DELHI TECHNOLOGICAL UNIVERSITY

DATABASE MANAGEMENT SYSTEM
MC - 302

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2K17/MC/087

DELHI TECHNOLOGICAL UNIVERSITY

VISION

TO BE A WORLD CLASS UNIVERSITY THROUGH EDUCATION, INNOVATION AND RESEARCH FOR THE SERVICE OF HUMANITY.

MISSION

- ✦ TO ESTABLISH CENTRES OF EXCELLENCE IN EMERGING AREAS OF SCIENCE, ENGINEERING, TECHNOLOGY, MANAGEMENT AND ALLIED AREAS.
- ✦ TO FOSTER AN ECOSYSTEM FOR INCUBATION, PRODUCT DEVELOPMENT, TRANSFER OF TECHNOLOGY AND ENTREPRENEURSHIP.
- ✦ TO CREATE ENVIRONMENT OF COLLABORATION, EXPERIMENTATION, IMAGINATION AND CREATIVITY.
- ✦ TO DEVELOP HUMAN POTENTIAL WITH ANALYTICAL ABILITIES, ETHICS AND INTEGRITY.
- ✦ TO PROVIDE ENVIRONMENT FRIENDLY, REASONABLE AND SUSTAINABLE SOLUTIONS FOR LOCAL AND GLOBAL NEEDS.

DEPARTMENT OF APPLIED MATHEMATICS

VISION

TO EMERGE AS A CENTRE OF EXCELLENCE AND EMINENCE BY IMPARTING FUTURISTIC TECHNICAL EDUCATION WITH SOLID MATHEMATICAL BACKGROUND IN KEEPING WITH GLOBAL STANDARDS, MAKING OUR STUDENTS TECHNOLOGICALLY AND MATHEMATICALLY COMPETENT AND ETHICALLY STRONG SO THAT THEY CAN READILY CONTRIBUTE TO THE RAPID ADVANCEMENT OF SOCIETY AND MANKIND

MISSION

- TO ACHIEVE ACADEMIC EXCELLENCE THROUGH INNOVATIVE TEACHING AND LEARNING PRACTICES.
- TO IMPROVE THE RESEARCH COMPETENCE TO ADDRESS SOCIAL NEEDS.
- TO INCULCATE A CULTURE THAT SUPPORTS AND REINFORCES ETHICAL, PROFESSIONAL BEHAVIOURS FOR A HARMONIOUS AND PROSPEROUS SOCIETY.
- STRIVE TO MAKE STUDENTS TO UNDERSTAND, APPRECIATE AND GAIN MATHEMATICAL SKILLS AND DEVELOP LOGIC, SO THAT THEY ARE ABLE TO CONTRIBUTE INTELLIGENTLY IN DECISION MAKING WHICH CHARACTERISES OUR SCIENTIFIC AND TECHNOLOGICAL AGE.

PROGRAMME EDUCATIONAL OUTCOMES

- ✦ TO PREPARE GRADUATES WITH A SOLID FOUNDATION IN ENGINEERING, MATHEMATICAL SCIENCE AND TECHNOLOGY FOR A SUCCESSFUL CAREER IN MATHEMATICS AND COMPUTING / FINANCE / COMPUTER ENGINEERING FIELDS.
- ✦ TO PREPARE GRADUATES TO BECOME EFFECTIVE COLLABORATORS / INNOVATORS, WHO COULD ABLY ADDRESS TOMORROW'S SOCIAL, TECHNICAL AND ENGINEERING CHALLENGES.
- ✦ TO ENRICH GRADUATES WITH INTEGRITY AND ETHICAL VALUES SO THAT THEY BECOME RESPONSIBLE ENGINEERS.

PROGRAMME OUTCOMES

The POs are defined in line with the graduate attributes set by NBA.

