



IT7359

ADVANCED DATABASE SYSTEM

Building The RDBMS Oracle 11g, 12c Enterprise Database

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1. Introduction

This project is about building the RDBMS Oracle 12c Enterprise Database. Through this report, RDBMS Oracle 12c installation, database creation, security setting, backup methods, auditing, and management will be shown.

2. Scenario

This database bases on the hospital database. However, its case is minimized to five tables and few roles with use to suit the study and research in building the database. All the brief design will be display in the logical design part.

3. Requirements

3.1 System requirement

In this project, the chosen operating system is Window 7. Beside, machines (PC or virtual machine) must meet these requirements:

- **Memory:** 8 GB.
- **Processors:** 4 (1 core each).
- **Hard disk (SCSI):** at least 60 GB.

Due to using the VMware, therefore some figure must adjust to let the system runs smoothly (Figure 1).

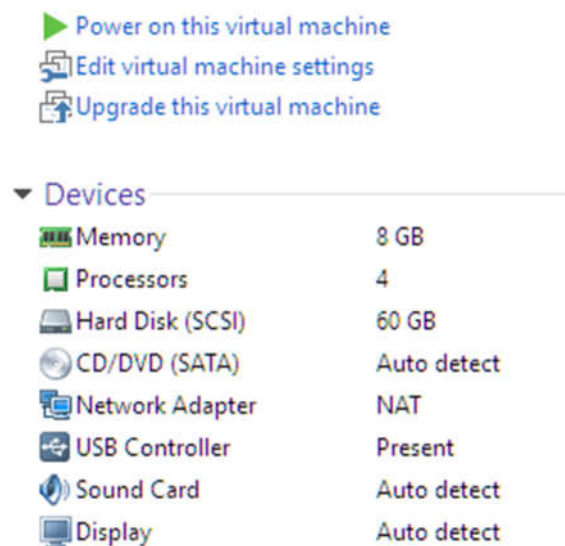


Figure 1: VMware figure adjustment

3.2 RDBMS requirement

Database is built by Oracle Database 12c Enterprise Edition. This version brings greatly benefit with customer deploying private database cloud. As mention above, this project's scenario is hospital. In the real life, it can be imagined that for this case, to storage the massive data which keep updating, changing and complex as the same time. Oracle Database 12c Enterprise Edition will provide comprehensive tools to manage all the processes, data and warehouse workloads. Moreover, security, data backup, recovery are the big concerns for most company, and this version has enough functions to cover unwanted disaster. On the other hands, based on study and research purpose, 12c version is the most suitable version to practice and conduct the experiment with building small scale database.

4. Logical Design

In these case , hospital database will have six tables which are:

- H_Laboratory: stores lab information
- H_Test: stores test conduct activities with test information and patient name.
- H_Patient: stores patients information
- H_Admission: stores the wards an patient IDs whose stay
- H_Ward: stores ward information
- H_Staff: stores staff's information and which ward they work at.

Schema

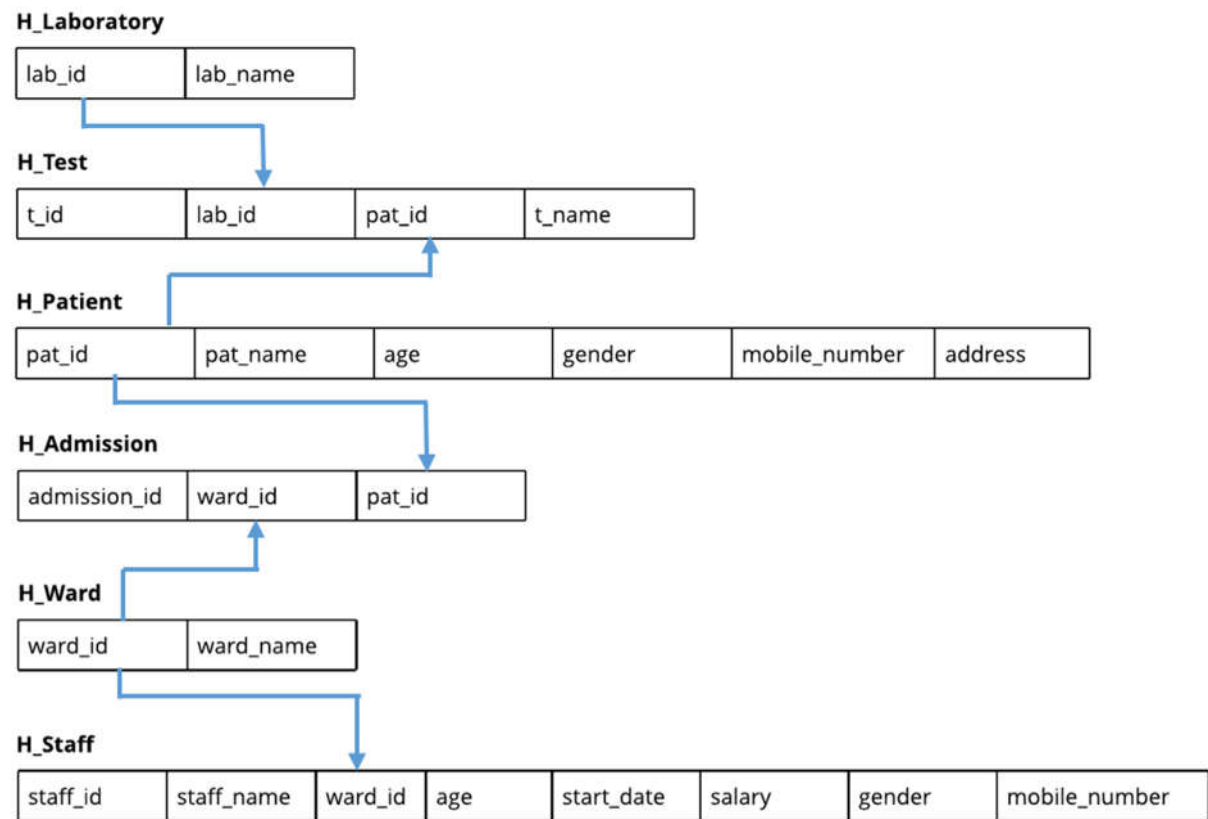


Figure 2: Hospital database schema

ER Diagram

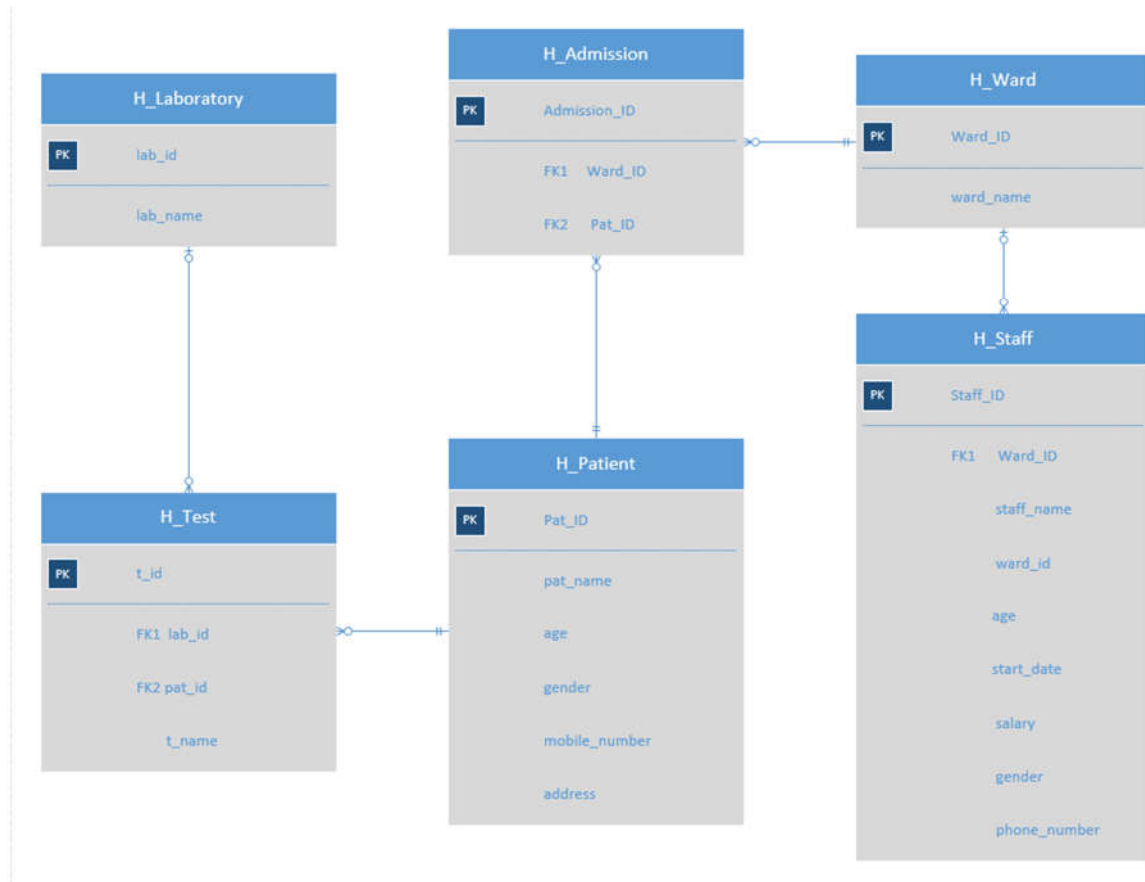


Figure 3: Hospital database - ER Diagram

5. Installation

After the open the Oracle Database 12c Setup file, installing window will appear. Two first step just the update and basic options, therefore no worry for coming to next action.



Figure 4: Installation - System class

In this stage – system class, depending on what class will the database implied, choice will be chosen. For this case, project is the study experience, which does not work in the sever, or the used machine is the data centre. Therefore, desktop should be chosen.

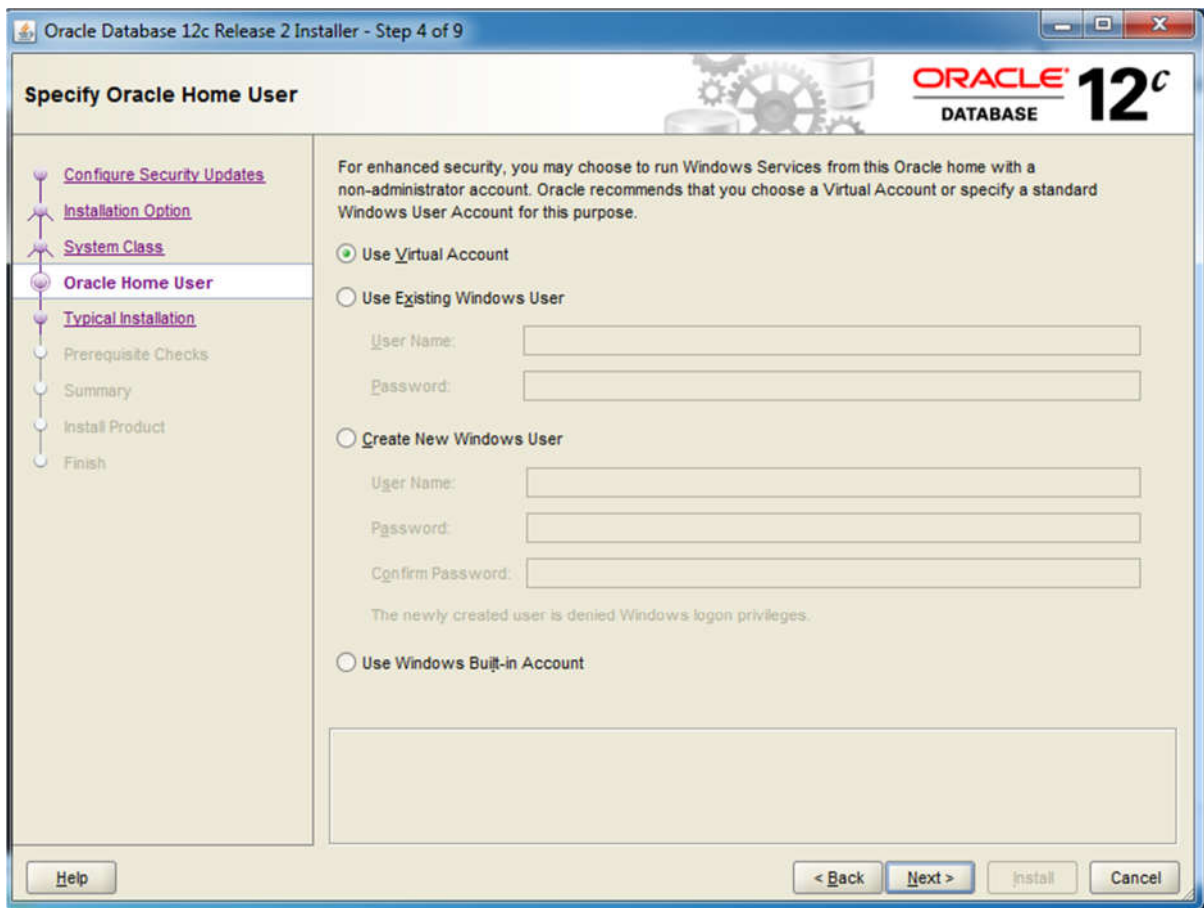


Figure 5: Installation - Home User choosing.

This project uses virtual account.

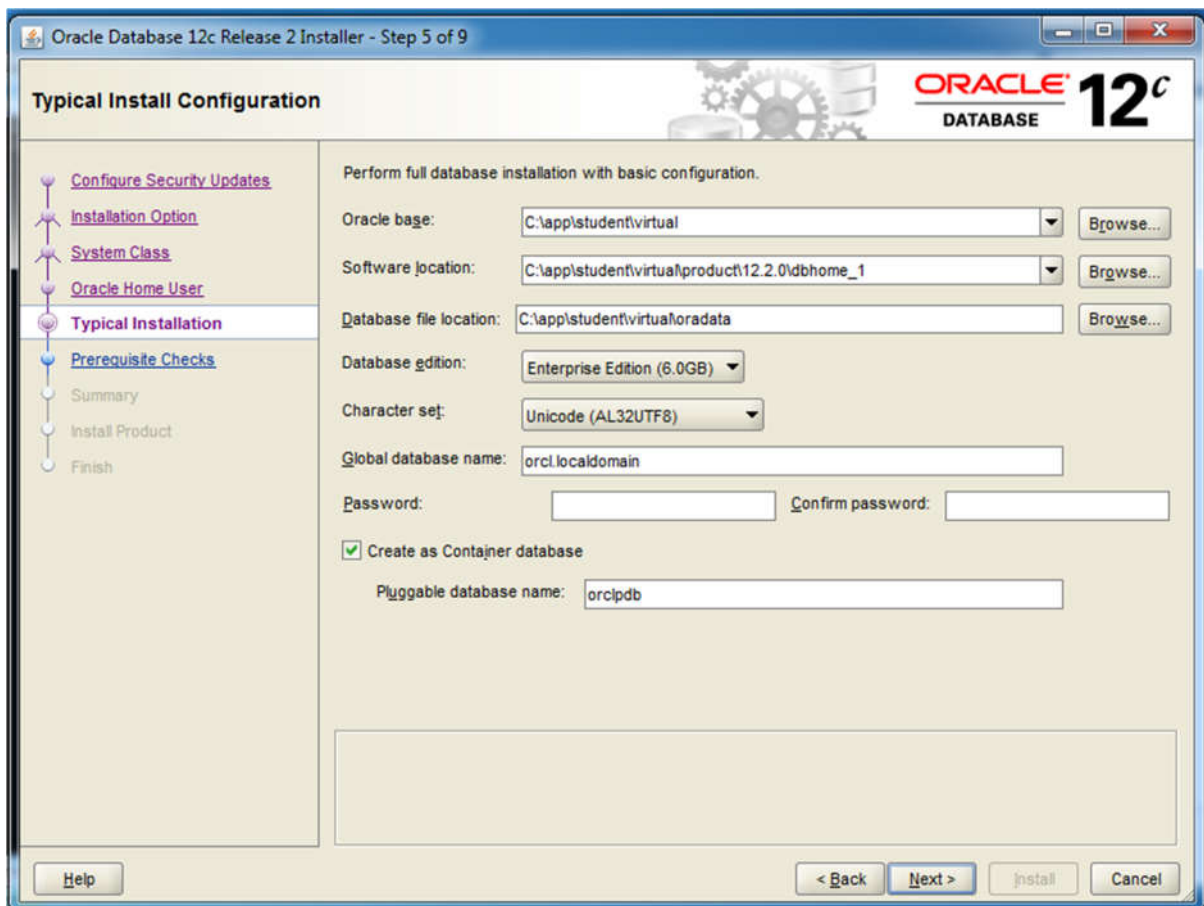


Figure 6: Installation - Typical installation

In this stage, Oracle System ID (SID) will be changed to “ph.hogphuc”, however it just take few letters and anything before dot (‘.’) my SID accidentally turn to be “ph”. At the same time, password will be set too.

