size(MB)	Space Used(MB)	Allocated Space Used(%)		Auto Extend	Allocated Free Space(MB)	Status
⦿	EXAMPLE	100.0	78.8		78.8	YES	21.2	✔
○	SYSAUX	590.0	558.4		94.6	YES	31.6	✔
○	SYSTEM	680.0	675.6		99.4	YES	4.4	✔
○	TBSALERT	120.0	91.0		75.8	NO	29.0	✔

e) Navigate to the Database home page. You should see the new alert in the Space Summary region. It will take several minutes for the change in status to take effect. Note the red flag instead of the yellow one.

Practice 18-1: Managing Storage (continued)

10) In your SQL*Plus session, execute the following delete statements to delete rows from tables in TBSALERT. These statements will take several minutes to complete. Then exit your SQL*Plus session.

```
SQL> delete employees1;
219136 rows deleted.
SQL> commit;
Commit complete.
SQL> delete employees2;
219136 rows deleted.
SQL> commit;
Commit complete.
SQL> delete employees3;
219136 rows deleted
SQL> commit;
Commit complete.
SQL> exit
$
```

11) Now, run the Segment Advisor for the TBSALERT tablespace in Enterprise Manager. Make sure that you run the Advisor in Comprehensive mode without time limitation. Accept and implement its recommendations. After the recommendations have been implemented, check whether the fullness level of TBSALERT is below 55%.

   a) From the Database home page, select Advisor Central under Related Links and then click Segment Advisor.

Practice 18-1: Managing Storage (continued)

b) On the Segment Advisor: Scope page, select Tablespaces and click Next.

c) On the Segment Advisor: Objects page, click Add, select TBSALERT. Click OK and then click Show Advanced Options.

d) In the Options section, click Limited and enter **30** for Time Limit (mins)

e) Then click Next.

Practice 18-1: Managing Storage (continued)

f) On the Segment Advisor: Schedule page, make sure Immediately is selected. Select your proper timezone and click Next.

g) On the Segment Advisor: Review page, click Show SQL.

```
Create task and objects script
DECLARE

taskname varchar2(100);
taskdesc varchar2(128);
task_id number;
object_id number;
timeLimit varchar2(25);
numDaysToRetain varchar2(25);
objectName varchar2(100);
objectType varchar2(100);


BEGIN
taskname := 'SEGMENTADV_5033431';
taskdesc :='Get shrink advice based on object growth trend';
numDaysToRetain :='30';
dbms_advisor.create_task('Segment Advisor',?,taskname,taskdesc
,NULL);
dbms_advisor.create_object(taskname, 'TABLESPACE', 'TBSALERT',
' ', ' ', NULL, object_id);
dbms_advisor.set_task_parameter(taskname, 'RECOMMEND_ALL',
'TRUE');
timeLimit :='1800';
dbms_advisor.set_task_parameter(taskname, 'TIME_LIMIT',
timeLimit);
```

Practice 18-1: Managing Storage (continued)

```
dbms_advisor.set_task_parameter(taskname, 'DAYS_TO_EXPIRE',
numDaysToRetain);
END;

Execute task script
DECLARE
taskname varchar2(100);
BEGIN
taskname := 'SEGMENTADV_5033431';
dbms_advisor.reset_task(taskname);
dbms_advisor.execute_task(taskname);
END;
```

h) Review the statements and click Return.

i) Back on the Segment Advisor: review page, the Submit button.

j) This takes you back to the Advisor Central page. Click the SEGMENTADV_*xxxxx*
   link in the Name column.

k) On the Segment Advisor Task page, click the Recommendation Details button .

Practice 18-1: Managing Storage (continued)

l) If needed, click your browser's Refresh button until you see recommendations for the TBSALERT tablespace.

m) Click Recommendation Details.

Recommendation Details for Tablespace: TBSALERT

View **All Recommendations**

Oracle uses the Automatic Segment Advisor job to detect segment issues regularly within maintenance windows. The following table contains the reclaimable space information for the evaluated segments in the selected tablespace. The recommendations come from the most recent runs of automatic and user-scheduled segment advisor jobs. Oracle recommends shrinking, reorganizing or compressing these segments to release unused space. Select the segment to implement the recommendation.

Schema [   ]   Recommendation [All Types ▼]
Segment [   ]   Minimum
Partition [   ]   Reclaimable
                             Space (MB) [   ]
                                              (Search)

(Shrink) (Reorganize) (Compress)

Select All | Select None

Select	Schema	Segment	Recommendation	Reclaimable Space (MB) ▽	Allocated Space (MB)	Used Space (MB)	Segment Type
☑	SYS	EMPLOYEES1	(Shrink)	15.57	18.00	2.43	TABLE
☑	SYS	EMPLOYEES2	(Shrink)	15.57	18.00	2.43	TABLE
☑	SYS	EMPLOYEES3	(Shrink)	15.57	18.00	2.43	TABLE

n) Click the Select All link and then click the Shrink button.

Shrink Segment: Options

The shrink operation compacts fragmented space and, optionally, frees the space. The shrink operation will take some time and will be scheduled as a job.   (Show SQL) (Cancel) (Implement)

⦿ Compact Segments and Release Space
This will first compact the segments and then release the recovered space to the tablespace. During the short space release phase, any cursors referencing this segment may be invalidated and queries on the segment could be affected.