- ✦ ENGINEERING KNOWLEDGE: THE GRADUATE OF MATHEMATICS & COMPUTING MUST HAVE AN ABILITY TO APPLY KNOWLEDGE OF MATHEMATICS, BASIC SCIENCE AND COMPUTER SCIENCE TO SOLVE ENGINEERING AND RELATED PROBLEMS.
- ✦ PROBLEM ANALYSIS: AN ABILITY TO IDENTIFY, ANALYZE AND FORMULATE COMPLEX ENGINEERING PROBLEMS TO REACH LOGICAL CONCLUSION.
- ✦ DESIGN/DEVELOPMENT OF SOLUTION: AN ABILITY TO DESIGN AND CONDUCT EXPERIMENTS, ANALYZE AND INTERPRET THE DATA.
- ✦ CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS: AN ABILITY TO USE RESEARCH BASED KNOWLEDGE AND APPLY RESEARCH METHODS TO PROVIDE VALID CONCLUSION.
- ✦ MODERN TOOL USAGES: AN ABILITY TO CREATE, SELECT AND IMPLEMENT APPROPRIATE TECHNIQUES, SUCH AS ARTIFICIAL INTELLIGENCE, NEURAL NETWORK TO MODEL COMPLEX COMPUTER ENGINEERING ACTIVITY.
- ✦ THE ENGINEER AND SOCIETY: AN ABILITY TO EXPLORE THE IMPACT OF ENGINEERING SOLUTIONS ON THE SOCIETY AND ALSO ON CONTEMPORARY ISSUES ON SOCIETAL AND ENVIRONMENTAL CONTEXT.
- ✦ ENVIRONMENT AND SUSTAINABILITY: AN ABILITY TO DESIGN A FEASIBLE SYSTEM, COMPONENT OR PROCESS WITHOUT VIOLATING NORMS FOR PUBLIC HEALTH AND SAFETY, CULTURAL, SOCIAL AND ENVIRONMENTAL ISSUES.
- ✦ EITHICS: AN ABILITY TO UNDERSTAND AND PRACTICE PROFESSIONAL AND ETHICAL RESPONSIBILITIES. 9. INDIVIDUAL AND TEAM WORKS : AN ABILITY TO FUNCTION EFFECTIVELY AS AN INTEGRAL MEMBER OR A LEADER IN A MULTIDISCIPLINARY TEAM.
- ✦ COMMUNICATION: AN ABILITY TO COMMUNICATE EFFECTIVELY IN BOTH ORAL AND WRITTEN FORM FOR EFFECTIVE TECHNICAL DECISION MAKING, REPORT MAKING AND PRESENTATION.
- ✦ PROJECT MANAGEMENT AND FINANCE: AN ABILITY TO DEMONSTRATE PRINCIPLE OF MANAGEMENT AND APPLY THEM TO SUITABLE PROJECTS.
- ✦ LIFE LONG LEARNING: AN ABILITY TO RECOGNIZE THE NEED FOR AND TO READY FOR LIFE LONG LEARNING TO KEEP UPDATED ON TECHNOLOGICAL CHANGES.

INDEX

Practical 1: Synopsis and ER Diagram

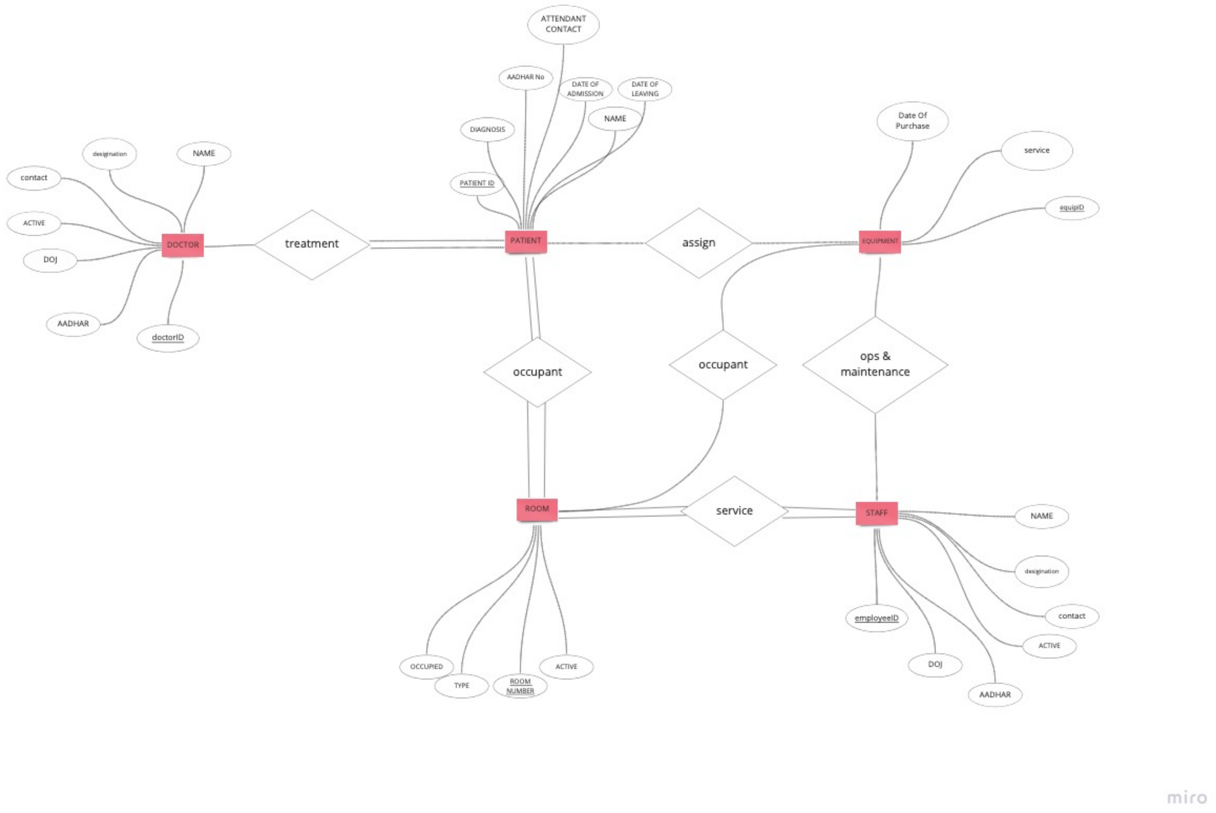
SYNOPSIS
Title - HOSPITAL MANAGEMENT SYSTEM