*Oracle SID: is the unique name that uniquely identifies user instance/database where as Service name is the TNS alias that user give when you remotely connect to user’s database and this Service name is recorded in Tnsnames.ora file on user’s clients and it can be the same as SID.

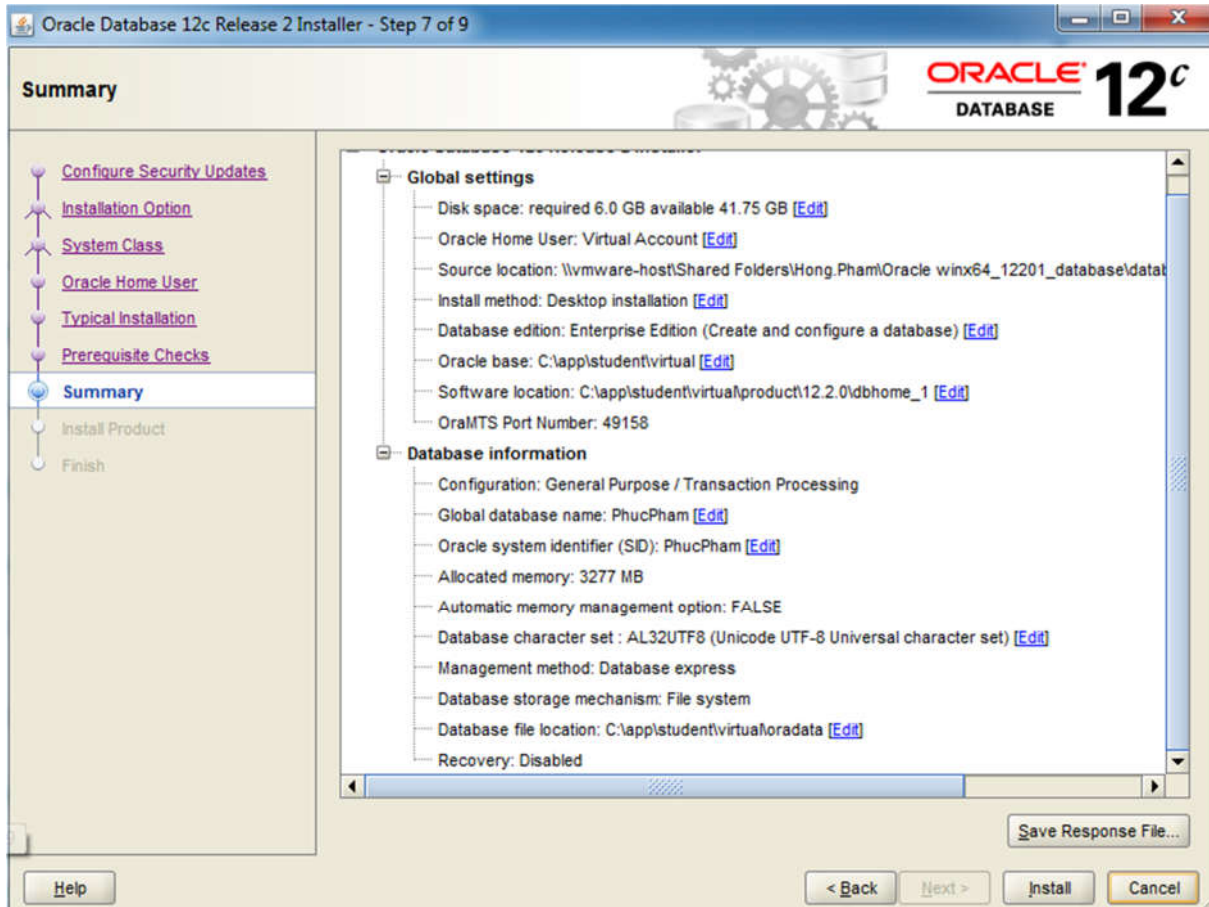


Figure 7: Installation – Summary

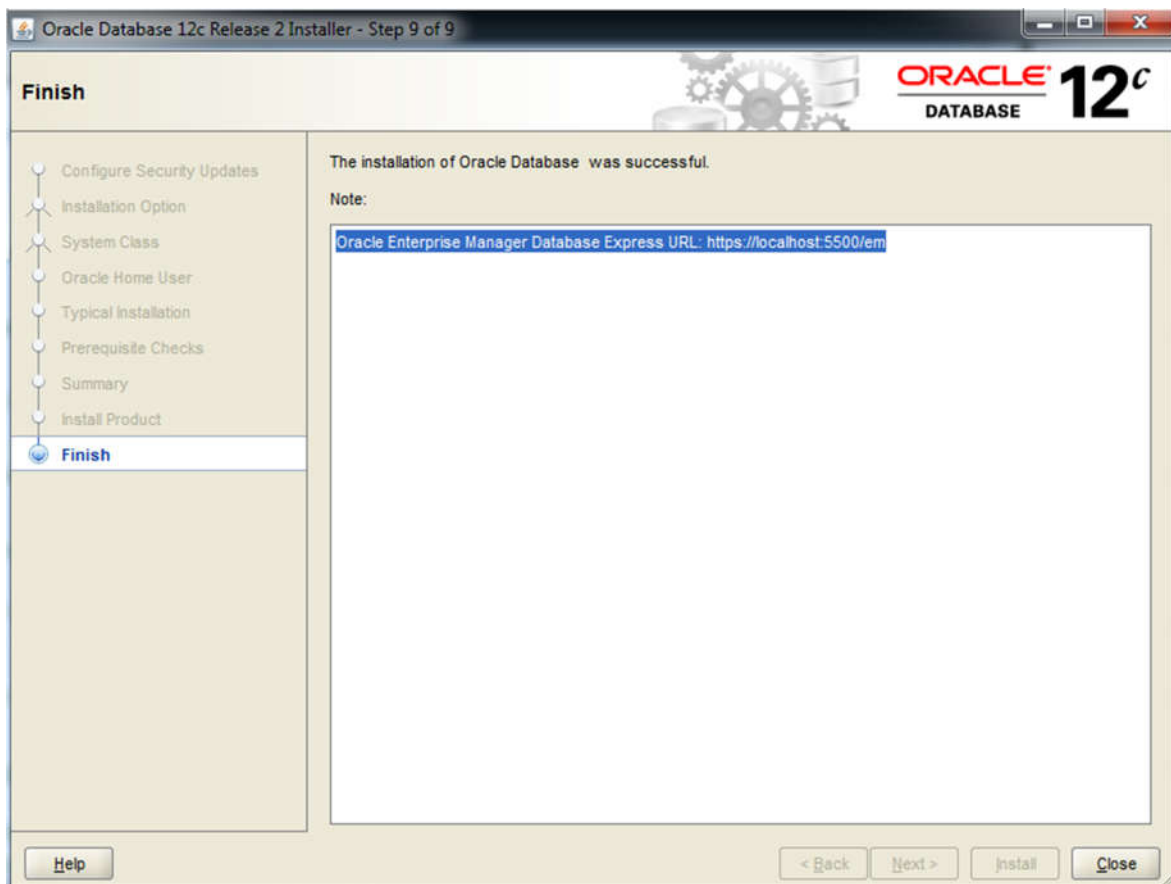


Figure 8: Installation - Finish

At the end, Oracle Enterprise Manager Express URL: <https://localhost:5500/em> will give to user. Follow that link and login by ID: system with the set password to get this result (Figure 9)

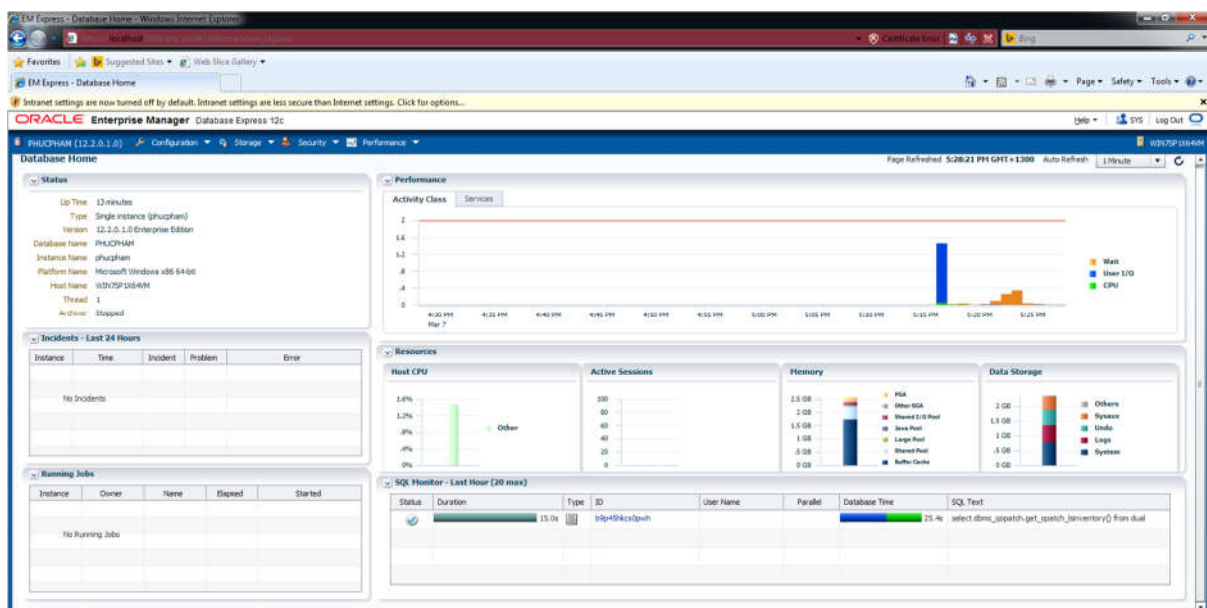


Figure 9: Installation - Oracle Enterprise Manager Express

6. Create Database

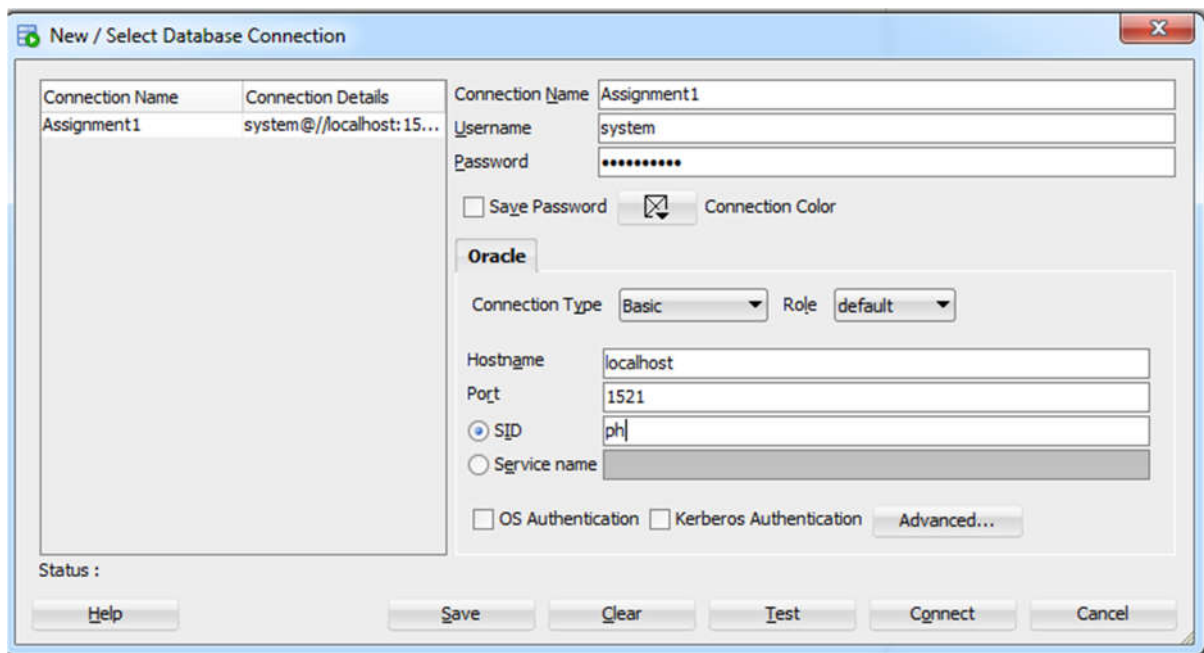


Figure 10: Create new connection

After installing RDBMS Oracle 12c, creating database activities can start. At this stage, system will build from scratch with the blank. Base on the logical design, database build in following steps:

1. Create table
2. Add Foreign Key – to create relationship
3. Add sequence – to auto generate ID for new entries
4. Add check constraint – to make sure the data is entered in right way.
5. Add data

Database generation are mostly base one code, and working on SQL Developer. At first, connection should be created, this is the system login therefore all the initial register information will be used to create this connection.

In this stage, TCP port 1521 is the default setting. TCP ports use the Transmission Control Protocol. TCP is the most commonly used protocol on the Internet and any TCP/IP network. Whereas the IP protocol deals only with packets, TCP enables two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and that packets will be delivered in the same order in which they were sent. Guaranteed communication/delivery is the key difference between TCP and UDP.