○ Compact Segments
Compacting will compact segment data without releasing the recovered space. After compacting the data, the recovered space can be quickly released by running Compact Segments and Release Space.

o) On the Shrink Segment: Options page, make sure that you click the "Compact Segments and Release Space" option button. Click Show SQL.

```
alter table "SYS"."EMPLOYEES1" shrink space
alter table "SYS"."EMPLOYEES2" shrink space
alter table "SYS"."EMPLOYEES3" shrink space
```

p) Review the statements and click Return.

Practice 18-1: Managing Storage (continued)

Shrink Segment: Options

The shrink operation compacts fragmented space and, optionally, frees the space. The shrink operation will take some time and will be scheduled as a job.

[Show SQL] [Cancel] [Implement]

⦿ Compact Segments and Release Space
This will first compact the segments and then release the recovered space to the tablespace. During the short space release phase, any cursors referencing this segment may be invalidated and queries on the segment could be affected.

○ Compact Segments
Compacting will compact segment data without releasing the recovered space. After compacting the data, the recovered space can be quickly released by running Compact Segments and Release Space.

q) On the Shrink Segment: Options page, click Implement.

Shrink Segment: Schedule

[Cancel] [Submit]

☑ **TIP** This operation may be resource-intensive and should be scheduled during off-peak hours.

Job Information

* Job Name   SQLSCRIPT_3083233
Job Description

Schedule

Schedule Type Standard

Time Zone Etc/GMT-7

Repeating

Repeat Do Not Repeat

Start

⦿ Immediately

r) On the Shrink Segment: Schedule page, click the Submit button.

| All | **Running** | History |

[View Job Status] [Stop Run] [View Job Definition] [Edit Job Definition] [Delete]

Select	Status	Name	Schema	Start Date	Elapsed Time (seconds)	CPU Used (seconds)	Session ID	Resource Consumer Group	Previous Runs
⦿	🔧	SQLSCRIPT_3083233	SYS	Jul 31, 2009 10:36:37 PM +07:00	2.45	.04	58	SYS_GROUP	0

s) On the Scheduler Jobs page, click the *SQLSCRIPT_nnn* link.

Practice 18-1: Managing Storage (continued)

General	Schedule	Options
Name SQLSCRIPT_3083233	Repeat **Do Not Repeat**	Raise Events **None**
Schema <u>SYS</u>	Start Date **Jul 31, 2009 10:36:37 PM Etc/GMT-7**	Maximum Run Duration (minutes) **None**
Enabled **FALSE**		Priority **Medium**
Description **None**		Schedule Limit (minutes) **None**
Logging Level **Log job runs only (RUNS)**		Maximum Runs **None**
Job Class <u>DEFAULT_JOB_CLASS</u>		Maximum Failures **None**
Auto Drop **FALSE**		Job Weight **1**
Restartable **FALSE**		Instance Stickiness **TRUE** For use in RAC. If instance_stickiness is set to TRUE, the Oracle Scheduler will attempt to execute the job on the same instance as the previous run
Destination		
Credential Name		

Command

Command Type **PL/SQL Block**
PL/SQL

```
    begin
    EXECUTE IMMEDIATE 'alter table "SYS"."EMPLOYEES1" shrink space';
    EXECUTE IMMEDIATE 'alter table "SYS"."EMPLOYEES2" shrink space';
    EXECUTE IMMEDIATE 'alter table "SYS"."EMPLOYEES3" shrink space';
    end;
```

Operation Detail

[View]

Select	Log ID	Log Date ▽	Operation	Status
⊙	340	Jul 31, 2009 10:36:47 PM +07:00	RUN	SUCCEEDED

t) On the View Job page, scroll to the bottom of the page. Under Operation Detail, you should see that the job succeeded. (If it's still running, use your browser's Refresh button). Then click OK.

12) Wait a few minutes and check that there are no longer any outstanding alerts for the TBSALERT tablespace. Then navigate to the Database home page. You should see Problem Tablespaces: 0.

Space Summary

Database Size (GB)	<u>1.415</u>
Problem Tablespaces	**0**
Segment Advisor Recommendations	⚠ <u>3</u>
Space Violations	✓ <u>0</u>
Dump Area Used (%)	<u>72</u>

13) Retrieve the history of the TBSALERT Tablespace Space Usage metric for the last 24 hours.

a) On the Database home page, select All Metrics in the Related Links region.

Practice 18-1: Managing Storage (continued)

▼Tablespaces Full	Some	Server Generated
Tablespace Free Space (MB)	Not Set	
Tablespace Space Used (%)	Set	

b) Expand the Tablespaces Full category, and click the Tablespace Space Used (%) link.

Tablespace Space Used (%)

Page Refreshed **Jul 31, 2009 10:46:09 PM GMT+07:00**

View Data Real Time: Manual Refresh ▼

Tablespace Name △	Current Value
EXAMPLE	0.24
SYSAUX	1.71
SYSTEM	2.06
TBSALERT	30.99
TEMP	0
UNDOTBS1	0.03
USERS	0.01

c) Make sure that you select Real Time: Manual Refresh from the View Data drop-down list. Then click the TBSALERT link.

d) This takes you to the Tablespace Space Used (%): Tablespace Name TBSALERT page. Select "Last 24 hours" from the View Data drop-down list.

Alert History

Comment for Most Recent Alert

Severity	Timestamp ▽	Message
✔	Jul 31, 2009 10:44:20 PM	Tablespace TBSALERT is 30 percent full
✖	Jul 31, 2009 10:04:17 PM	Tablespace TBSALERT is 75 percent full
✔	Jul 31, 2009 9:49:29 PM	Tablespace TBSALERT is 0 percent full

e) View entries in the Alert History.