The DBMS lab project being chosen is intended for the efficient and effective management of a given hospital system. A hospital management system (HMS) is a Database management system that facilitates managing the functioning of the hospital or any medical set up. This system or software will help in making the whole functioning paperless. The hospital records management software keeps a track of all the operations, stores the users' data, performs its query and generates documentation when required.

Such a system can be integrated for storing & processing information for managing all aspects of a hospital's operations such as medical, financial, administrative, legal, and compliance. It may also include electronic health records, business intelligence, and revenue cycle management so some details of the features supported are listed below:-

1. Maintaining a record of all doctors and staff of the hospital, including their rank and role in the organization.
2. Maintaining a record of all rooms, Machines and life-saving equipment in the hospital.
3. Record keeping of all patients visiting the hospital and details of their treatment and status of being admitted.
4. Maintaining a record of which equipment was utilized during the treatment of which patient.
5. Maintaining details of staff assigned to a room or equipment for cleaning and assisting respectively.
6. Details of list Doctors and shift of doctors assigned to a patient and same for hospital staff.

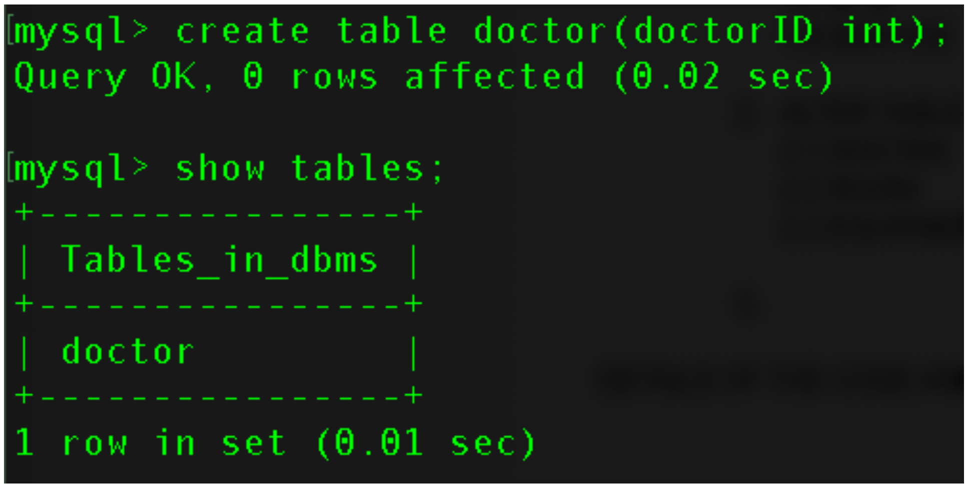
Entity - Relation Diagram



Practical 2: To implement DDL statements

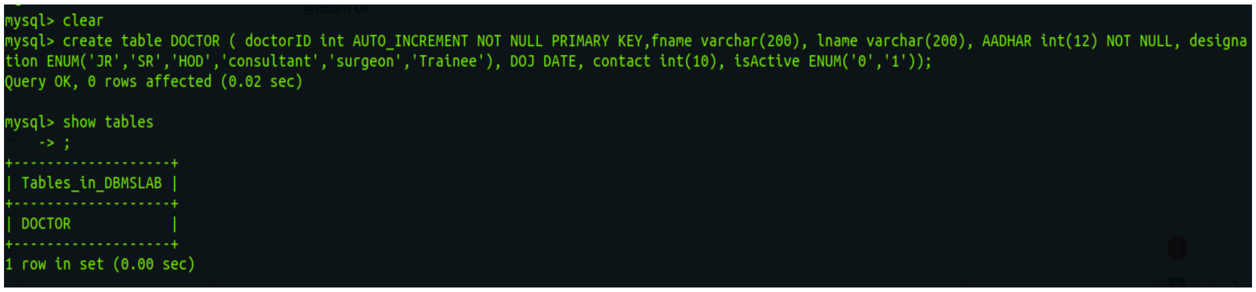
1. CREATE
2. CREATE with constraints
3. ALTER TABLE (with all constraints)
4. DROP TABLE