Database building will using these following SQL code:

6.1. Create table

```
Create table H_Laboratory(  
lab_id number(6) not null,  
lab_name varchar2(50) not null,  
constraint pk_H_Laboratory primary key (lab_id)  
);
```

```
Create table H_Test(  
t_id number(6) not null,  
t_name varchar2(50) not null,  
lab_id number(6) not null,  
pat_id number(6) not null,  
constraint pk_H_Test primary key (t_id)  
);
```

```
Create table H_Patient(  
pat_id number(6) not null,  
pat_name varchar2(50) not null,  
age number(3) not null,  
gender varchar(2) not null,  
mobile_number varchar(10) not null,  
address varchar2(50) not null,  
constraint pk_H_Patient primary key (pat_id)  
);
```

```
Create table H_Ward(  
ward_id number(6) not null,  
ward_name varchar2(50) not null,  
constraint pk_H_Ward primary key (ward_id)  
);
```

```
Create table H_Admission(  
admission_id number(6) not null,  
ward_id number(6) not null,  
pat_id number(6) not null,  
constraint pk_H_Admission primary key (admission_id)  
);
```

```
Create table H_Staff(  
staff_id number(6) not null,  
staff_name varchar2(50) not null,  
ward_id number(6) not null,  
age number(3) not null,  
start_date date,  
salary varchar(10) not null,  
gender varchar(2) not null,  
phone_number number(10) not null,  
constraint pk_H_Staff primary key (staff_id)  
);
```


6.2 Add foreign keys

```
alter table H_Test
```

```
add constraint fk_H_Test foreign key (pat_id)
```

```
references H_Patient (pat_id);
```

```
alter table H_Admission
```

```
add constraint fk_H_Admission foreign key (ward_id)
```

```
references H_Ward (ward_id);
```

```
alter table H_Staff
```

```
add constraint fk_H_Staff foreign key (ward_id)
```

```
references H_Ward (ward_id);
```

6.3. Create sequences

```
create sequence lab_s
```

```
minvalue 10000
```

```
maxvalue 10999
```

```
start with 10000
```

```
increment by 1
```

```
cache 100;
```

```
create or replace trigger lab_id_gen
```

```
before insert on h_laboratory
```

```
for each row
```

```
when (new.lab_id is null)
```

```
begin
```

```
select lab_s.nextval
```

```
into :new.lab_id
```

```
from dual;
```

```
end;
```

```
/
```

```
create sequence test_s
```

```
minvalue 20000
```

```
maxvalue 20999
```

```
start with 20000
```

```
increment by 1
```

```
cache 100;
```

```
create or replace trigger t_id_gen
```

```
before insert on h_test
```

```
for each row
when (new.t_id is null)
begin
    select test_s.nextval
    into :new.t_id
    from dual;
end;
/
```

```
create sequence pat_s
minvalue 30000
maxvalue 30999
start with 30000
increment by 1
cache 100;
```

```
create or replace trigger pat_id_gen
before insert on h_patient
for each row
when (new.pat_id is null)
begin
    select pat_s.nextval
    into :new.pat_id
    from dual;
end;
/
```

```
create sequence ward_s
minvalue 50000
maxvalue 50999
start with 50000
```

increment by 1

cache 100;

create or replace trigger ward_id_gen

before insert on h_ward

for each row

when (new.ward_id is null)

begin

select ward_s.nextval

into :new.ward_id

from dual;

end;

/

create sequence ad_s

minvalue 60000

maxvalue 600999

start with 600000

increment by 1

cache 100;

create or replace trigger admission_id_gen

before insert on h_admission

for each row

when (new.admission_id is null)

begin

select ad_s.nextval

into :new.admission_id

from dual;

end;

/

```
create sequence staff_s
minvalue 70000
maxvalue 70999
start with 70000
increment by 1
cache 100;

create or replace trigger staff_id_gen
    before insert on h_staff
for each row
when (new.staff_id is null)
begin
    select staff_s.nextval
    into :new.staff_id
    from dual;
end;
/
```

6.4. Create check constraints

Alter table H_Patient

Add constraint ck_patient_MB

Check (mobile_number not like '%[^0-9]%');

Alter Table H_Patient

Add constraint uc_patient_name_address UNIQUE (pat_name, address, mobile_number);

Alter table H_Patient

Add constraint uc_patient unique (mobile_number);

Alter table H_Staff

Add constraint ck_staff_salary

Check (salary > 500);

Alter table H_Staff

Add constraint ck_staff_gender

Check ((gender = 'M') or (gender = 'F'));

Alter table H_Staff

Add constraint ck_staff_age

Check ((age> 18) and (age < 70));

Alter table H_Staff

Add constraint uc_staff unique (phone_number);

6.5. Add data

```
Insert into h_laboratory  
values(lab_s.nextval, 'Xray');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Eyes');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Blood');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Urine Analyse');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Teeth');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'SurgerCTy');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Aduibility');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Joint');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Family planning');
```

```
Insert into h_laboratory  
values(lab_s.nextval, 'Ultrasonic');
```

Insert into h_patient

values(pat_s.nextval, 'Jorah Mormont', '40', 'M', '0213789422', 'Upper Hutt');

Insert into h_patient

values(pat_s.nextval, 'Cersei Lannister', '38', 'F', '0216094252', 'Petone');

Insert into h_patient

values(pat_s.nextval, 'Joffrey Baratheon', '20', 'M', '0225824782', 'King Landing');

Insert into h_patient

values(pat_s.nextval, 'Jon Snow', '30', 'M', '0216163402', 'Winterfell');

Insert into h_patient

values(pat_s.nextval, 'Kal Drogo', '37', 'M', '0225874782', 'Essos');

Insert into h_patient

values(pat_s.nextval, 'Arya Stark', '18', 'M', '0225814862', 'Kelson');

Insert into h_patient

values(pat_s.nextval, 'Theon Greyjoy', '28', 'M', '0225880962', 'Koro Koro');

Insert into h_patient

values(pat_s.nextval, 'Margaery Tyrell', '37', 'F', '0225899782', 'Astapor');

Insert into h_patient

values(pat_s.nextval, 'Christian Grey', '31', 'M', '0225634862', 'Dragon Stone');

Insert into h_patient


```
values(pat_s.nextval, 'Ygritte', '25', 'F', '0225210962', 'Quarth');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Lung X-Ray', '10005', '30001');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Head CT Scan', '10000', '30001');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Lipit Test', '10002', '30002');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Eyes cheking', '10001', '30003');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Braces', '10004', '30004');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Urine test', '10003', '30006');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Stomach scan', '10009', '30000');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Procreation test', '10008', '30004');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Audibility check', '10006', '30005');
```

```
Insert into h_test
```

```
values(test_s.nextval, 'Xray', '10007','30005');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Bond');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Blood');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Eyes');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Psychology');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Pulmonology');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Internist');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Procreation');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Dental');
```

```
Insert into h_ward
```

```
values( ward_s.nextval, 'Digestion system');
```

```
Insert into h_ward  
values( ward_s.nextval, 'Otolaryngology');
```

```
Insert into h_admission  
values (ad_s.nextval, '50001', '30001');
```

```
Insert into h_admission  
values (ad_s.nextval, '50002', '30003');
```

```
Insert into h_admission  
values (ad_s.nextval, '50003', '30002');
```

```
Insert into h_admission  
values (ad_s.nextval, '50004', '30007');
```

```
Insert into h_admission  
values (ad_s.nextval, '50005', '30006');
```

```
Insert into h_admission  
values (ad_s.nextval, '50009', '30005');
```

```
Insert into h_admission  
values (ad_s.nextval, '50002', '30004');
```

```
Insert into h_admission  
values (ad_s.nextval, '50006', '30006');
```

```
Insert into h_admission  
values (ad_s.nextval, '50007', '30004');
```

```
Insert into h_admission  
values (ad_s.nextval, '50009', '30005');
```

Insert into h_admission

values (ad_s.nextval, '50008', '30008');

Insert into h_staff

values(staff_s.nextval, 'Will Pham', '50002', '25', '7 Jan 2015', '15000', 'M','0226789645');

Insert into h_staff

values(staff_s.nextval, 'Brienne Tarth', '50001', '42', '22 Nov 2014', '27100', 'F','0209856123');

Insert into h_staff

values(staff_s.nextval, 'Melisandre', '50003', '26', '20 Mar 2016', '13200', 'F','0221682557');

Insert into h_staff

values(staff_s.nextval, 'Viserys Targaryen', '50004', '34', '17 Nov 2015', '22500', 'M','0226158645');

Insert into h_staff

values(staff_s.nextval, 'Davos Seaworth', '50005', '28', '31 Jan 2014', '22500', 'M','0226158200');

Insert into h_staff

values(staff_s.nextval, 'Samwell Tarly', '50006', '28', '27 Aug 2015', '22500', 'M','0226128285');

Insert into h_staff

values(staff_s.nextval, 'Phuong Nguyen', '50007', '22', '25 Sep 2016', '14500', 'F','0221682557');

Insert into h_staff

values(staff_s.nextval, 'Yo Yen', '50009', '28', '17 Nov 2015', '22500', 'M','0226158645');

Insert into h_staff

values(staff_s.nextval, 'Berry Alan', '50009', '31', '27 Jun 2014', '27100', 'M','0226158200');

Insert into h_staff

```
values( staff_s.nextval, 'Ron Potter', '50008', '25 ', '15 Jan 2015', '17400', 'M','0226128285');
```

7. Create basis users, role and privileges

User and role creation, privileges grants are follow these code:

7.1. Create user with security profile

```
create user DBAdmin  
identified by DBAdmin  
default TABLESPACE users  
temporary tablespace temp  
password expire  
account UNLOCK;
```

```
grant DBA to DBAdmin;
```

```
alter user DBAdmin  
identified by DBAdmin_1; ( take the screenshot)
```

```
CREATE PROFILE DBA_user LIMIT  
  FAILED_LOGIN_ATTEMPTS 3  
  PASSWORD_LIFE_TIME 60  
  PASSWORD_REUSE_TIME 60  
  PASSWORD_REUSE_MAX 3  
  PASSWORD_VERIFY_FUNCTION verify_function  
  PASSWORD_LOCK_TIME 1/24  
  PASSWORD_GRACE_TIME 10  
  CONNECT_TIME 15 ;
```

```
alter user DBAdmin  
PROFILE DBA_user;
```

commit;

create user doctor

identified by 1234

default TABLESPACE users

temporary tablespace temp

password expire

account UNLOCK;

grant DBA to doctor;

CREATE PROFILE doctor_user LIMIT

FAILED_LOGIN_ATTEMPTS 4

PASSWORD_LIFE_TIME 60

PASSWORD_REUSE_TIME 60

PASSWORD_REUSE_MAX 3

PASSWORD_VERIFY_FUNCTION verify_function

PASSWORD_LOCK_TIME 1/24

PASSWORD_GRACE_TIME 10

CONNECT_TIME 60 ;

alter user Doctor

PROFILE doctor_user;

commit;

```
create user reception
identified by 1234
default TABLESPACE users
temporary tablespace temp
password expire
account UNLOCK;
```

```
grant DBA to reception;
```

```
alter user reception
identified by ReCept10n__;
```

```
CREATE PROFILE reception_user LIMIT
  FAILED_LOGIN_ATTEMPTS 5
  PASSWORD_LIFE_TIME 60
  PASSWORD_REUSE_TIME 60
  PASSWORD_REUSE_MAX 3
  PASSWORD_VERIFY_FUNCTION verify_function
  PASSWORD_LOCK_TIME 1/24
  PASSWORD_GRACE_TIME 10
  CONNECT_TIME 60 ;
```

```
alter user reception
PROFILE reception_user;
```

```
commit;
```


In this case:

Password_parameters sets lengths of time are interpreted in number of days.

FAILED_LOGIN_ATTEMPTS specifies the number of failed attempts to log in to the user account before the account is locked.

PASSWORD_LIFE_TIME specifies the number of days the same password can be used for authentication. If you also set a value for **PASSWORD_GRACE_TIME**, the password expires if it is not changed within the grace period, and further connections are rejected.

PASSWORD_REUSE_MAX specifies the number of password changes required before the current password can be reused.

PASSWORD_LOCK_TIME specifies the number of days an account will be locked after the specified number of consecutive failed login attempts.

PASSWORD_GRACE_TIME specifies the number of days after the grace period begins during which a warning is issued and login is allowed. If the password is not changed during the grace period, the password expires.

PASSWORD_VERIFY_FUNCTION lets a PL/SQL password complexity verification script be passed as an argument to the CREATE PROFILE statement.

CONNECT_TIME Specify the total elapsed time limit for a session, expressed in minutes.

7.2 Create role and grant role's, user's privileges

```
create role patient_info_editor;
```

```
grant insert, select, update on system.H_Patient to patient_info_editor;
```

```
grant insert, select, update on system.H_Test to patient_info_editor;
```

```
grant insert, select, update on system.H_Admission to patient_info_editor;
```

```
grant patient_info_editor to doctor;
```

```
create role patient_info_checking;
```

```
grant insert, select on system.H_Patient to patient_info_checking;
```

```
grant insert, select on system.H_Test to patient_info_checking;
```

```
grant insert, select on system.H_Admission to patient_info_checking;
```

```
grant patient_info_checking to reception;
```

```
create role hospital_info_editor;
```

```
grant insert, select, update on H_Ward to hospital_info_editor;
```

```
grant insert, select, update on H_Laboratory to hospital_info_editor
```

```
grant insert, select, update on H_Staff to hospital_info_editor;
```

```
grant hospital_info_editor to DBAdmin;
```

```
GRANT CREATE JOB TO hospital_info_editor ;
```

```
GRANT CREATE ROLE TO hospital_info_editor ;
```

```
GRANT CREATE TRIGGER TO hospital_info_editor ;
```

```
GRANT ALTER ANY RULE SET TO hospital_info_editor ;
```

```
GRANT CREATE VIEW TO hospital_info_editor ;
```

GRANT CREATE TABLE TO hospital_info_editor ;
GRANT CREATE TYPE TO hospital_info_editor ;
GRANT ALTER USER TO hospital_info_editor ;
GRANT CREATE USER TO hospital_info_editor ;
GRANT ALTER ANY ROLE TO hospital_info_editor ;
GRANT GRANT ANY PRIVILEGE TO hospital_info_editor ;
GRANT READ ANY TABLE TO hospital_info_editor ;
GRANT ALTER SYSTEM TO hospital_info_editor ;
GRANT GRANT ANY ROLE TO hospital_info_editor ;
GRANT ALTER ANY RULE TO hospital_info_editor ;

create role DB_security;
GRANT ALTER PROFILE TO DB_security ;
GRANT AUDIT SYSTEM TO DB_security ;
GRANT GRANT ANY OBJECT PRIVILEGE TO DB_security ;
GRANT ALTER ANY TABLE TO DB_security ;
GRANT FORCE ANY TRANSACTION TO DB_security ;
GRANT FLASHBACK ANY TABLE TO DB_security ;
GRANT BACKUP ANY TABLE TO DB_security ;
GRANT CREATE ANY RULE SET TO DB_security ;
GRANT ALTER USER TO DB_security ;
GRANT GLOBAL QUERY REWRITE TO DB_security ;
GRANT CREATE ANY RULE TO DB_security ;
GRANT ALTER TABLESPACE TO DB_security ;
GRANT GRANT ANY PRIVILEGE TO DB_security ;
GRANT ALTER ANY TRIGGER TO DB_security ;
GRANT CREATE ANY VIEW TO DB_security ;
GRANT FLASHBACK ARCHIVE ADMINISTER TO DB_security ;
GRANT IMPORT FULL DATABASE TO DB_security ;
GRANT COMMENT ANY TABLE TO DB_security ;
GRANT READ ANY TABLE TO DB_security ;

```

GRANT READ ANY FILE GROUP TO DB_security ;
GRANT FORCE TRANSACTION TO DB_security ;
GRANT ALTER ANY TYPE TO DB_security ;
GRANT ALTER SYSTEM TO DB_security ;
GRANT CREATE ANY TYPE TO DB_security ;
GRANT ALTER DATABASE TO DB_security ;
GRANT GRANT ANY ROLE TO DB_security ;

```

```
grant DB_security to DBAdmin;
```

View Profile: DBA_USER

General

Composite Limit (Service Units)	DEFAULT
Private SGA	DEFAULT
Connect Time (Min.)	15
Idle Time (min.)	DEFAULT
Reads/Call (Blocks)	DEFAULT
Reads/Session (Blocks)	DEFAULT
CPU/Call (Sec./100)	DEFAULT
CPU/Session (Sec./100)	DEFAULT
Concurrent Session (Per User)	DEFAULT