14) Reset the databasewide default thresholds from the Tablespace Space Usage metric for

a) On the Tablespace Space Used (%): Tablespace Name TBSALERT page, click the Edit Tablespace link in the related Links section.

b) This opens the Edit Tablespace: TBSALERT page. Click the Thresholds tab.

c) Click Use Database Default Thresholds option in the Space Used (%) section. Then click Show SQL.

Practice 18-1: Managing Storage (continued)

```
Show SQL
                                                                    [Return]
BEGIN DBMS_SERVER_ALERT.SET_THRESHOLD(9000,NULL,NULL,NULL,NULL,1,1,NULL,5,'TBSALERT');
END;
```

d) Review the statement and click return.

e) On the Edit Tablespace: TBSALERT, Thresholds page, click the Apply button.
   You should receive a success message.

15) **Note: This is your mandatory cleanup step**. Because you have finished with your
    test case, view and execute the seg_advsr_cleanup.sh script from the labs
    directory to drop your TBSALERT tablespace.

```
$ cat seg_advsr_cleanup.sh
#!/bin/sh
# For training only, execute as oracle OS user

sqlplus /nolog <<EOF
connect / as sysdba
alter system set disk_asynch_io = TRUE scope = spfile;
shutdown immediate;
startup
drop tablespace tbsalert including contents and datafiles;
exit
EOF
$
```

```
$ ./seg_advsr_cleanup.sh
SQL> Connected.
SQL>
System altered.

SQL> Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337324 bytes
Variable Size             385878036 bytes
Database Buffers           88080384 bytes
Redo Buffers                5963776 bytes
Database mounted.
Database opened.
SQL>
Tablespace dropped.

SQL>
$
```

Physical disks with 4 KB-sectors are now available. Although this largely concerns only the operating system, the Oracle server is aware of them and uses them automatically when you create new databases.

However, as a DBA you might have databases, which were created on 512-bytes disks. In this practice, you learn about how to perform an offline migration from 512-bytes disks to 4 KB-sector disks.

Practice 19-1: Managing Space for the Database

In this practice, you view a demonstration of using 4 KB-sector disks. The focus is on performing an offline migration of redo log groups form 512-bytes to 4 KB-sector disks.

1) Click the `oracle's Home` icon on your desktop.

2) Navigate to the `/home/oracle/demos/4kb_disks` directory.

3) Double-click the `4kb_disks_viewlet_swf.html` file.

4) In the Run or Display window, click Display and view the presentation.

5) Use the controls at the bottom of the viewlet window to start, pause and stop the presentation, as suits your personal learning style.

6) Uninterrupted viewing of the demos takes about ten minutes. When you have finished viewing the presentation, close your Web browser window.

Background: You are responsible for an active database that cannot be shut down. It is running in ARCHIVELOG mode. Now you are requested to duplicate this database, for testing purposes.

To setup a working environment for your duplicated database, you:

- Add two disks to your DATA disk group.
- Ensure that the orcl source database is in ARCHIVELOG mode with a 7 GB fast recovery area.
- Set up dbtest as the net service name for your planned dbtest database.
- Use Oracle Net Manager to configure the LISTENER with the dbtest and orcl database services.
- Clone a database by using RMAN. Start the duplication process in Enterprise Manager.
- Test access

Practice 20-1: Duplicating a Database

In this practice, you clone a database and use additional utilities to setup a working environment. To simulate this environment, assume that your active database is orcl (which is stored in ASM).

1) Before you start cloning your database, add the last two ASM disks to the DATA disk group.

   a) From a graphical terminal window, connected as user oracle, set up your environment to use the +ASM instance, and execute asmca.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$
$ asmca
```

   b) On the Configure ASM: Disk Groups subpage, select DATA disk group.

   c) Right click.
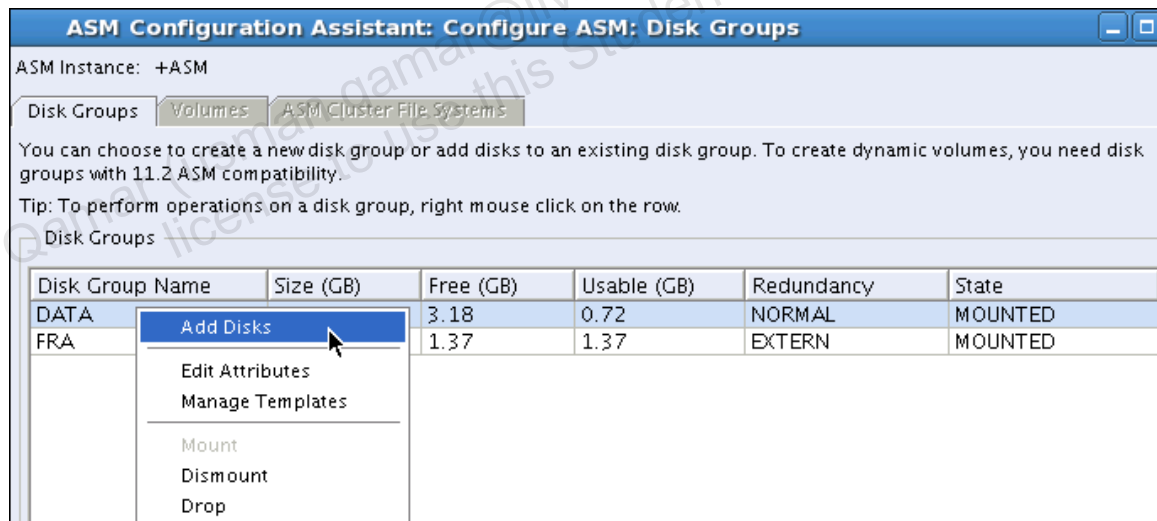
   d) Select Add disks.

   e) On the Add Disks page, select both ORCl:ASMDISK12 and ORCL:ASMDISK13.

   f) Click OK.

Practice 20-1: Duplicating a Database (continued)

g) On the information window that appears, click OK.

h) Back to the Configure ASM: Disk Groups subpage, click Exit.

i) On the ASM Configuration Assistant window, click Yes.

2) Check the ASM activities and wait until the rebalance operation is finished:

a) Log in to Enterprise Manager as user `SYS`.

b) On the Home page, click the +ASM link in the General section.

c) On the ASM Home page, click the Disk Groups tab.

d) You may have to log in to the ASM instance if you have not previously done it and saved credentials:

- On the Automatic Storage Management Login page, enter `SYS` in the Username field, `oracle_4U` in the Password field, and `SYSASM` in the Connect As field.

- Select Save as Preferred Credential. Then click Login.

e) On the Disk Groups sub page, click the DATA link.

f) On the Disk Group: DATA page, click at the Pending Operations field in the General section.

g) Click Refresh and **Wait until the rebalance operation is finished.**

h) Then click the database tab.

3) To ensure that you are pointing to the `orcl` database and that this database is in `ARCHIVELOG` mode with a 7 GB fast recovery area, execute the `rman_archivelog.sh` script from a terminal window in your working directory.