CREATE TABLE
CREATE TABLE DOCTOR(docterID int);



```
mysql> create table doctor(doctorID int);
Query OK, 0 rows affected (0.02 sec)

mysql> show tables;
+-----------------+
| Tables_in_dbms |
+-----------------+
| doctor          |
+-----------------+
1 row in set (0.01 sec)
```

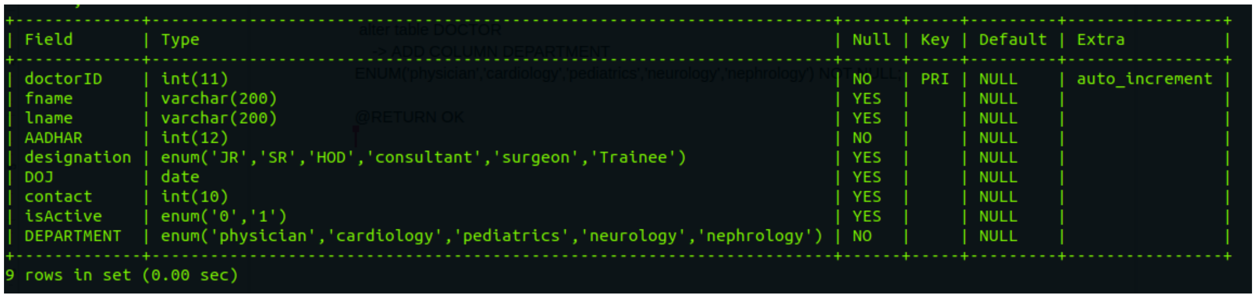
CREATE with CONSTRAINTS
CREATE TABLE DOCTOR (doctorID int AUTO_INCREMENT NOT NULL PRIMARY KEY,fname varchar(200), lname varchar(200), AADHAR int(12) NOT NULL, designation ENUM('JR','SR','HOD','consultant','surgeon','Trainee'), DOJ DATE, contact int(10), isActive ENUM('0','1'));



```
mysql> clear
mysql> create table DOCTOR ( doctorID int AUTO_INCREMENT NOT NULL PRIMARY KEY,fname varchar(200), lname varchar(200), AADHAR int(12) NOT NULL, designa
tion ENUM('JR','SR','HOD','consultant','surgeon','Trainee'), DOJ DATE, contact int(10), isActive ENUM('0','1'));
Query OK, 0 rows affected (0.02 sec)

mysql> show tables
    -> ;
+-------------------+
| Tables_in_DBMSLAB |
+-------------------+
| DOCTOR            |
+-------------------+
1 row in set (0.00 sec)
```

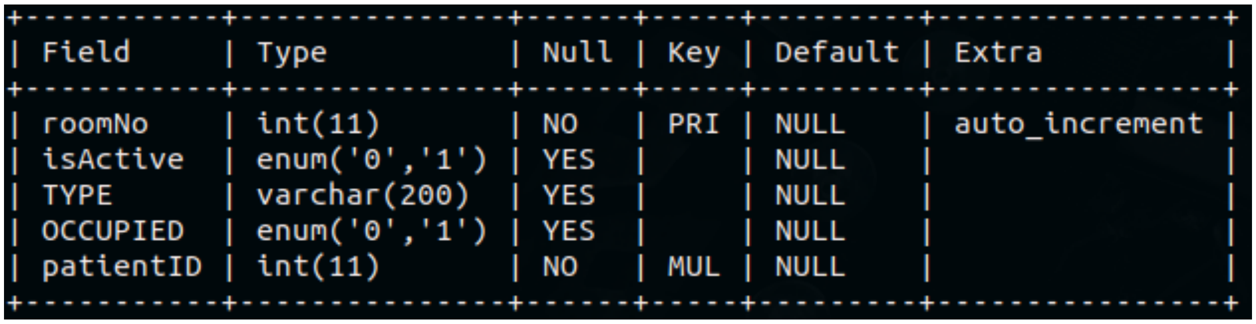
ALTER TABLE

ALTER TABLE DOCTOR ADD COLUMN DEPARTMENT ENUM('physician','cardiology','pediatrics','neurology','nephrology') NOT NULL;