Password

	DEFAULT
Lock (days past expiration)	10
Number of days to lock for	.0416
Complexity function	ORA12C_STRONG_VERIFY_FUNCTION
Number of passwords to keep	3
Number of days to keep for	60
Expire in (days)	60
Number of failed login attempts to lock after	3

Figure 11: DBAdmin user profile after adjust

View Profile: DOCTOR_USER

General

Composite Limit (Service Units)	DEFAULT
Private SGA	DEFAULT
Connect Time (Min.)	60
Idle Time (min.)	DEFAULT
Reads/Call (Blocks)	DEFAULT
Reads/Session (Blocks)	DEFAULT
CPU/Call (Sec./100)	DEFAULT
CPU/Session (Sec./100)	DEFAULT
Concurrent Session (Per User)	DEFAULT

Password

	DEFAULT
Lock (days past expiration)	10
Number of days to lock for	.0416
Complexity function	ORA12C_STRONG_VERIFY_FUNCTION
Number of passwords to keep	3
Number of days to keep for	60
Expire in (days)	60
Number of failed login attempts to lock after	4

Figure 12: Doctor_user profile after adjust

View Profile: RECEPTION_USER

General

Composite Limit (Service Units)	DEFAULT
Private SGA	DEFAULT
Connect Time (Min.)	60
Idle Time (min.)	DEFAULT
Reads/Call (Blocks)	DEFAULT
Reads/Session (Blocks)	DEFAULT
CPU/Call (Sec./100)	DEFAULT
CPU/Session (Sec./100)	DEFAULT
Concurrent Session (Per User)	DEFAULT

Password

	DEFAULT
Lock (days past expiration)	10
Number of days to lock for	.0416
Complexity function	ORA12C_STRONG_VERIFY_FUNCTION
Number of passwords to keep	3
Number of days to keep for	60
Expire in (days)	60
Number of failed login attempts to lock after	5

Figure 13: Reception_user profile after adjust

8. Security

8.1. Create strong security password for profile

Password are important, the more complicated the more secure the system become. Therefore, these SQL code is used to generate strong password requirements:

```
alter profile DBA_user  
limit  
password_verify_function  
ora12c_strong_verify_function;
```

```
alter profile doctor_user  
limit  
password_verify_function  
ora12c_strong_verify_function;
```

```
alter profile reception_user  
limit  
password_verify_function  
ora12c_strong_verify_function;
```

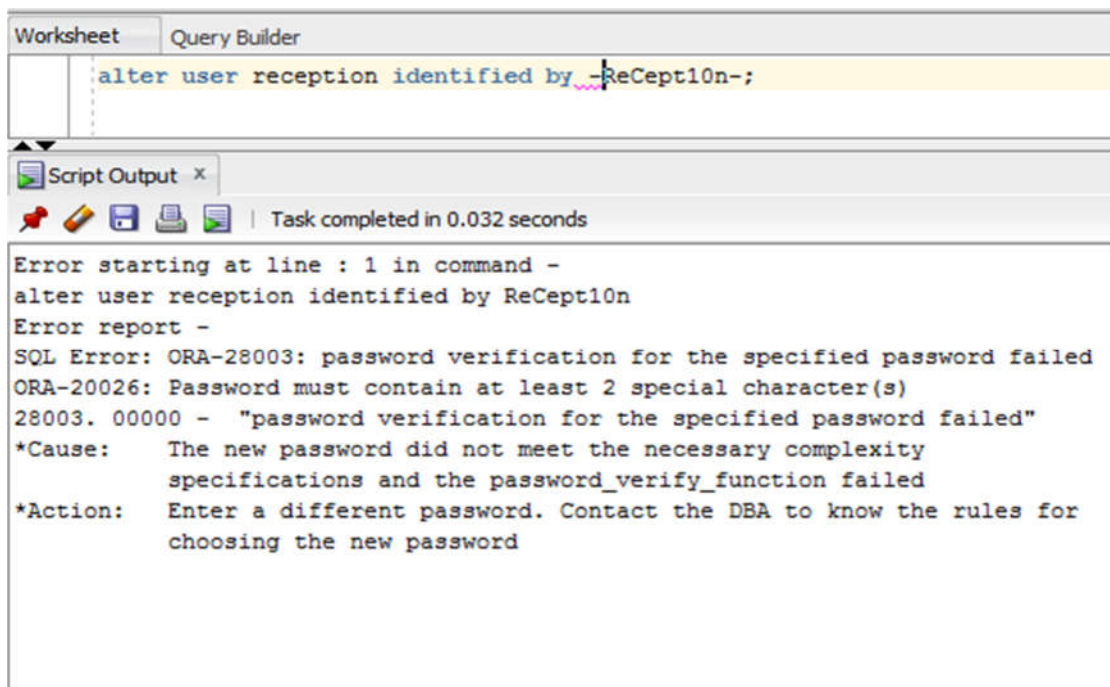


Figure 14: Strong password policy is applied

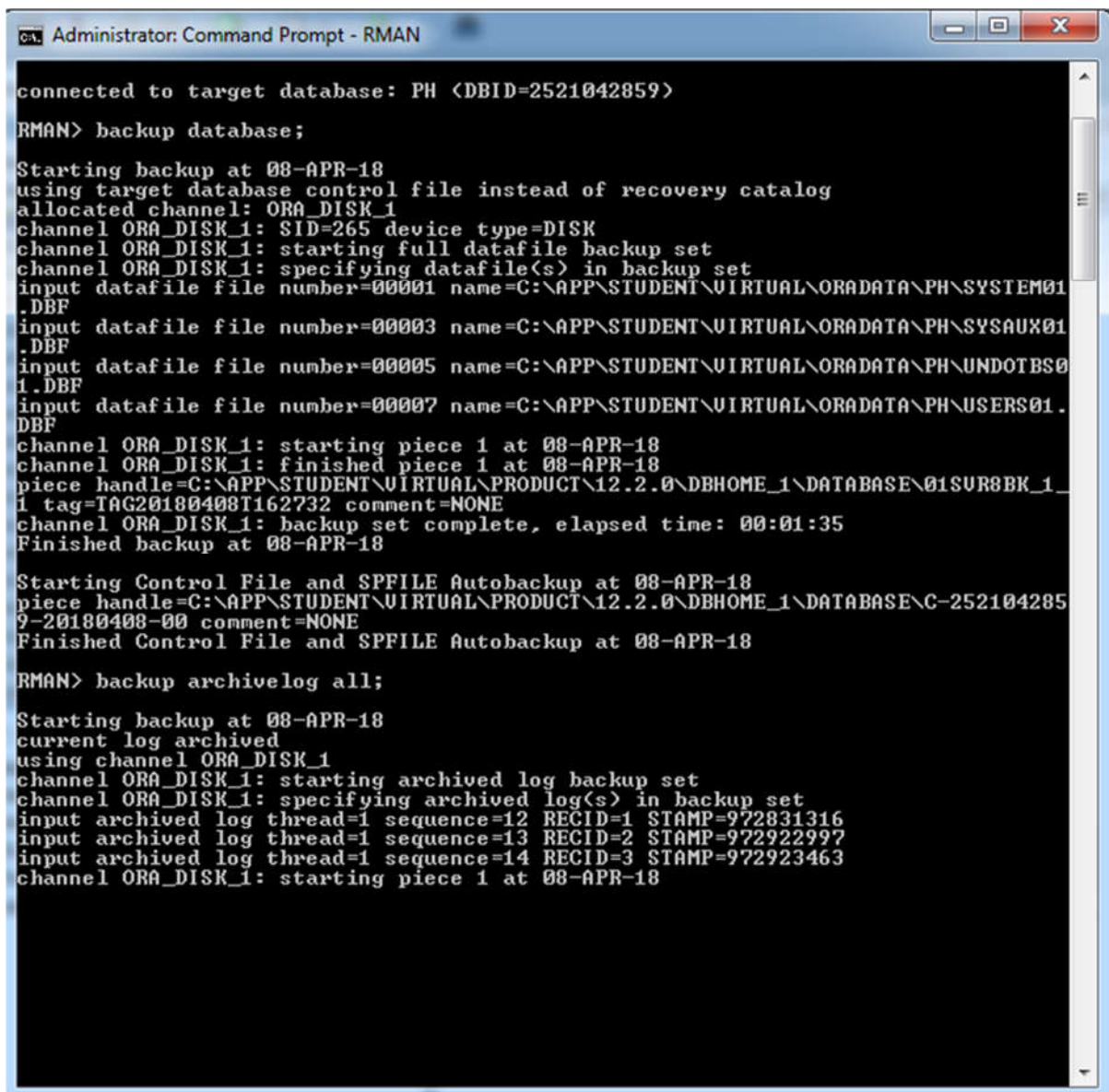
After alter profile, users will be test again with alter query to change password, at this time, system will strictly in accepting the new password, exactly, it asks for the passwords with at least two capital letters, at least two digits and two special characters.

9. Backup

9.1. Hot backup

Hot back up is the back up when the system is still in connection. To make the hot backup, firstly system must connect to data base as the code in RMAN:

Connect target /



```
Administrator: Command Prompt - RMAN
connected to target database: PH (DBID=2521042859)
RMAN> backup database;
Starting backup at 08-APR-18
using target database control file instead of recovery catalog
allocated channel: ORA_DISK_1
channel ORA_DISK_1: SID=265 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=000001 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\SYSTEM01.DBF
input datafile file number=000003 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\SYSAUX01.DBF
input datafile file number=000005 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\UNDOTBS01.DBF
input datafile file number=000007 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\USERS01.DBF
channel ORA_DISK_1: starting piece 1 at 08-APR-18
channel ORA_DISK_1: finished piece 1 at 08-APR-18
piece handle=C:\APP\STUDENT\VIRTUAL\PRODUCT\12.2.0\DBHOME_1\DATABASE\01SUR8BK_1_1 tag=TAG20180408T162732 comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:01:35
Finished backup at 08-APR-18

Starting Control File and SPFILE Autobackup at 08-APR-18
piece handle=C:\APP\STUDENT\VIRTUAL\PRODUCT\12.2.0\DBHOME_1\DATABASE\C-2521042859-20180408-00 comment=NONE
Finished Control File and SPFILE Autobackup at 08-APR-18
RMAN> backup archivelog all;
Starting backup at 08-APR-18
current log archived
using channel ORA_DISK_1
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=12 RECID=1 STAMP=972831316
input archived log thread=1 sequence=13 RECID=2 STAMP=972922997
input archived log thread=1 sequence=14 RECID=3 STAMP=972923463
channel ORA_DISK_1: starting piece 1 at 08-APR-18
```

Figure 15: Hot back up - backup database and archivelog

Backup database: backup the database

Backup archivelog all: backup all the archive log

In the other way, the file can go with the tag, by adding “tag=<name>”

```

RMAN> backup database tag=database_full_backup;

Starting backup at 10-APR-18
using channel ORA_DISK_1
channel ORA_DISK_1: starting full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=000001 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\SYSTEM01.
DBF
input datafile file number=000003 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\SYSAUX01.
DBF
input datafile file number=000005 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\UNDOTBS0
1.DBF
input datafile file number=000008 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\RMAN_DAT
A01.DBF
input datafile file number=000007 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\USERS01.
DBF
channel ORA_DISK_1: starting piece 1 at 10-APR-18
channel ORA_DISK_1: finished piece 1 at 10-APR-18
piece handle=C:\APP\STUDENT\VIRTUAL\PRODUCT\12.2.0\DBHOME_1\DATABASE\0CT011D3_1
1 tag=DATABASE_FULL_BACKUP comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:01:16
Finished backup at 10-APR-18

Starting Control File and SPFILE Autobackup at 10-APR-18
piece handle=C:\APP\STUDENT\VIRTUAL\PRODUCT\12.2.0\DBHOME_1\DATABASE\C-252104285
9-20180410-03 comment=NONE

```

Figure 16: Backup with the tag

Or backup as compressed by using following code with tag:

“backup as compressed backupset database tag=<name>”

```

RMAN> backup as compressed backupset database tag=compressed_full_bak;

Starting backup at 10-APR-18
using channel ORA_DISK_1
channel ORA_DISK_1: starting compressed full datafile backup set
channel ORA_DISK_1: specifying datafile(s) in backup set
input datafile file number=000001 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\SYSTEM01.
DBF
input datafile file number=000003 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\SYSAUX01.
DBF
input datafile file number=000005 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\UNDOTBS0
1.DBF
input datafile file number=000008 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\RMAN_DAT
A01.DBF
input datafile file number=000007 name=C:\APP\STUDENT\VIRTUAL\ORADATA\PH\USERS01.
DBF
channel ORA_DISK_1: starting piece 1 at 10-APR-18
channel ORA_DISK_1: finished piece 1 at 10-APR-18
piece handle=C:\APP\STUDENT\VIRTUAL\PRODUCT\12.2.0\DBHOME_1\DATABASE\0ET011IF_1
1 tag=COMPRESSED_FULL_BAK comment=NONE
channel ORA_DISK_1: backup set complete, elapsed time: 00:01:05
Finished backup at 10-APR-18

Starting Control File and SPFILE Autobackup at 10-APR-18
piece handle=C:\APP\STUDENT\VIRTUAL\PRODUCT\12.2.0\DBHOME_1\DATABASE\C-252104285
9-20180410-04 comment=NONE
Finished Control File and SPFILE Autobackup at 10-APR-18

RMAN>

```

Figure 17: Compressed backup

9.2. Cold backup & Recovery

Multiplexing of control and redo log files

To create the multiplexing of control we use the code to generate another log:

```
ALTER DATABASE
```

```
ADD LOGFILE MEMBER
```

```
'C:\APP\STUDENT\VIRTUAL\ORADATA\PH\REDO102.LOG'
```

```
TO GROUP 1;
```

```
ALTER DATABASE
```

```
ADD LOGFILE MEMBER
```

```
'C:\APP\STUDENT\VIRTUAL\ORADATA\PH\REDO202.LOG'
```

```
TO GROUP 2;
```

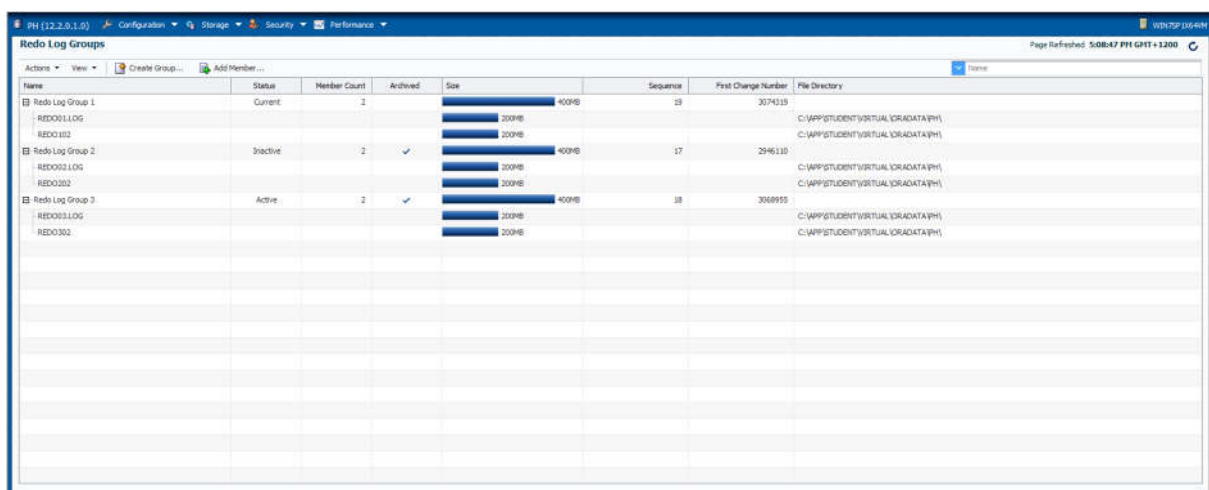
```
ALTER DATABASE
```

```
ADD LOGFILE MEMBER
```

```
'C:\APP\STUDENT\VIRTUAL\ORADATA\PH\REDO302.LOG'
```

```
TO GROUP 3;
```

After enter those code above, new log is created and can be checked through Oracle Enterprise



The screenshot displays the 'Redo Log Groups' configuration page in Oracle Enterprise Manager. The table lists three redo log groups, each with two members. Group 1 is 'Current', Group 2 is 'Inactive', and Group 3 is 'Active'. All members are 200MB in size and located in the directory 'C:\APP\STUDENT\VIRTUAL\ORADATA\PH\'. The 'Archived' column shows checkmarks for the inactive and active groups.