```
$ . oraenv
ORACLE_SID = [+ASM] ? orcl
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/dbhome_1 is
/u01/app/oracle
```

Practice 20-1: Duplicating a Database (continued)

```
$ ./rman_archivelog.sh
******************************************
For demo purposes ONLY:
  * Enable ARCHIVELOG mode for database

The script may appear to hang at the SQL prompt
when the database is shutting down and being
opened. Wait a few minutes and it should progress.
******************************************


SQL> SQL>
System altered.

SQL> SQL> Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> ORACLE instance started.

Total System Global Area  481259520 bytes
Fixed Size                  1337324 bytes
Variable Size             394266644 bytes
Database Buffers           79691776 bytes
Redo Buffers                5963776 bytes
Database mounted.
SQL>
Database altered.

SQL>
Database altered.

SQL> Database log mode              Archive Mode
Automatic archival              Enabled
Archive destination             USE_DB_RECOVERY_FILE_DEST
Oldest online log sequence      15
Next log sequence to archive    17
Current log sequence            17
SQL>
$
```

4) Set up dbtest as the net service name for your planned dbtest database.

a) In a graphical terminal window as the oracle user, set up your environment to point to your orcl instance and invoke the netca utility.

```
$ . oraenv
ORACLE_SID = [orcl] ? orcl
$ netca
```

The Oracle Net Configuration Assistant (NETCA) opens a window.

b) On the Welcome page, select "Local Net Service Name configuration," and click Next.

c) On the Net Service Name Configuration page, select Add and click Next.

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Practice 20-1: Duplicating a Database (continued)

    d) In the Service Name field, enter `dbtest` and click Next.

    e) On the Net Service Name Configuration, Select Protocols page, select TCP and click Next.
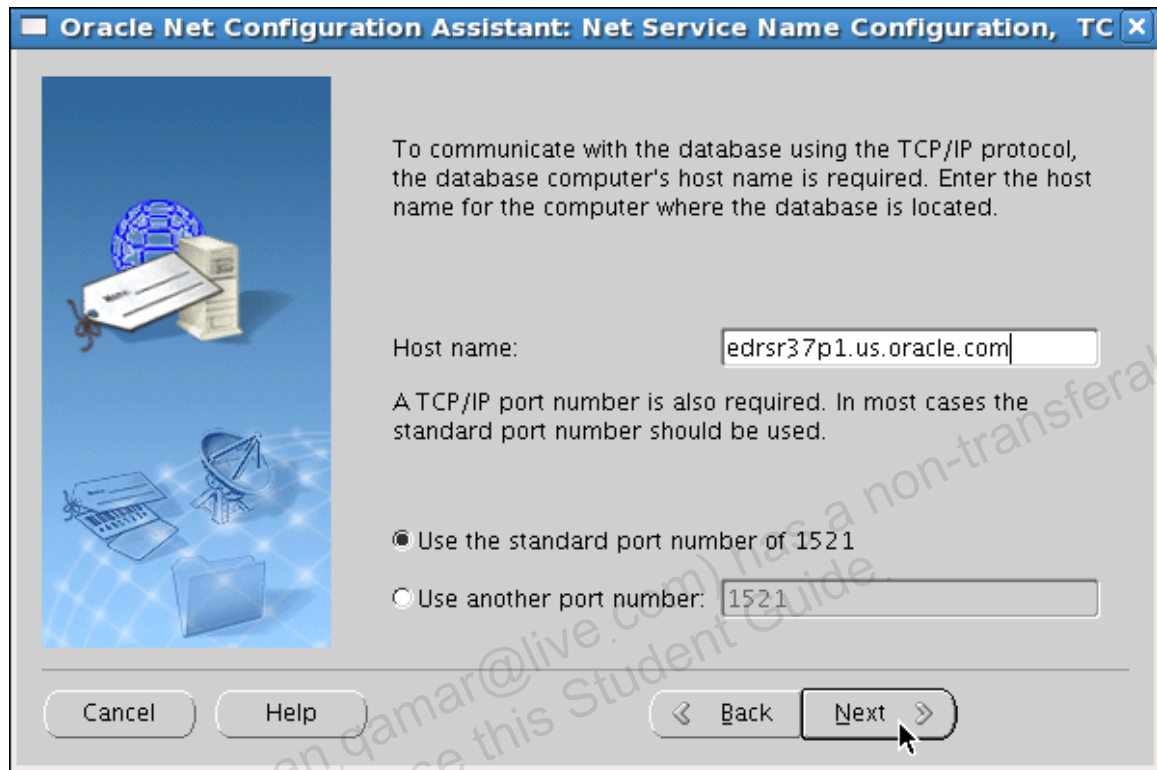
    f) On the Net Service Name Configuration, TCP/IP Protocol page, enter **your** host name, for example, `edrsr37p1.us.oracle.com`, select "Use the standard port number of 1521," and then click Next.

    g) On the Net Service Name Configuration, Test page, select "No, do not test" (because your `dbtest` database does not yet exist) and click Next.

    h) On the Net Service Name Configuration, Net Service Name page, enter `dbtest` as Net Service Name, and then click Next.

    i) Click No in answer to the question "Would you like to configure another net service name?" and then click Next.

    j) When you see the completion message, click Next again.

    k) Finally, click Finish.

5) Use Oracle Net Manager to configure the `LISTENER` with the `dbtest` and `orcl` database services.

    a) In a graphical terminal window as the `oracle` user, set up your environment to point to your `+ASM` instance and invoke the `netmgr` utility.