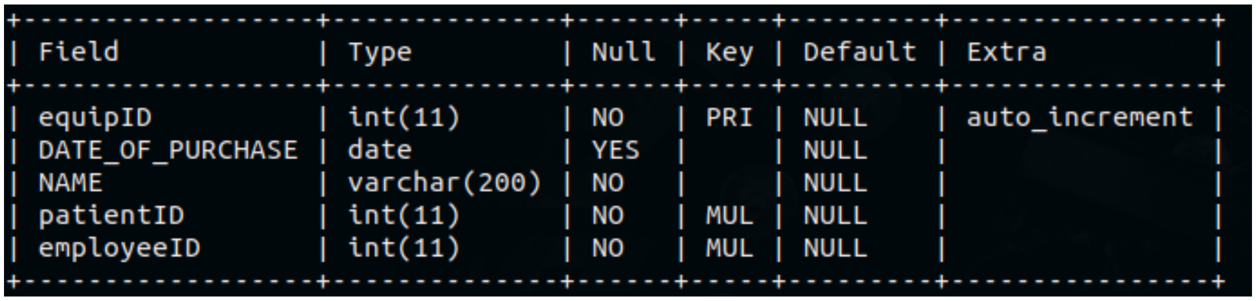
```
+-------------+-----------------------------------------------------------------------+------+-----+---------+----------------+
| Field       | Type                                                                  | Null | Key | Default | Extra          |
+-------------+-----------------------------------------------------------------------+------+-----+---------+----------------+
| doctorID    | int(11)                                                               | NO   | PRI | NULL    | auto_increment |
| fname       | varchar(200)                                                          | YES  |     | NULL    |                |
| lname       | varchar(200)                                                          | YES  |     | NULL    |                |
| AADHAR      | int(12)                                                               | NO   |     | NULL    |                |
| designation | enum('JR','SR','HOD','consultant','surgeon','Trainee')                | YES  |     | NULL    |                |
| DOJ         | date                                                                  | YES  |     | NULL    |                |
| contact     | int(10)                                                               | YES  |     | NULL    |                |
| isActive    | enum('0','1')                                                         | YES  |     | NULL    |                |
| DEPARTMENT  | enum('physician','cardiology','pediatrics','neurology','nephrology') | NO   |     | NULL    |                |
+-------------+-----------------------------------------------------------------------+------+-----+---------+----------------+
9 rows in set (0.00 sec)
```

ALTER TABLE ROOM ADD FOREIGN KEY (patientID) REFERENCES PATIENT(patientID);



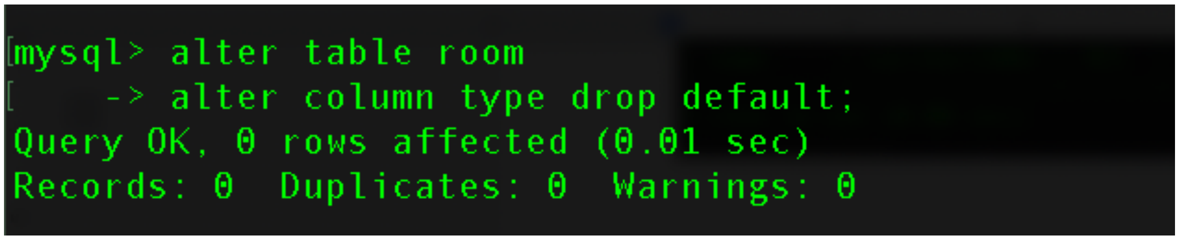
```
+-----------+---------------+------+-----+---------+----------------+
| Field     | Type          | Null | Key | Default | Extra          |
+-----------+---------------+------+-----+---------+----------------+
| roomNo    | int(11)       | NO   | PRI | NULL    | auto_increment |
| isActive  | enum('0','1') | YES  |     | NULL    |                |
| TYPE      | varchar(200)  | YES  |     | NULL    |                |
| OCCUPIED  | enum('0','1') | YES  |     | NULL    |                |
| patientID | int(11)       | NO   | MUL | NULL    |                |
+-----------+---------------+------+-----+---------+----------------+
```

ALTER TABLE EQUIPMENT ADD patientID int NOT NULL;
ALTER TABLE EQUIPMENT ADD employeeID int NOT NULL;
ALTER TABLE EQUIPMENT ADD FOREIGN KEY (patientID) REFERENCES PATIENT(patientID);
ALTER TABLE EQUIPMENT ADD FOREIGN KEY (employeeID) REFERENCES STAFF(employeeID);