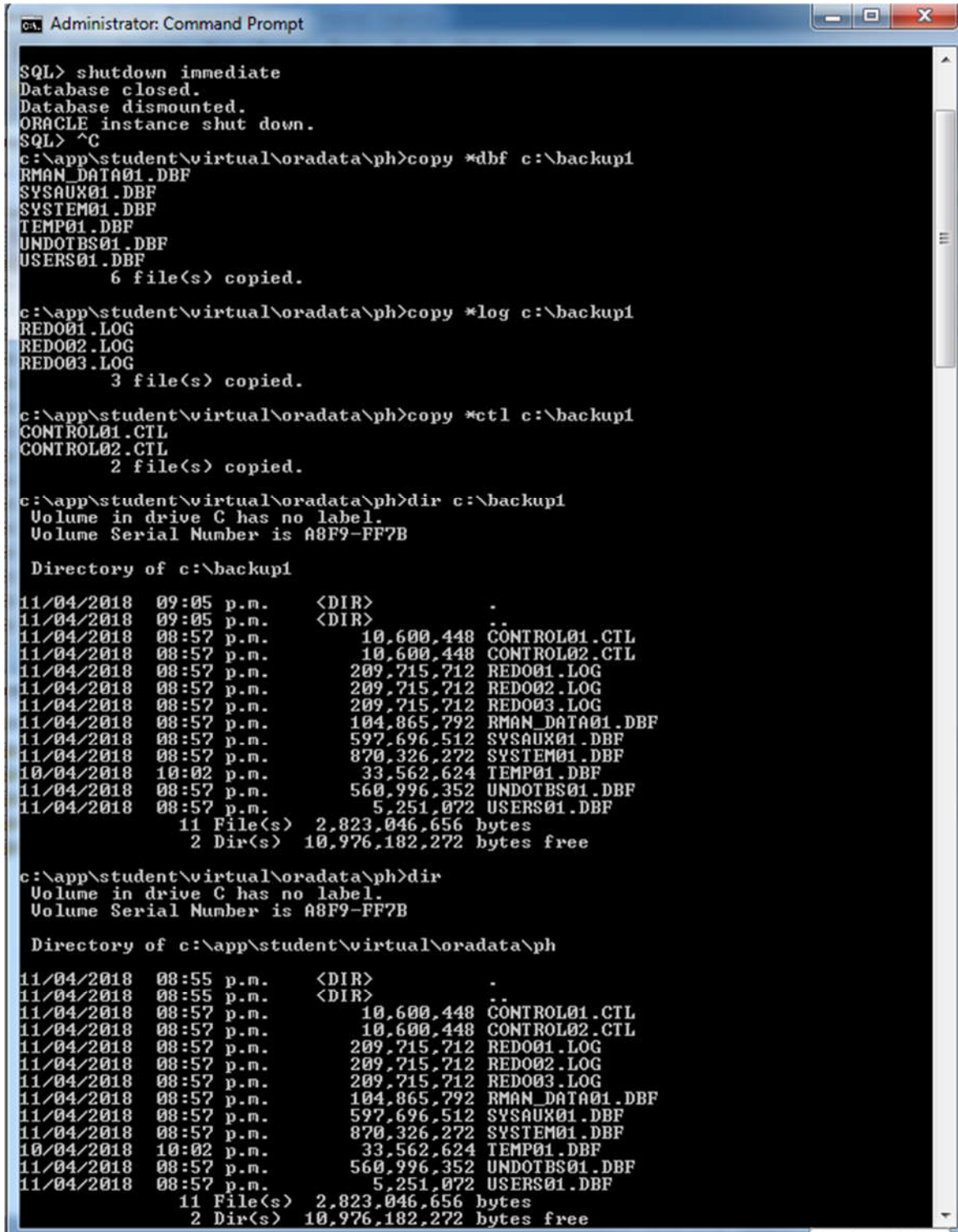
Name	Status	Member Count	Archived	Size	Sequence	First Change Number	File Directory
Redo Log Group 1	Current	2		400MB	15	3074315	
REDO111.LOG				200MB			C:\APP\STUDENT\VIRTUAL\ORADATA\PH\
REDO112				200MB			C:\APP\STUDENT\VIRTUAL\ORADATA\PH\
Redo Log Group 2	Inactive	2	✓	400MB	17	2946110	
REDO201.LOG				200MB			C:\APP\STUDENT\VIRTUAL\ORADATA\PH\
REDO202				200MB			C:\APP\STUDENT\VIRTUAL\ORADATA\PH\
Redo Log Group 3	Active	2	✓	400MB	18	3068955	
REDO301.LOG				200MB			C:\APP\STUDENT\VIRTUAL\ORADATA\PH\
REDO302				200MB			C:\APP\STUDENT\VIRTUAL\ORADATA\PH\

Figure 18: Multiplexing of control and redo log files

Recovery

It is obvious that the backup files are located in the maze of folder, therefore, to make it easier to recover the database or the find out these files, backup folder relocation is needed.

In this case new folder called "Backup1" store in C disk will used to contain backup file.



```
Administrator: Command Prompt

SQL> shutdown immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> ^C
c:\app\student\virtual\oradata\ph>copy *dbf c:\backup1
RMAN_DATA01.DBF
SYSAUX01.DBF
SYSTEM01.DBF
TEMP01.DBF
UNDOTBS01.DBF
USERS01.DBF
        6 file(s) copied.

c:\app\student\virtual\oradata\ph>copy *log c:\backup1
REDO01.LOG
REDO02.LOG
REDO03.LOG
        3 file(s) copied.

c:\app\student\virtual\oradata\ph>copy *ctl c:\backup1
CONTROL01.CTL
CONTROL02.CTL
        2 file(s) copied.

c:\app\student\virtual\oradata\ph>dir c:\backup1
Volume in drive C has no label.
Volume Serial Number is A8F9-FF7B

Directory of c:\backup1

11/04/2018  09:05 p.m.      <DIR>          .
11/04/2018  09:05 p.m.      <DIR>          ..
11/04/2018  08:57 p.m.             10,600,448 CONTROL01.CTL
11/04/2018  08:57 p.m.             10,600,448 CONTROL02.CTL
11/04/2018  08:57 p.m.             209,715,712 REDO01.LOG
11/04/2018  08:57 p.m.             209,715,712 REDO02.LOG
11/04/2018  08:57 p.m.             209,715,712 REDO03.LOG
11/04/2018  08:57 p.m.             104,865,792 RMAN_DATA01.DBF
11/04/2018  08:57 p.m.             597,696,512 SYSAUX01.DBF
11/04/2018  08:57 p.m.             870,326,272 SYSTEM01.DBF
10/04/2018  10:02 p.m.             33,562,624 TEMP01.DBF
11/04/2018  08:57 p.m.             560,996,352 UNDOTBS01.DBF
11/04/2018  08:57 p.m.              5,251,072 USERS01.DBF
11 File(s)  2,823,046,656 bytes
2 Dir(s)  10,976,182,272 bytes free

c:\app\student\virtual\oradata\ph>dir
Volume in drive C has no label.
Volume Serial Number is A8F9-FF7B

Directory of c:\app\student\virtual\oradata\ph

11/04/2018  08:55 p.m.      <DIR>          .
11/04/2018  08:55 p.m.      <DIR>          ..
11/04/2018  08:57 p.m.             10,600,448 CONTROL01.CTL
11/04/2018  08:57 p.m.             10,600,448 CONTROL02.CTL
11/04/2018  08:57 p.m.             209,715,712 REDO01.LOG
11/04/2018  08:57 p.m.             209,715,712 REDO02.LOG
11/04/2018  08:57 p.m.             209,715,712 REDO03.LOG
11/04/2018  08:57 p.m.             104,865,792 RMAN_DATA01.DBF
11/04/2018  08:57 p.m.             597,696,512 SYSAUX01.DBF
11/04/2018  08:57 p.m.             870,326,272 SYSTEM01.DBF
10/04/2018  10:02 p.m.             33,562,624 TEMP01.DBF
11/04/2018  08:57 p.m.             560,996,352 UNDOTBS01.DBF
11/04/2018  08:57 p.m.              5,251,072 USERS01.DBF
11 File(s)  2,823,046,656 bytes
2 Dir(s)  10,976,182,272 bytes free
```

Figure 19: copy file from original folder to new backup folder

```

c:\app\student\virtual\oradata\ph>del *
c:\app\student\virtual\oradata\ph\*, Are you sure (Y/N)? y

c:\app\student\virtual\oradata\ph>dir
Volume in drive C has no label.
Volume Serial Number is A8F9-FF7B

Directory of c:\app\student\virtual\oradata\ph

11/04/2018  09:12 p.m.      <DIR>          .
11/04/2018  09:12 p.m.      <DIR>          ..
               0 File(s)                0 bytes
               2 Dir(s)  13,798,715,392 bytes free

c:\app\student\virtual\oradata\ph>sqlplus / as sysdba

SQL*Plus: Release 12.2.0.1.0 Production on Wed Apr 11 21:13:03 2018

Copyright (c) 1982, 2016, Oracle.  All rights reserved.

Connected to an idle instance.

SQL> startup;
ORACLE instance started.

Total System Global Area 2583691264 bytes
Fixed Size                  8750160 bytes
Variable Size               687868848 bytes
Database Buffers           1879048192 bytes
Redo Buffers                 8024064 bytes
ORA-00205: error in identifying control file, check alert log for more info

SQL> _

```

Figure 20: Delete database and start the system

For the cold backup, connect must be shutdown first then we backup the database with the same code as hot backup then copy those files (database, control files, logs) to new locations.

After that, original database will be deleted and start up the system. Due to the lost of control file, system can not start.


```
Administrator: Command Prompt - sqlplus / as sysdba
SQL> shutdown immediate
ORA-01507: database not mounted

ORACLE instance shut down.
SQL> ^C
c:\app\student\virtual\oradata\ph>copy c:\backup1\*.
c:\backup1\*.
The system cannot find the file specified.
0 file(s) copied.

c:\app\student\virtual\oradata\ph>copy c:\backup1\* .
c:\backup1\CONTROL01.CTL
c:\backup1\CONTROL02.CTL
c:\backup1\REDO01.LOG
c:\backup1\REDO02.LOG
c:\backup1\REDO03.LOG
c:\backup1\RMAN_DATA01.DBF
c:\backup1\SYSAUX01.DBF
c:\backup1\SYSTEM01.DBF
c:\backup1\TEMP01.DBF
c:\backup1\UNDOTBS01.DBF
c:\backup1\USERS01.DBF
11 file(s) copied.

c:\app\student\virtual\oradata\ph>dir
Volume in drive C has no label.
Volume Serial Number is A8F9-FF7B

Directory of c:\app\student\virtual\oradata\ph

11/04/2018 09:17 p.m. <DIR> .
11/04/2018 09:17 p.m. <DIR> ..
11/04/2018 08:57 p.m. 10,600,448 CONTROL01.CTL
11/04/2018 08:57 p.m. 10,600,448 CONTROL02.CTL
11/04/2018 08:57 p.m. 209,715,712 REDO01.LOG
11/04/2018 08:57 p.m. 209,715,712 REDO02.LOG
11/04/2018 08:57 p.m. 209,715,712 REDO03.LOG
11/04/2018 08:57 p.m. 104,865,792 RMAN_DATA01.DBF
11/04/2018 08:57 p.m. 597,696,512 SYSAUX01.DBF
11/04/2018 08:57 p.m. 870,326,272 SYSTEM01.DBF
10/04/2018 10:02 p.m. 33,562,624 TEMP01.DBF
11/04/2018 08:57 p.m. 560,996,352 UNDOTBS01.DBF
11/04/2018 08:57 p.m. 5,251,072 USERS01.DBF
11 File(s) 2,823,046,656 bytes
2 Dir(s) 10,974,863,360 bytes free

c:\app\student\virtual\oradata\ph>sqlplus / as sysdba

SQL*Plus: Release 12.2.0.1.0 Production on Wed Apr 11 21:18:06 2018

Copyright (c) 1982, 2016, Oracle. All rights reserved.

Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area 2583691264 bytes
Fixed Size 8750160 bytes
Variable Size 687868848 bytes
Database Buffers 1879048192 bytes
Redo Buffers 8024064 bytes
Database mounted.
Database opened.
SQL> _
```

Figure 21: copy back the database - recovery

Before recovering the database, system should be shut down again. Then database import to original folder.

```
Administrator: Command Prompt - sqlplus / as sysdba
SQL> shutdown immediate
ORA-01507: database not mounted

ORACLE instance shut down.
SQL> ^C
c:\app\student\virtual\oradata\ph>copy c:\backup1\*.
c:\backup1\*.
The system cannot find the file specified.
0 file(s) copied.

c:\app\student\virtual\oradata\ph>copy c:\backup1\* .
c:\backup1\CONTROL01.CTL
c:\backup1\CONTROL02.CTL
c:\backup1\REDO01.LOG
c:\backup1\REDO02.LOG
c:\backup1\REDO03.LOG
c:\backup1\RMAN_DATA01.DBF
c:\backup1\SYSAUX01.DBF
c:\backup1\SYSTEM01.DBF
c:\backup1\TEMP01.DBF
c:\backup1\UNDOTBS01.DBF
c:\backup1\USERS01.DBF
11 file(s) copied.

c:\app\student\virtual\oradata\ph>dir
Volume in drive C has no label.
Volume Serial Number is A8F9-FF7B

Directory of c:\app\student\virtual\oradata\ph
11/04/2018 09:17 p.m. <DIR> .
11/04/2018 09:17 p.m. <DIR> ..
11/04/2018 08:57 p.m. 10,600,448 CONTROL01.CTL
11/04/2018 08:57 p.m. 10,600,448 CONTROL02.CTL
11/04/2018 08:57 p.m. 209,715,712 REDO01.LOG
11/04/2018 08:57 p.m. 209,715,712 REDO02.LOG
11/04/2018 08:57 p.m. 209,715,712 REDO03.LOG
11/04/2018 08:57 p.m. 104,865,792 RMAN_DATA01.DBF
11/04/2018 08:57 p.m. 597,696,512 SYSAUX01.DBF
11/04/2018 08:57 p.m. 870,326,272 SYSTEM01.DBF
10/04/2018 10:02 p.m. 33,562,624 TEMP01.DBF
11/04/2018 08:57 p.m. 560,996,352 UNDOTBS01.DBF
11/04/2018 08:57 p.m. 5,251,072 USERS01.DBF
11 File(s) 2,823,046,656 bytes
2 Dir(s) 10,974,863,360 bytes free

c:\app\student\virtual\oradata\ph>sqlplus / as sysdba
SQL*Plus: Release 12.2.0.1.0 Production on Wed Apr 11 21:18:06 2018
Copyright (c) 1982, 2016, Oracle. All rights reserved.
Connected to an idle instance.

SQL> startup
ORACLE instance started.

Total System Global Area 2583691264 bytes
Fixed Size 8750160 bytes
Variable Size 687868848 bytes
Database Buffers 1879048192 bytes
Redo Buffers 8024064 bytes
Database mounted.
Database opened.
SQL> _
```

Figure 22: Database system after recovery

After importing file to main system location, system will start up and can run normally.