```
$ . oraenv
ORACLE_SID = [orcl] ? +ASM
```

Practice 20-1: Duplicating a Database (continued)

```
The Oracle base for
ORACLE_HOME=/u01/app/oracle/product/11.2.0/grid is
/u01/app/oracle
$ netmgr
```

b) The Oracle Net Manager opens a window. Click the "+" icon, right before the word "Local," then click the "+" icon, right before the word "Listeners" to expand the nodes in the navigation tree until you see the listener, called "LISTENER."
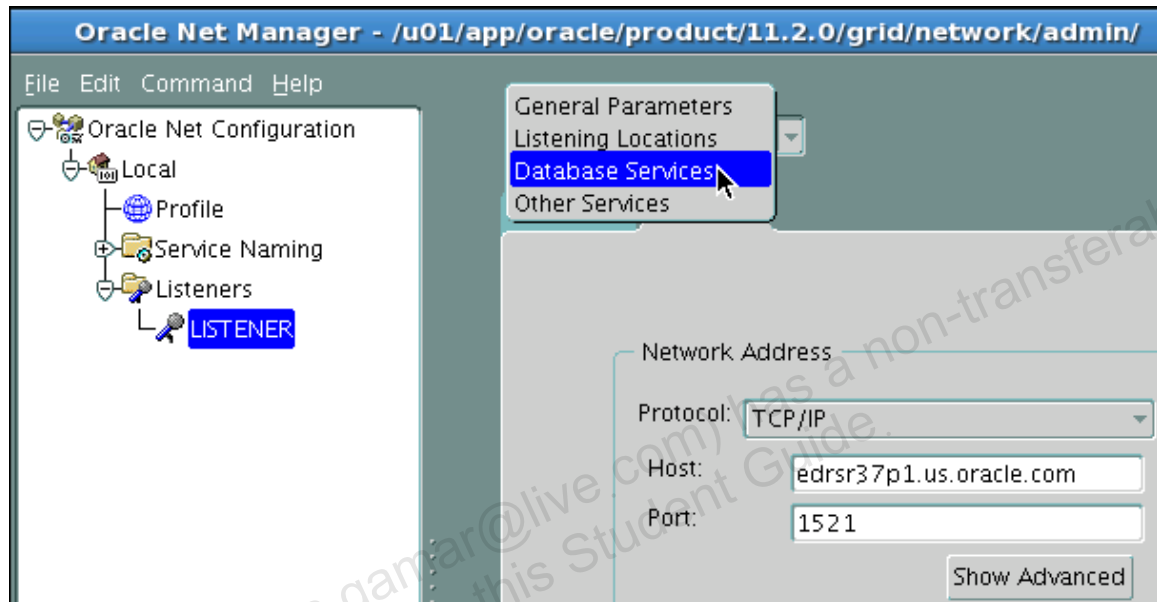
c) First select LISTENER in the left part of the window then, select Database Services from the drop-down in the right part of the window.

d) Click the Add Database button.

Practice 20-1: Duplicating a Database (continued)
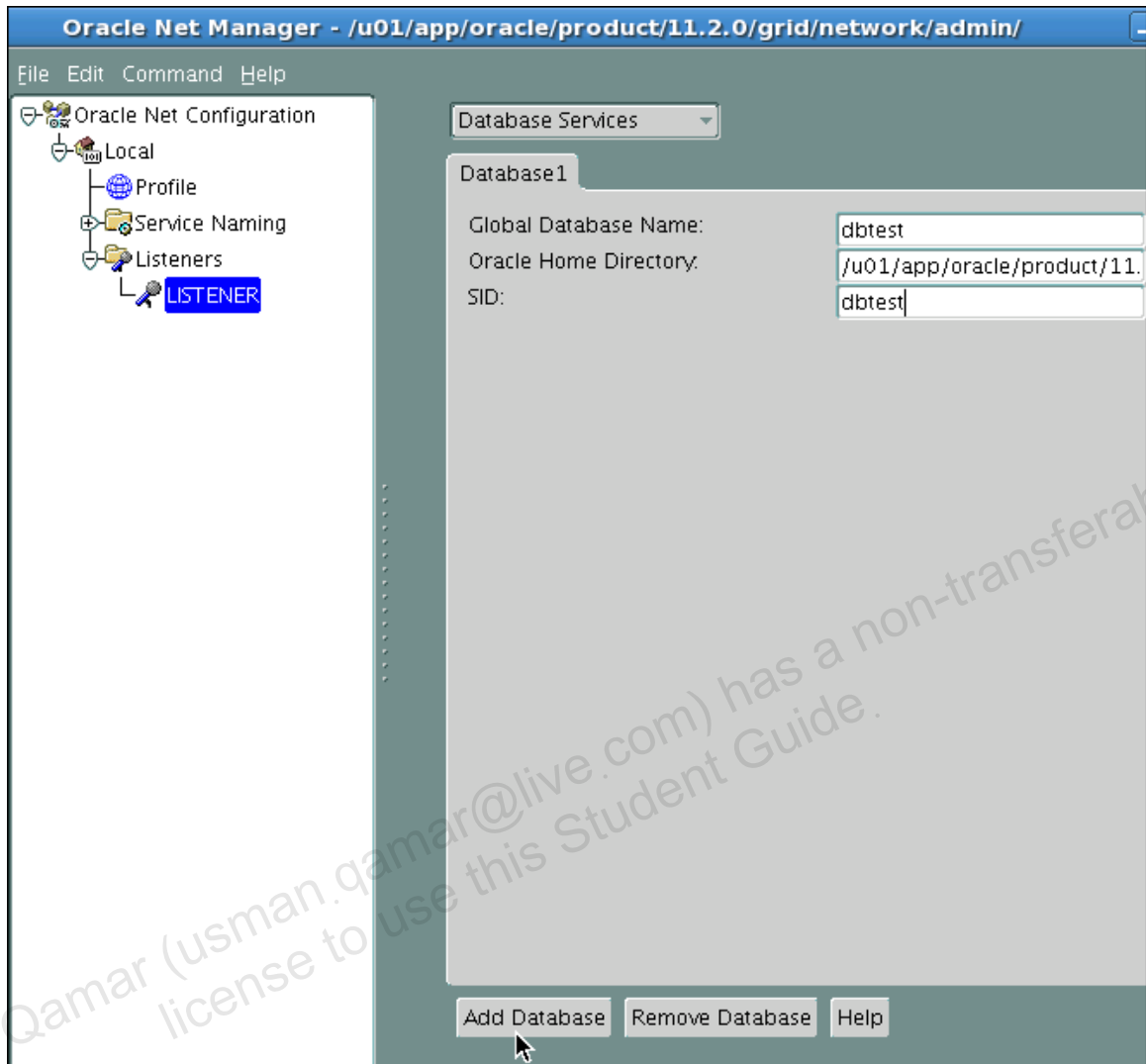
e) Enter or confirm the following values:
    Global Database Name: `dbtest`
    Oracle Home Directory: `/u01/app/oracle/product/11.2.0/grid/`
    SID: `dbtest`

f) Click the Add Database button again.

g) Enter the following values:
    Global Database Name: `orcl`
    Oracle Home Directory: `/u01/app/oracle/product/11.2.0/grid/`
    SID: `orcl`

Practice 20-1: Duplicating a Database (continued)
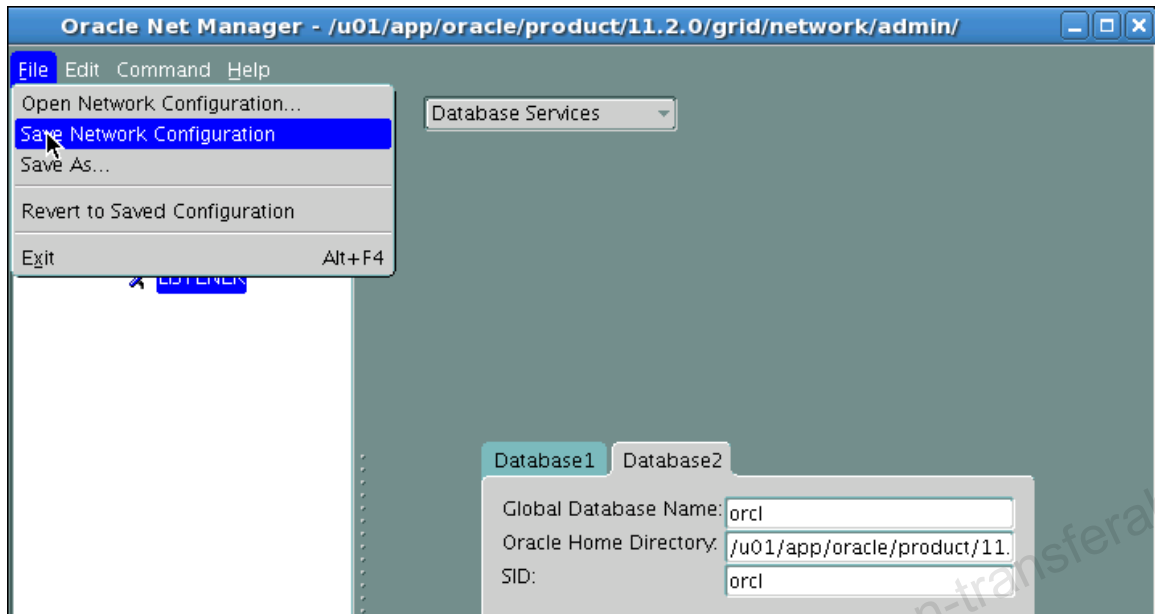
h) From the Oracle Net Manager menu bar, select File > Save Network
Configuration, then File > Exit.

6) Clone a database by using RMAN. Start the duplication process in Enterprise
Manager.

a) Log in to Enterprise Manager as the SYS user with the oracle_4U password and
connect as SYSDBA.

b) Navigate to Data Movement > Clone Database (in the Move Database Files
section).
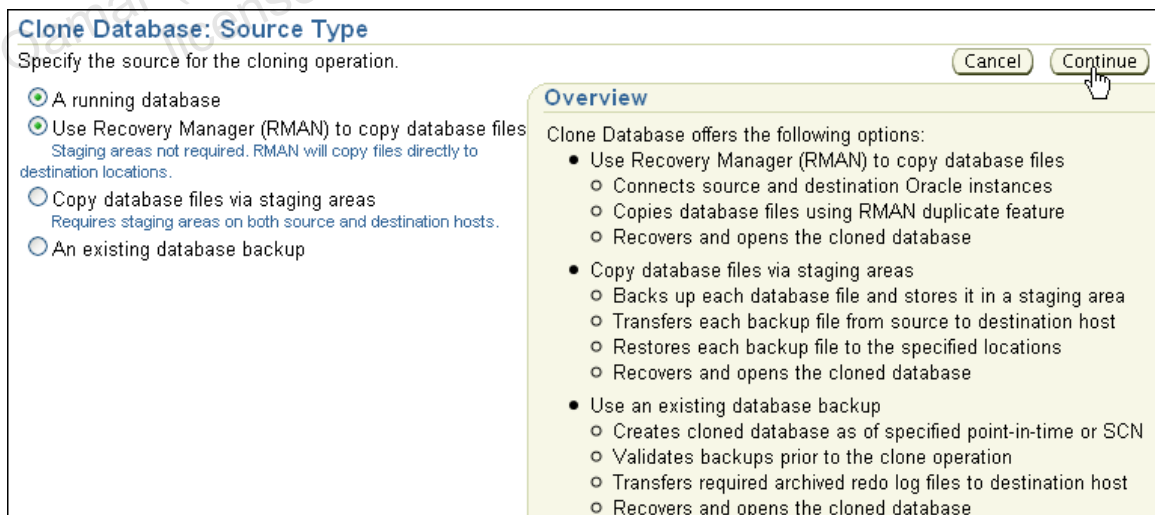
c) On the Clone Database: Source Type page, select "A running database" and "Use
Recovery Manager (RMAN) to copy database files" and then click Continue.

Practice 20-1: Duplicating a Database (continued)

d) On the Clone Database: Source Options page, enter or confirm `oracle` as the username and password, click "Save as Preferred Credential," and then click Next.