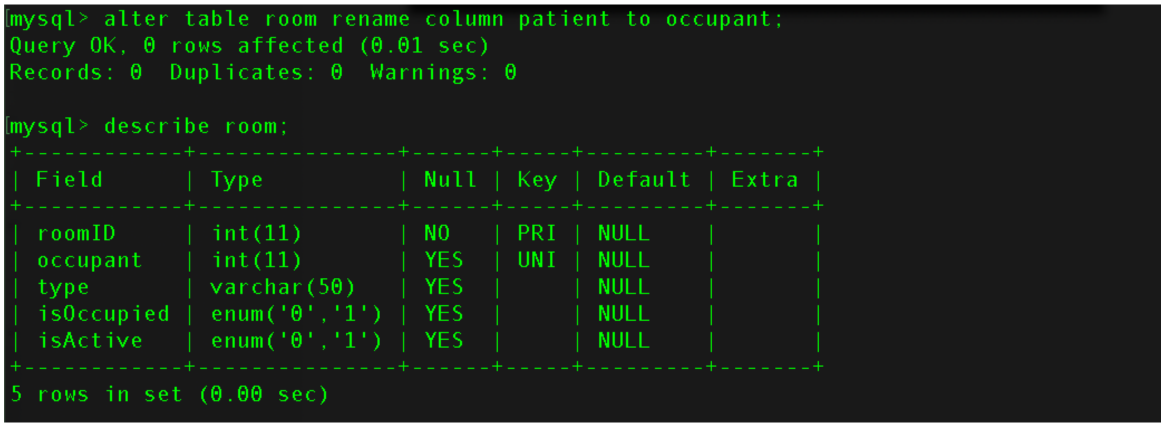
```
+------------------+--------------+------+-----+---------+----------------+
| Field            | Type         | Null | Key | Default | Extra          |
+------------------+--------------+------+-----+---------+----------------+
| equipID          | int(11)      | NO   | PRI | NULL    | auto_increment |
| DATE_OF_PURCHASE | date         | YES  |     | NULL    |                |
| NAME             | varchar(200) | NO   |     | NULL    |                |
| patientID        | int(11)      | NO   | MUL | NULL    |                |
| employeeID       | int(11)      | NO   | MUL | NULL    |                |
+------------------+--------------+------+-----+---------+----------------+
```

ALTER TABLE ROOM ALTER COLUMN TYPE DROP DEFAULT;



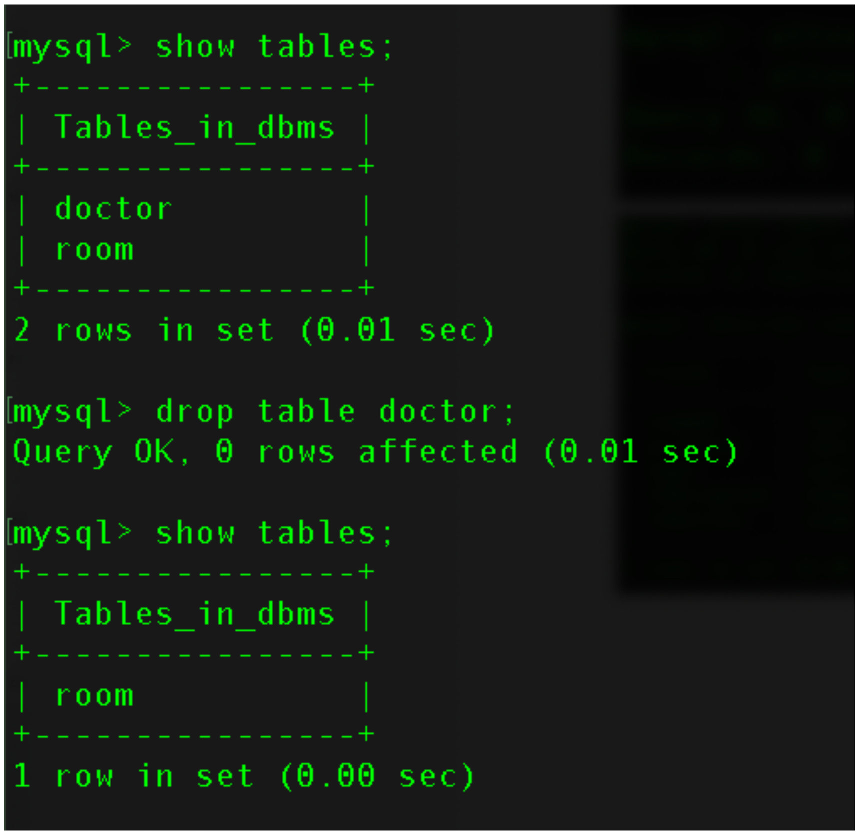
```
mysql> alter table room
    -> alter column type drop default;
Query OK, 0 rows affected (0.01 sec)
Records: 0  Duplicates: 0  Warnings: 0
```