10. Audit



```
C:\Users\student>sqlplus / as sysdba
SQL*Plus: Release 12.2.0.1.0 Production on Sat Apr 14 15:05:41 2018
Copyright (c) 1982, 2016, Oracle. All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production
SQL> show parameter audit_trail

NAME                                 TYPE        VALUE
-----
audit_trail                          string      DB
SQL> show parameter audit_file_dest

NAME                                 TYPE        VALUE
-----
audit_file_dest                      string      C:\APP\STUDENT\VIRTUAL\ADMIN\PH\ADUMP
SQL> alter system set audit_trail=DB, extended scope=spfile;
System altered.
SQL> show parameter audit_trail

NAME                                 TYPE        VALUE
-----
audit_trail                          string      DB
SQL> shu immediate
Database closed.
Database dismounted.
ORACLE instance shut down.
SQL> startup
ORACLE instance started.

Total System Global Area 2583691264 bytes
Fixed Size                  8750160 bytes
Variable Size             687868848 bytes
Database Buffers          1879048192 bytes
Redo Buffers                8024064 bytes
Database mounted.
Database opened.
SQL> show parameter audit_trail

NAME                                 TYPE        VALUE
-----
audit_trail                          string      DB, EXTENDED
SQL> audit table;
Audit succeeded.
SQL>
```

Figure 23: set audit data

To make the audit we need to check the parameter by the code:

<Show parameter audit_trail>

As the result, all of them are save in Database – not the specific file then we need to like it to the file to store them.

```
SQL> audit select, update, delete on system.h_patient by access;
Audit succeeded.
SQL> --dba_audit_trail
SQL> desc dba_audit_trail
```

Name	Null?	Type
OS_USERNAME		VARCHAR2(255)
USERNAME		VARCHAR2(128)
USERHOST		VARCHAR2(128)
TERMINAL		VARCHAR2(255)
TIMESTAMP		DATE
OWNER		VARCHAR2(128)
OBJ_NAME		VARCHAR2(128)
ACTION	NOT NULL	NUMBER
ACTION_NAME		VARCHAR2(28)
NEW_OWNER		VARCHAR2(128)
NEW_NAME		VARCHAR2(128)
OBJ_PRIVILEGE		VARCHAR2(32)
SYS_PRIVILEGE		VARCHAR2(40)
ADMIN_OPTION		VARCHAR2(1)
GRANTEE		VARCHAR2(128)
AUDIT_OPTION		VARCHAR2(40)
SES_ACTIONS		VARCHAR2(19)
LOGOFF_TIME		DATE
LOGOFF_LREAD		NUMBER
LOGOFF_PREAD		NUMBER
LOGOFF_LWRITE		NUMBER
LOGOFF_DLOCK		VARCHAR2(40)
COMMENT_TEXT		VARCHAR2(4000)
SESSIONID	NOT NULL	NUMBER
ENTRYID	NOT NULL	NUMBER
STATEMENTID	NOT NULL	NUMBER
RETURNCODE	NOT NULL	NUMBER
PRIV_USED		VARCHAR2(40)
CLIENT_ID		VARCHAR2(128)
ECONTEXT_ID		VARCHAR2(64)
SESSION_CPU		NUMBER
EXTENDED_TIMESTAMP		TIMESTAMP(6) WITH TIME ZONE
PROXY_SESSIONID		NUMBER
GLOBAL_UID		VARCHAR2(32)
INSTANCE_NUMBER		NUMBER
OS_PROCESS		VARCHAR2(16)
TRANSACTIONID		RAW(8)
SCN		NUMBER
SQL_BIND		NVARCHAR2(2000)
SQL_TEXT		NVARCHAR2(2000)
OBJ_EDITION_NAME		VARCHAR2(128)
DBID		NUMBER
RLS_INFO		CLOB
CURRENT_USER		VARCHAR2(128)

```
SQL>
```

Figure 24: check the description of audit table

As is description for the audit table, there are many information will be shown, and not all of them are needed. To make sure it show what we need, we will use *select* query to choose the suitable information. And format them with the format query to make the table in good looking format (with the code: < col [name] format a[column width] >

To reduce the loss of data mostly in the patient table, admission and staff which are usually updating or getting new data. Therefore three tables above are chosen to audit.

```

C:\Users\student>sqlplus / as sysdba

SQL*Plus: Release 12.2.0.1.0 Production on Sun Apr 15 13:05:39 2018
Copyright (c) 1982, 2016, Oracle. All rights reserved.

Connected to:
Oracle Database 12c Enterprise Edition Release 12.2.0.1.0 - 64bit Production
SQL> audit select, update, delete on system.H_Patient by access;
Audit succeeded.
SQL> audit select, update, delete on system.H_Test by access;
Audit succeeded.
SQL> audit select, update, delete on system.H_Staff by access;
Audit succeeded.
SQL> audit select, update, delete on system.H_Admission by access;
Audit succeeded.
SQL>
SQL>
SQL> select os_username, username, timestamp, action_name, sql_text
2         from dba_audit_trail;

```

Figure 26: audit the database activities

```

SQL> col os_username format a25
SQL> col username format a15
SQL> col sql_text format a50
SQL> set lin 200
SQL> set pagesize 200
SQL>
SQL> select os_username, username, timestamp, action_name, sql_text
2         from dba_audit_trail;

```

OS_USERNAME	USERNAME	TIMESTAMP	ACTION_NAME	SQL_TEXT
student	DOCTOR	14-APR-18	SELECT	/* SQL Analyze(28,0) */ select * from system.H_Pa
				tient
student	DOCTOR	14-APR-18	SELECT	select * from system.H_Patient
student	RECEPTION	15-APR-18	SELECT	/* SQL Analyze(274,0) */ select * from SYSTEM.H_P
				ATIENT
student	RECEPTION	15-APR-18	SELECT	select * from SYSTEM.H_PATIENT

```

SQL>

```

Figure 25: audit result

11. Management

11.1. Create partition for table

```
alter table H_staff
```

```
modify
```

```
partition by range(start_date)(  
partition p_staff_s14 values less than(TO_DATE('01-JAN-2015','dd-MON-yyyy')),  
partition p_staff_s15 values less than(TO_DATE('01-JAN-2016','dd-MON-yyyy')),  
partition p_staff_s16 values less than(TO_DATE('01-JAN-2017','dd-MON-yyyy'))  
online;
```

```
alter table H_laboratory
```

```
modify
```

```
partition by list(lab_name)(  
partition p_lab_blockA values ('Xray','Eyes','Teeth','Audiability'),  
partition p_lab_blockB values ('Blood','Urine Analyse','Ultrasonic'),  
partition p_lab_blockC values ('Family planning','Joint','SurgerCTy')  
)  
online;
```

```
alter table H_patient
```

```
modify
```

```
partition by list (gender)  
subpartition by range (age)  
(  
    partition p_patient_m values ('M')  
    (  
        subpartition p_patient_m_kid values less than (18),  
        subpartition p_patient_m_adult values less than (60),  
        subpartition p_patient_m_elder values less than (MAXVALUE)
```

),

partition p_patient_f values ('F')

(

subpartition p_patient_f_kid values less than (18),

subpartition p_patient_f_adult values less than (60),

subpartition p_patient_f_elder values less than (MAXVALUE)

)

) online;

The screenshot shows the Oracle SQL Developer interface. On the left, the 'Connections' pane displays a tree of database objects, including tables like AQ\$_QUEUE_TABLES, AQ\$_QUEUES, AQ\$_SCHEDULES, H_ADMISSION, H_LABORATORY, H_PATIENT, H_STAFF, and H_TEST. The 'H_PATIENT' table is selected, showing its columns: PAT_ID, PAT_NAME, AGE, GENDER, MOBILE_NUMBER, ADDRESS, P_PATIENT_F, and P_PATIENT_M. Below this, the 'Reports' pane shows various report types. The main pane displays the 'Partitions' tab for the 'H_PATIENT' table. It shows a table with columns: PARTITION_NAME, LAST_ANALYZED, NUM_ROWS, BLOCKS, SAMPLE_SIZE, and HIGH_VALUE. The table contains two rows: 1 P_PATIENT_F and 2 P_PATIENT_M. Below this, the 'Subpartitions' tab is visible, showing a table with columns: SUBPARTITION_NAME, LAST_ANALYZED, NUM_ROWS, BLOCKS, SAMPLE_SIZE, and HIGH_VALUE. The table contains three rows: 1 P_PATIENT_F_KID, 2 P_PATIENT_F_ADULT, and 3 P_PATIENT_F_ELDER.

PARTITION_NAME	LAST_ANALYZED	NUM_ROWS	BLOCKS	SAMPLE_SIZE	HIGH_VALUE
1 P_PATIENT_F	14/04/18	3	1	3	'F'
2 P_PATIENT_M	14/04/18	7	1	7	'M'

SUBPARTITION_NAME	LAST_ANALYZED	NUM_ROWS	BLOCKS	SAMPLE_SIZE	HIGH_VALUE
1 P_PATIENT_F_KID	14/04/18	0	0	(null)	18
2 P_PATIENT_F_ADULT	14/04/18	3	1	3	60
3 P_PATIENT_F_ELDER	14/04/18	0	0	(null)	MAXVALUE

Figure 27: H_Patient table after dividing to partitions

PARTITION_NAME	LAST_ANALYZED	NUM_ROWS	BLOCKS	SAMPLE_SIZE	HIGH_VALUE
1 P_STAFF_S14	14/04/18	3	1	3	TO_DATE(' 2015-01-01 00:00:00', 'YYYY-MM-DD HH24:MI:SS', 'NLS_CALENDAR=GREGORIAN')
2 P_STAFF_S15	14/04/18	5	1	5	TO_DATE(' 2016-01-01 00:00:00', 'YYYY-MM-DD HH24:MI:SS', 'NLS_CALENDAR=GREGORIAN')
3 P_STAFF_S16	14/04/18	2	1	2	TO_DATE(' 2017-01-01 00:00:00', 'YYYY-MM-DD HH24:MI:SS', 'NLS_CALENDAR=GREGORIAN')

Figure 28:H_Staff table partitions

PARTITION_NAME	LAST_ANALYZED	NUM_ROWS	BLOCKS	SAMPLE_SIZE	HIGH_VALUE
1 P_LAB_BLOCKA	14/04/18	4	1	4	'Xray', 'Eyes', 'Teeth', 'Aduibility'
2 P_LAB_BLOCKB	14/04/18	3	1	3	'Blood', 'Urine Analyse', 'Ultrasonic'
3 P_LAB_BLOCKC	14/04/18	3	1	3	'Family planning', 'Joint', 'SurgerCTy'

Figure 29:H_Laboratory table partitions

STAFF_ID	STAFF_NAME	WARD_ID	AGE	START_DATE	SALARY	GENDER	PHONE_NUMBER
1	70001 Brienne Tarth	50001	42	22/11/14	27100	F	209856123
2	70004 Davos Seaworth	50005	28	31/01/14	22500	M	226158200
3	70008 Berry Alan	50009	31	27/06/14	27100	M	226582360
4	70000 Will Pham	50002	25	07/01/15	15000	M	226789645
5	70003 Viserys Targaryen	50004	34	17/11/15	22500	M	226158645
6	70005 Samwell Tarly	50006	28	27/08/15	22500	M	226128285
7	70007 Yo Yen	50009	28	17/11/15	22500	M	216170245
8	70009 Ron Potter	50008	25	15/01/15	17400	M	221889485
9	70002 Melisandre	50003	26	20/03/16	13200	F	221682557
10	70006 Phuong Nguyen	50007	22	25/09/16	14500	F	272282557

Figure 30:H_Staff table data grouping

Partitions are use to sub divide data to small part to make it become more logical and easier to manage. In this case:

H_Staff table is divided to three parts by using r.ange partition base on the year of start_date.

H_Laboratory is divided by list partition to three groups

H_Patient partitions is base one gender and age which will used combined partitions of list- range.

11.2. Adding audit trigger

```
CREATE TABLE SAL_LOG (  
    USERNAME_ID NUMBER(8,0) NOT NULL,  
    USERNAME_P VARCHAR2(50 BYTE) NOT NULL,  
    ACTION_DATE DATE,  
    OLD_SAL VARCHAR2(50 BYTE) NOT NULL,  
    NEW_SAL VARCHAR2(50 BYTE) NOT NULL  
);
```

```
create or replace trigger Salary_Audit_Gen  
after update of Salary on H_Staff  
for each row  
begin  
    insert into Sal_Log (Username_id, USERNAME_P, Action_date, Old_sal, New_sal)  
    values (:old.staff_ID, user, SYSDATE, :old.staff_Salary, :new.staff_salary);  
End;
```

11.4. Create views

```
CREATE VIEW test_view AS

SELECT t_id, t_name, lab_name, pat_name

FROM h_test , h_laboratory, h_patient

where h_test.lab_id = h_laboratory.lab_id

and h_test.pat_id = h_patient.pat_id

with read only;
```

```
CREATE VIEW admission_view AS

SELECT admission_id, ward_name, pat_name

FROM h_admission , h_ward, h_patient

where h_admission.ward_id = h_ward.ward_id

and h_admission.pat_id = h_patient.pat_id

with read only;
```

```
CREATE VIEW staff_view AS

SELECT staff_id, staff_name, ward_name, age, start_date, salary, gender, phone_number

FROM h_staff, h_ward

where h_ward.WARD_ID = h_staff.ward_id

with read only;
```

```
grant SELECT on "SYSTEM"."ADMISSION_VIEW" to "RECEPTION";

grant SELECT on "SYSTEM"."TEST_VIEW" to "RECEPTION";
```

```
grant SELECT on "SYSTEM"."ADMISSION_VIEW" to "DOCTOR";

grant SELECT on "SYSTEM"."TEST_VIEW" to "DOCTOR";
```

```
grant SELECT on "SYSTEM"."ADMISSION_VIEW" to "DBADMIN";

grant SELECT on "SYSTEM"."TEST_VIEW" to "DBADMIN";

grant SELECT on "SYSTEM"."STAFF_VIEW" to "DBADMIN";
```

To make it secure, just few user can be able to read the tables and the rest should be see the filter view (which is what the database designer want them to see). Show we create the view then share it (grant the select) to the specific user. Some way, view make it easier for user to understand the information.