e) On the Clone Database: Select Destination page, enter `dbtest` both as Global Database Name and as Instance Name, and select Automatic Storage Management (ASM) from the Database Storage drop down list. Then click Next.

f) If the Clone Database: ASM Instance Login page appears, enter `oracle_4U` as `SYS` password, and click Login.

Practice 20-1: Duplicating a Database (continued)

g) On the Clone Database: Destination Options page, enter or confirm DATA as Database Area, FRA as the Flash Recovery Area, and enter 2000 as the Flash Recovery Area Size. Then click Next.

h) You receive a warming that the FRA is smaller then twice the database size. Because you plan to rarely use the FRA of this test database, click Yes to continue.

i) On the Clone Database: Database Configuration page:

- Select "Configure Enterprise Manager Database Control for this database",

- Confirm
  /u01/app/oracle/product/11.2.0/dbhome_1/network/admin as
  the Configuration File Location.

- Enter or confirm /u01/app/oracle/product/11.2.0/dbhome_1 in the
  Listener Oracle Home field.

- Enter oracle_4U six times in all password fields, and enter 5505 as HTTP
  port.

- Click Next.

j) If you receive a warning, that the sqlnet.ora file or the listener.ora file
  do not exist, accept the warning by clicking Yes.

Practice 20-1: Duplicating a Database (continued)

k) On the Clone Database: Schedule page, ensure that the job starts immediately and click Next.

l)   On the Clone Database: Review page, review the Details, including the Database Storage and click Submit Job.

m) Wait on the "Clone Database job is being submitted" page.

n)   The Clone Database: Confirmation page should display a success message. Click the View Status to transfer to the Job Activity page.

o)   This takes you to the Execution page. Occasionally, click your browser's reload button, to display the job progress until you receive a success message. (The execution time for your job depends on your hardware and available system resources.)

Practice 20-1: Duplicating a Database (continued)