ALTER TABLE ROOM RENAME COLUMN PATIENT TO OCCUPANT;



```
mysql> alter table room rename column patient to occupant;
Query OK, 0 rows affected (0.01 sec)
Records: 0  Duplicates: 0  Warnings: 0

mysql> describe room;
+------------+---------------+------+-----+---------+-------+
| Field      | Type          | Null | Key | Default | Extra |
+------------+---------------+------+-----+---------+-------+
| roomID     | int(11)       | NO   | PRI | NULL    |       |
| occupant   | int(11)       | YES  | UNI | NULL    |       |
| type       | varchar(50)   | YES  |     | NULL    |       |
| isOccupied | enum('0','1') | YES  |     | NULL    |       |
| isActive   | enum('0','1') | YES  |     | NULL    |       |
+------------+---------------+------+-----+---------+-------+
5 rows in set (0.00 sec)
```

DROP TABLE
DROP TABLE DOCTOR;

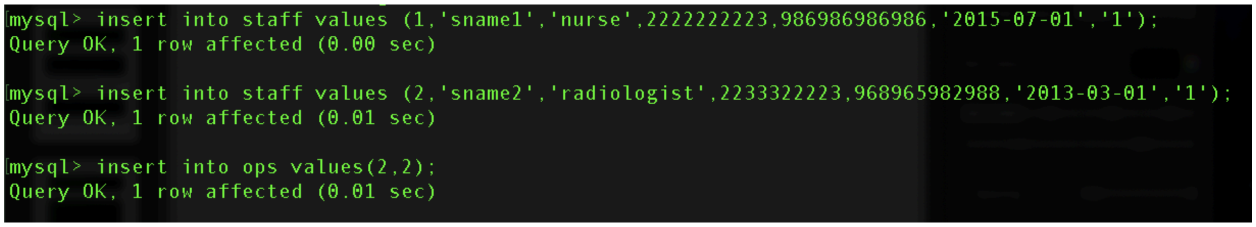


```
mysql> show tables;
+----------------+
| Tables_in_dbms |
+----------------+
| doctor         |
| room           |
+----------------+
2 rows in set (0.01 sec)

mysql> drop table doctor;
Query OK, 0 rows affected (0.01 sec)

mysql> show tables;
+----------------+
| Tables_in_dbms |
+----------------+
| room           |
+----------------+
1 row in set (0.00 sec)
```

Practical 3: To implement DML statements

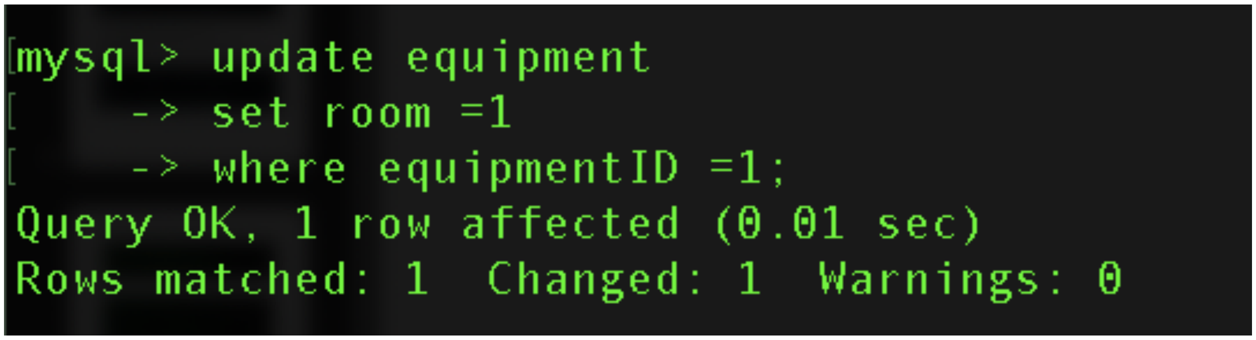
1. INSERT
2. UPDATE
3. DELETE
4. TRUNCATE

INSERT
INSERT INTO STAFF VALUES (1,’SNAME1’,’NURSE’,2222222223,986986986986,’2015-07-01’,’1’);