11.4. OS authentication

```
create role report;
```

```
grant SELECT ANY DICTIONARY to "REPORT";
```

```
grant SELECT ANY TABLE to "REPORT";
```

```
grant SELECT on "SYSTEM"."H_TEST" to "REPORT";
```

```
grant SELECT on "SYSTEM"."H_ADMISSION" to "REPORT";
```

```
grant SELECT on "SYSTEM"."H_LABORATORY" to "REPORT";
```

```
grant SELECT on "SYSTEM"."H_STAFF" to "REPORT";
```

```
grant SELECT on "SYSTEM"."H_PATIENT" to "REPORT";
```

```
grant SELECT on "SYSTEM"."H_WARD" to "REPORT";
```

```
grant READ on "SYSTEM"."H_TEST" to "REPORT";
```

```
grant READ on "SYSTEM"."H_ADMISSION" to "REPORT";
```

```
grant READ on "SYSTEM"."H_LABORATORY" to "REPORT";
```

```
grant READ on "SYSTEM"."H_STAFF" to "REPORT";
```

```
grant READ on "SYSTEM"."H_PATIENT" to "REPORT";
```

```
grant READ on "SYSTEM"."H_WARD" to "REPORT";
```

```
commit;
```

For this section, 'report' role is create to illustrate next activities.

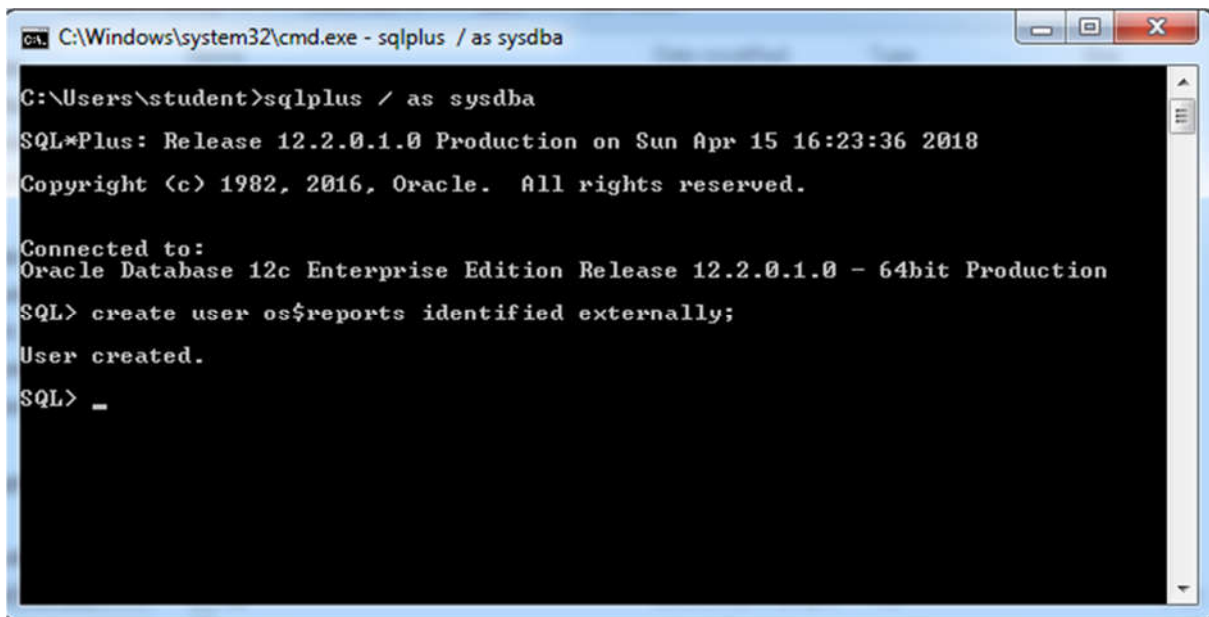


Figure 31: create external user

For the local machine, mostly users are local, however, we can create some external user by the code in figure 31.

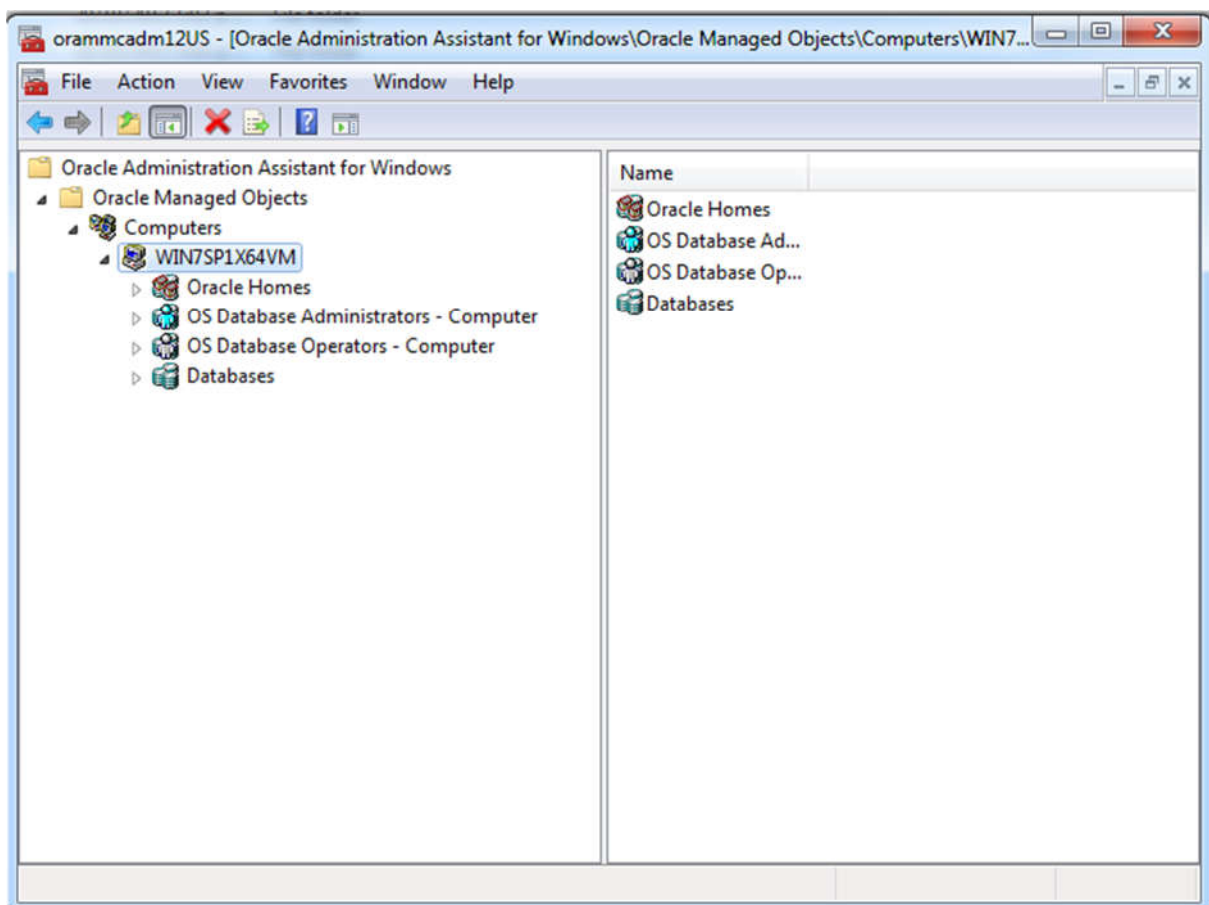


Figure 32: OS authentication – Administration assistant

Open Administration assistant for Window can help administrator quickly create role, grant the privileges, or manage the system(Figure 32).

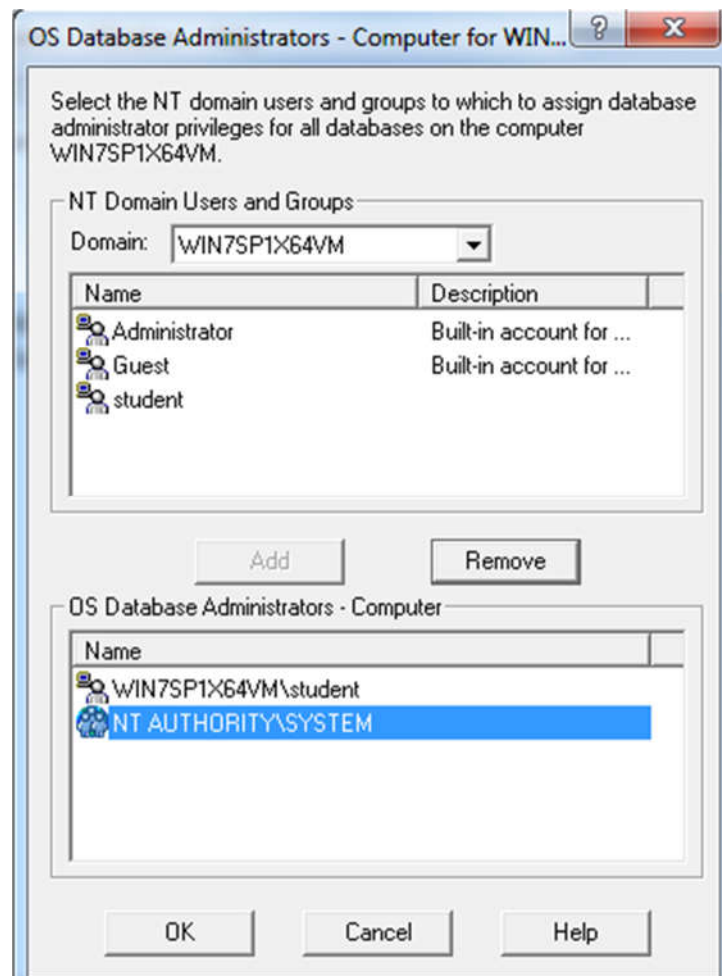


Figure 33: Granting administrator privileges for all databases on computer – OS Database Operator

We can also grant role to external users, however in this case there is the problem, it may resulted in the choosing class.

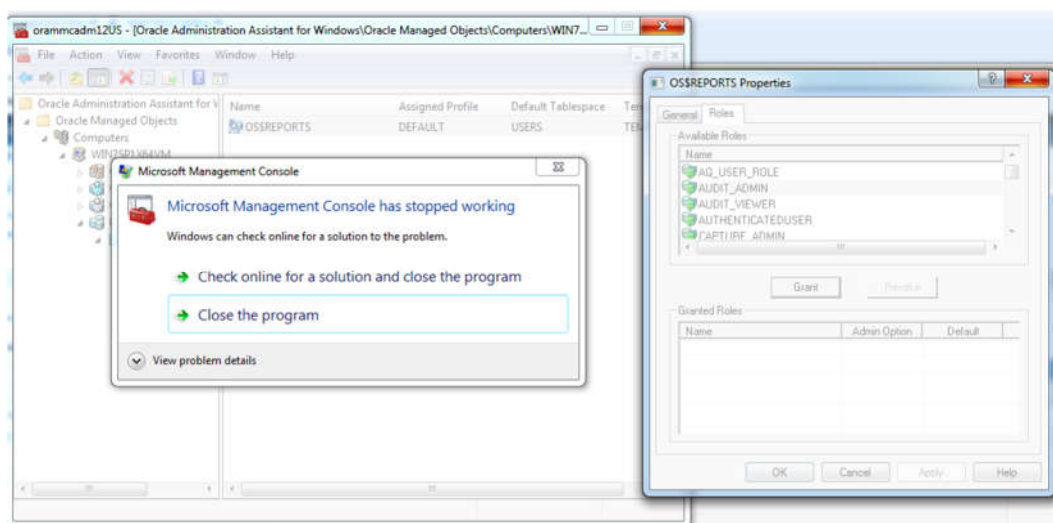


Figure 34: grant the role for external user.

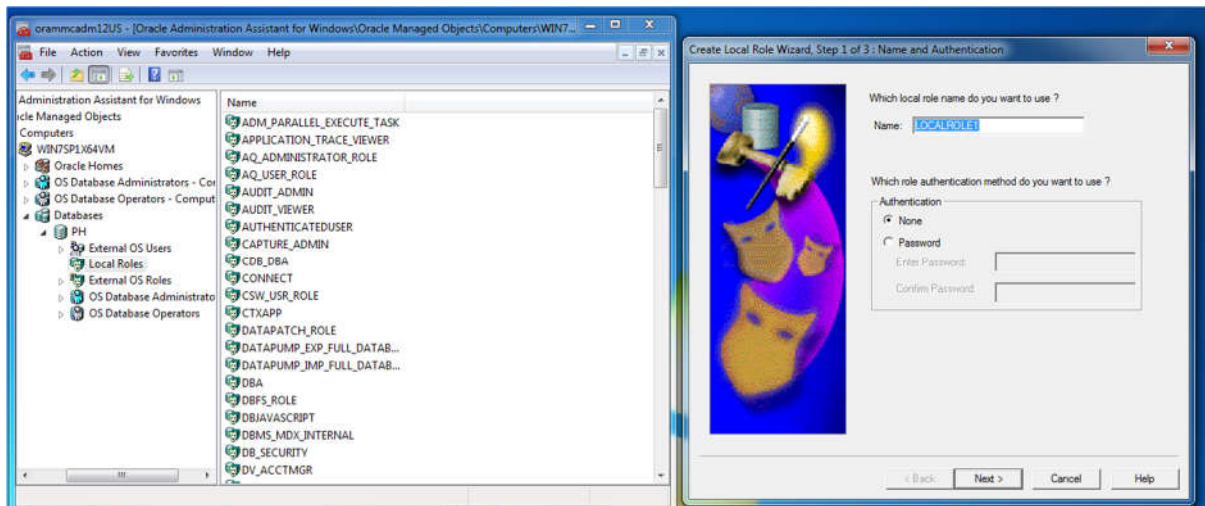


Figure 35: Create local user

As mention before this application can help administrator to create user (Figure 35), grant privileges, roles,(Figure 36 - 37)