```
Summary
          Status  Succeeded
       Scheduled  Aug 2, 2009 6:53:22 PM (UTC+07:00)
         Started  Aug 2, 2009 6:53:22 PM (UTC+07:00)
           Ended  Aug 2, 2009 7:52:29 PM (UTC+07:00)
    Elapsed Time  3546 seconds
    Notification  No
```

p) Scroll to the bottom of the page to see the executed steps. Some of the executed steps have output logs, for example:

- Source Preparation shows the initialization parameters of the source database.

- Destination Preparation shows `dbtest` listener and service information.

- Duplicate database contains RMAN operations.

- Recover Database shows restarting of the `dbtest` database.

- Add Temporary Files also shows output from Enterprise Manager configuration.

- Check Database and Mask data each log into the new duplicated database.

Name	Targets	Status	Started	Ended	Elapsed Time (seconds)
▼ Execution: edrsr37p1.us.oracle.com	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:53:22 PM (UTC+07:00)	Aug 2, 2009 7:52:29 PM (UTC+07:00)	3546
⊘Previous					
Step: Source Preparation	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:53:35 PM (UTC+07:00)	Aug 2, 2009 6:53:38 PM (UTC+07:00)	3
Step: Create Control File	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:53:45 PM (UTC+07:00)	Aug 2, 2009 6:53:46 PM (UTC+07:00)	1
Step: Destination Directories Creation	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:53:56 PM (UTC+07:00)	Aug 2, 2009 6:53:56 PM (UTC+07:00)	0
Step: Copy Initialization and Password Files	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:54:06 PM (UTC+07:00)	Aug 2, 2009 6:54:07 PM (UTC+07:00)	1
Step: Skip Copy or Transfer Controlfile	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:54:16 PM (UTC+07:00)	Aug 2, 2009 6:54:17 PM (UTC+07:00)	1
Step: Destination Preparation	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:54:26 PM (UTC+07:00)	Aug 2, 2009 6:54:34 PM (UTC+07:00)	8
Step: Duplicate Database	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 6:54:36 PM (UTC+07:00)	Aug 2, 2009 7:15:47 PM (UTC+07:00)	1270
Step: Skip Creating Standby Control File	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:15:56 PM (UTC+07:00)	Aug 2, 2009 7:15:58 PM (UTC+07:00)	2
Step: Skip Switching Clone Type	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:16:07 PM (UTC+07:00)	Aug 2, 2009 7:16:09 PM (UTC+07:00)	2
Step: Recover Database	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:16:17 PM (UTC+07:00)	Aug 2, 2009 7:16:45 PM (UTC+07:00)	28
Step: Add Temporary Files	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:16:48 PM (UTC+07:00)	Aug 2, 2009 7:51:31 PM (UTC+07:00)	2083
Step: Check Database and Run Post Cloning Scripts	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:51:43 PM (UTC+07:00)	Aug 2, 2009 7:51:58 PM (UTC+07:00)	14
Step: Mask data	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:52:07 PM (UTC+07:00)	Aug 2, 2009 7:52:09 PM (UTC+07:00)	2
Step: Add EM Target	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:52:17 PM (UTC+07:00)	Aug 2, 2009 7:52:19 PM (UTC+07:00)	2
Step: Cleanup Source Temporary Directory	edrsr37p1.us.oracle.com	Succeeded	Aug 2, 2009 7:52:27 PM (UTC+07:00)	Aug 2, 2009 7:52:29 PM (UTC+07:00)	2

7) Test the access to your cloned databases in SQL*Plus.

Practice 20-1: Duplicating a Database (continued)

a) Connected as the oracle user in a graphical terminal session, ensure that you are pointing to the orcl database.