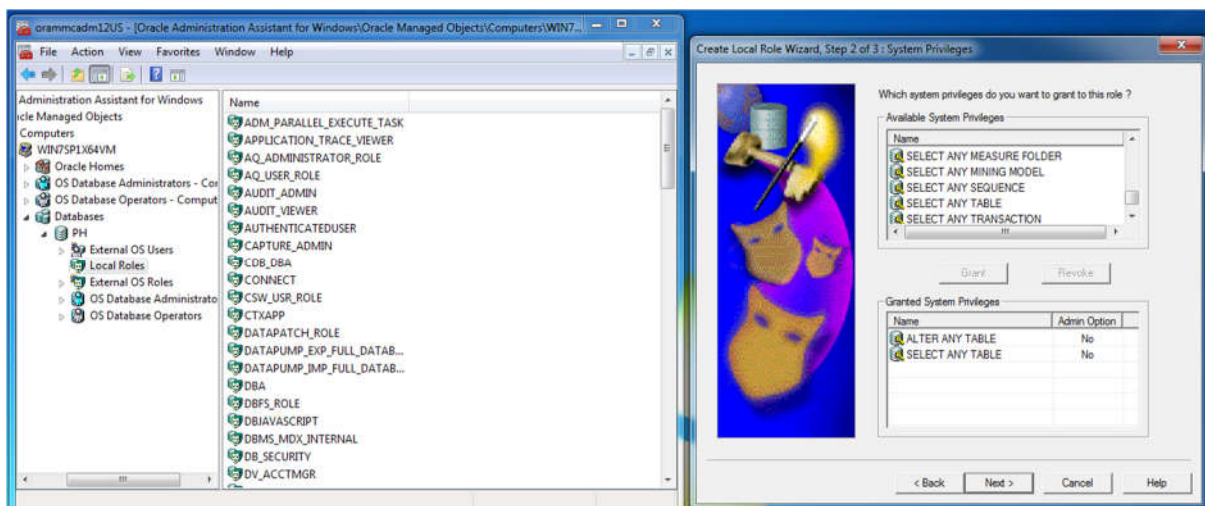


Figure 36: grant privileges

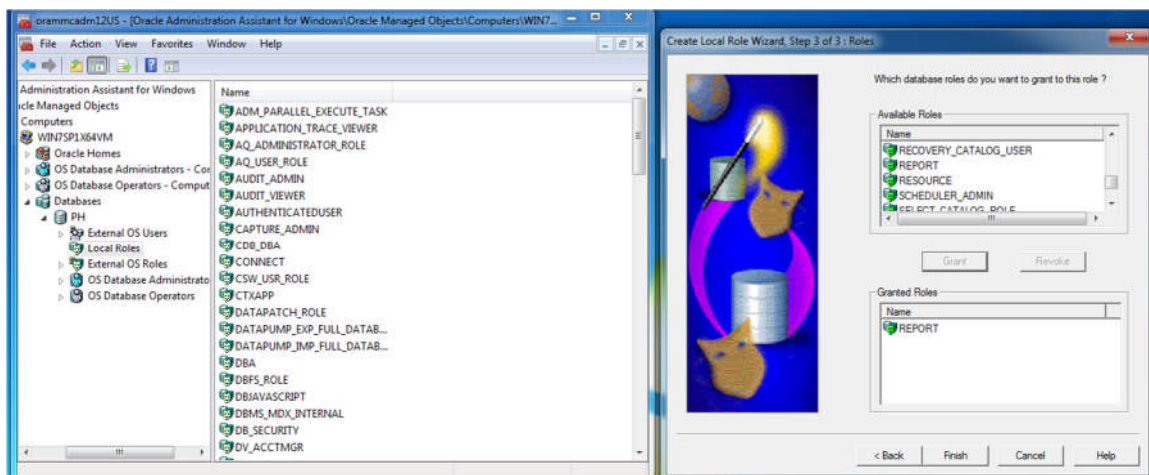


Figure 37: grant role

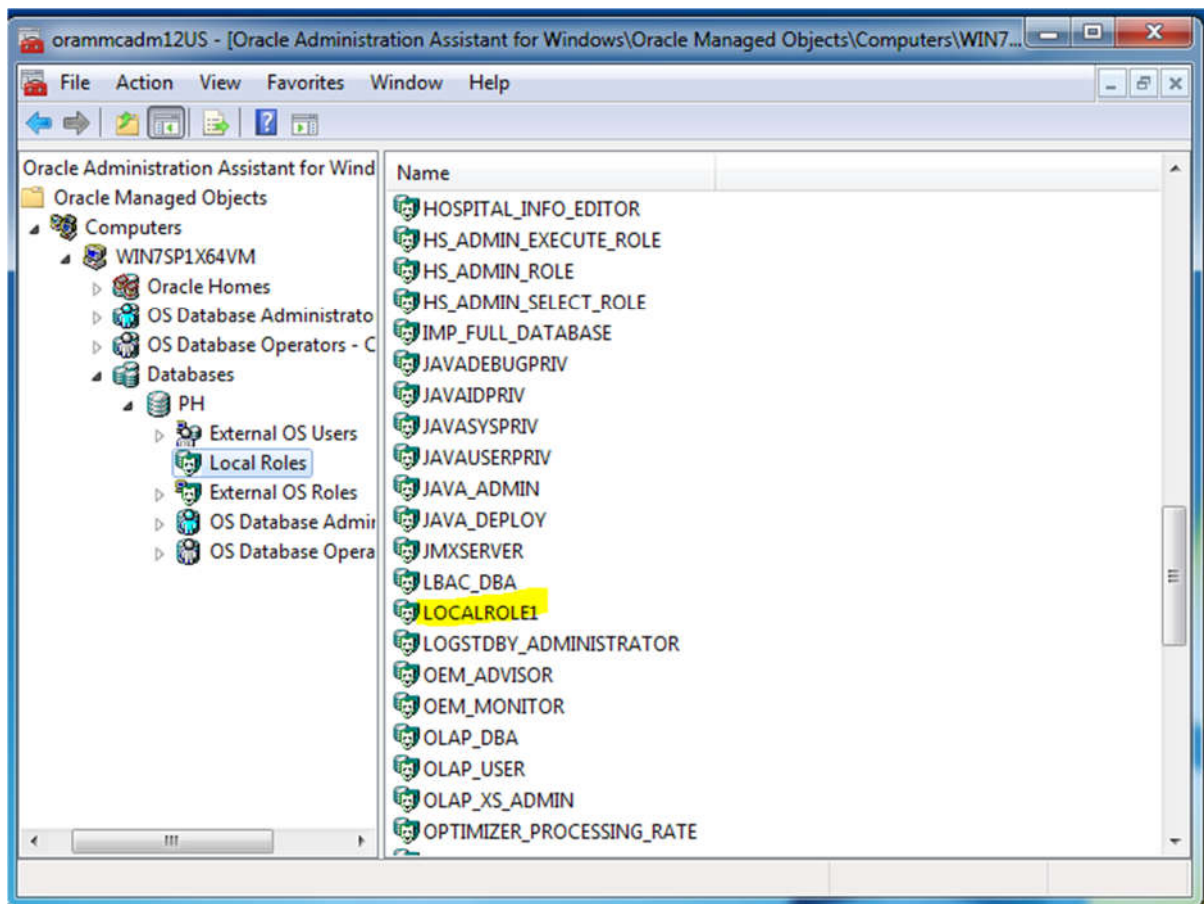


Figure 38: Local user created

11.5. Export XML code for database

To export the XML code, all user need is clicking (left-click) on the table name in dictionary and choose export. Change format to xml, untick the option export DDL.

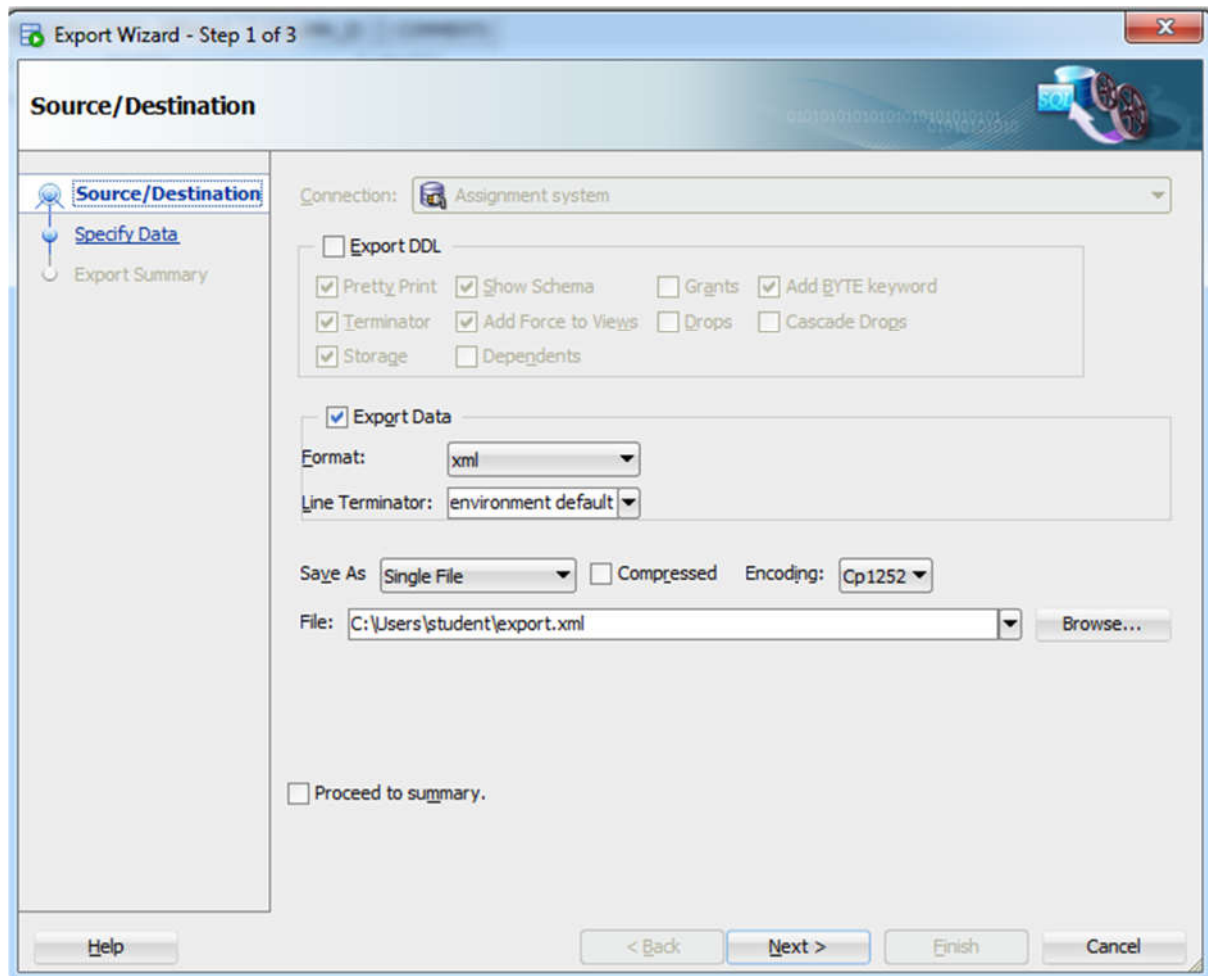


Figure 39: Export xml code

File is saved in the File box in the first step.

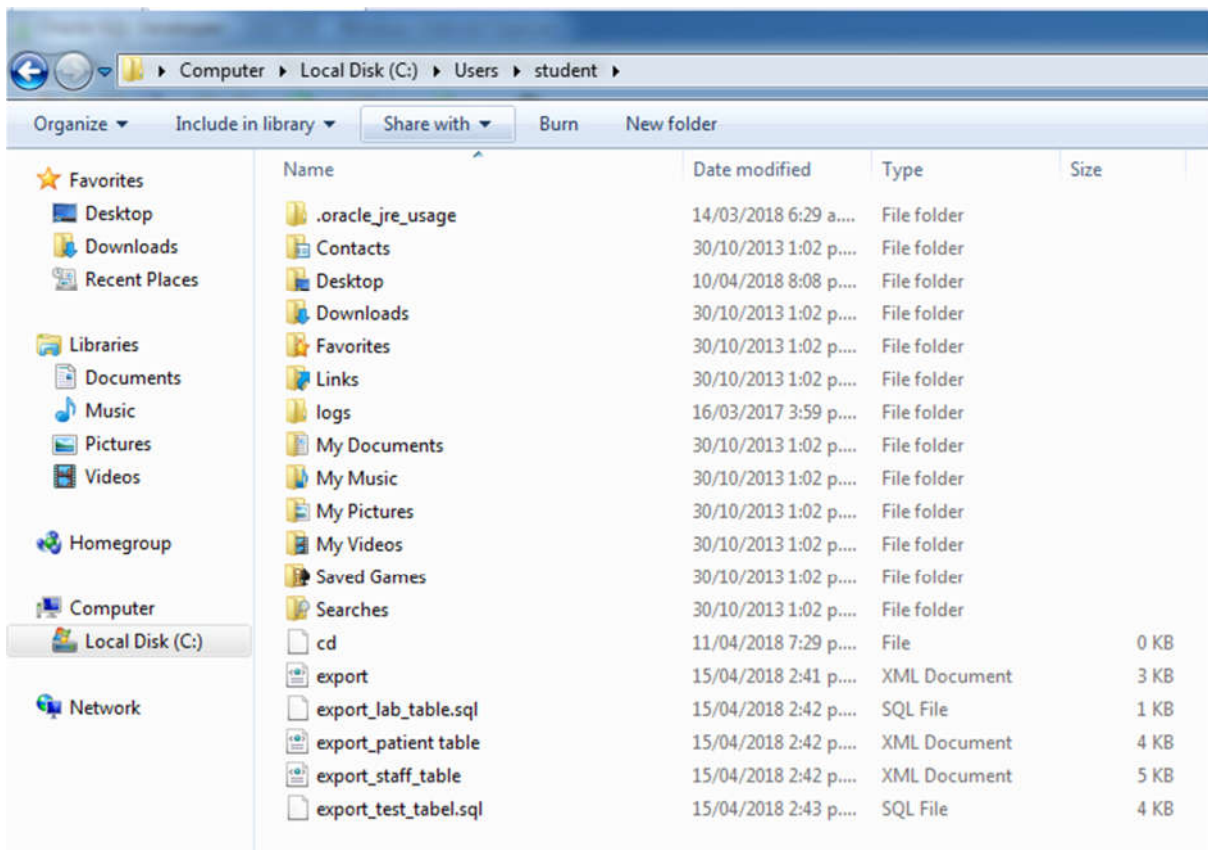


Figure 40: File destination


```

<?xml version='1.0' encoding='Cp1252' ?>
<RESULTS>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30000]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Jorah Mormont]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[40]]></COLUMN>
    <COLUMN NAME="GENDER"><![CDATA[M]]></COLUMN>
    <COLUMN NAME="MOBILE_NUMBER"><![CDATA[0213789422]]></COLUMN>
    <COLUMN NAME="ADDRESS"><![CDATA[Upper Hutt]]></COLUMN>
  </ROW>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30002]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Joffrey Baratheon]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[20]]></COLUMN>
    <COLUMN NAME="GENDER"><![CDATA[M]]></COLUMN>
    <COLUMN NAME="MOBILE_NUMBER"><![CDATA[0225824782]]></COLUMN>
    <COLUMN NAME="ADDRESS"><![CDATA[King Landing]]></COLUMN>
  </ROW>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30003]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Jon Snow]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[30]]></COLUMN>
    <COLUMN NAME="GENDER"><![CDATA[M]]></COLUMN>
    <COLUMN NAME="MOBILE_NUMBER"><![CDATA[0216163402]]></COLUMN>
    <COLUMN NAME="ADDRESS"><![CDATA[Winterfell]]></COLUMN>
  </ROW>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30004]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Kal Drogo]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[37]]></COLUMN>
    <COLUMN NAME="GENDER"><![CDATA[M]]></COLUMN>
    <COLUMN NAME="MOBILE_NUMBER"><![CDATA[0225874782]]></COLUMN>
    <COLUMN NAME="ADDRESS"><![CDATA[Essos]]></COLUMN>
  </ROW>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30005]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Arya Stark]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[18]]></COLUMN>
    <COLUMN NAME="GENDER"><![CDATA[M]]></COLUMN>
    <COLUMN NAME="MOBILE_NUMBER"><![CDATA[0225814862]]></COLUMN>
    <COLUMN NAME="ADDRESS"><![CDATA[kelson]]></COLUMN>
  </ROW>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30006]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Theon Greyjoy]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[28]]></COLUMN>
    <COLUMN NAME="GENDER"><![CDATA[M]]></COLUMN>
    <COLUMN NAME="MOBILE_NUMBER"><![CDATA[0225880962]]></COLUMN>
    <COLUMN NAME="ADDRESS"><![CDATA[Koro Koro]]></COLUMN>
  </ROW>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30008]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Christian Grey]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[31]]></COLUMN>
    <COLUMN NAME="GENDER"><![CDATA[M]]></COLUMN>
    <COLUMN NAME="MOBILE_NUMBER"><![CDATA[0225634862]]></COLUMN>
    <COLUMN NAME="ADDRESS"><![CDATA[Dragon Stone]]></COLUMN>
  </ROW>
  <ROW>
    <COLUMN NAME="PAT_ID"><![CDATA[30001]]></COLUMN>
    <COLUMN NAME="PAT_NAME"><![CDATA[Cersei Lannister]]></COLUMN>
    <COLUMN NAME="AGE"><![CDATA[38]]></COLUMN>
  </ROW>

```

Figure 41: XML code form table