```
$ . oraenv
ORACLE_SID = [+ASM] ? orcl
$
```

b) Connect as the SYS user to your orcl database and execute the following query:

select dbid, name, created, open_mode
from v$database;

```
$ sqlplus / as sysdba

SQL> select dbid, name, created, open_mode from v$database;

      DBID NAME      CREATED             OPEN_MODE
---------- --------- ------------------- ---------------------
1221383234 ORCL      2009-07-30:19:21:38 READ WRITE
SQL>
```

c) Now connect as the SYSTEM user with the oracle_4U password to your dbtest database and execute the preceding query. Exit from SQL*Plus.

```
SQL> connect system@dbtest
Enter password: oracle_4U <<< not displayed
Connected.
SQL> select dbid, name, created, open_mode from v$database;

      DBID NAME      CREATED             OPEN_MODE
---------- --------- ------------------- ---------------------
1086723993 DBTEST    2009-08-02:19:12:25 READ WRITE
SQL> exit
$
```
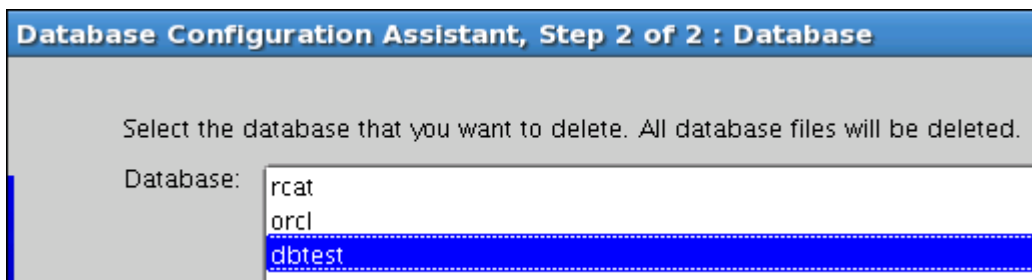
8) With the dbca utility, delete the DBTEST database because it is no longer needed

a. In a terminal window,sStart dbca.

```
$ dbca
```

b. Click Next on the Welcome page.

c. Choose Delete a Database on the Operations page.

Database Configuration Assistant, Step 2 of 2 : Database

Select the database that you want to delete. All database files will be deleted.

Database:
rcat
orcl
dbtest

d. Select dbtest from the list of databases to delete. Then click Finish.

Practice 20-1: Duplicating a Database (continued)

e. Confirm the delete operation by clicking Yes.

f. After the delete operation is finished, click No when asked if you want to perform another dbca operation.