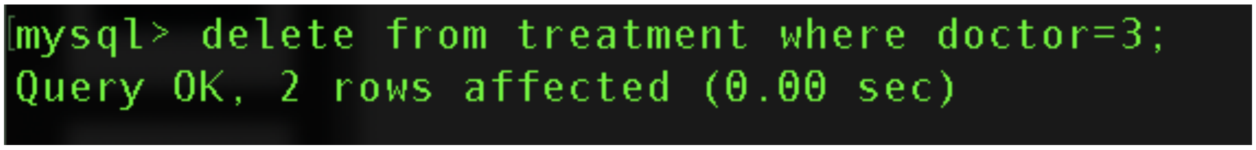
```
mysql> insert into staff values (1,'sname1','nurse',2222222223,986986986986,'2015-07-01','1');
Query OK, 1 row affected (0.00 sec)

mysql> insert into staff values (2,'sname2','radiologist',2233322223,968965982988,'2013-03-01','1');
Query OK, 1 row affected (0.01 sec)

mysql> insert into ops values(2,2);
Query OK, 1 row affected (0.01 sec)
```

UPDATE
UPDATE EQUIPMENT SET ROOM=1 WHERE EQUIPMENTID=1;



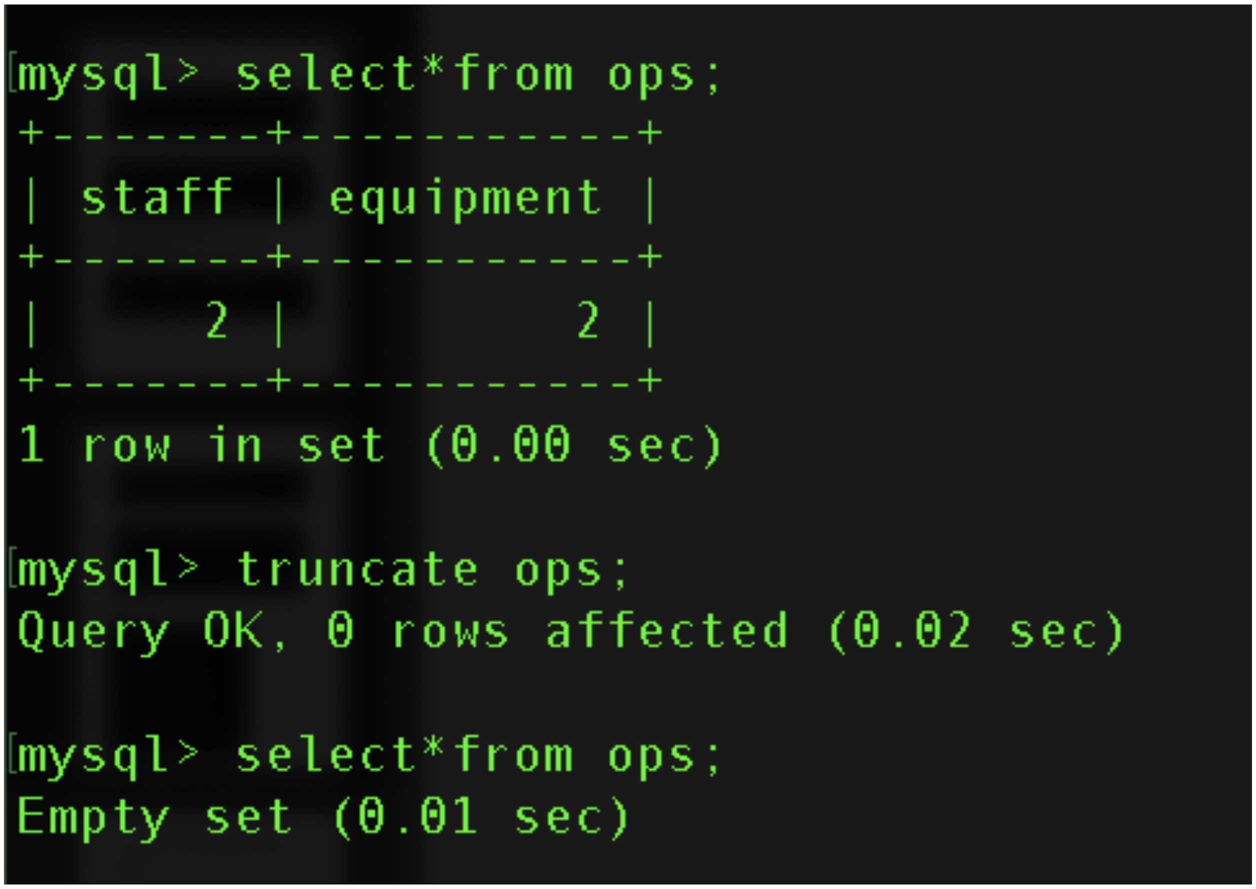
```
mysql> update equipment
    -> set room =1
    -> where equipmentID =1;
Query OK, 1 row affected (0.01 sec)
Rows matched: 1  Changed: 1  Warnings: 0
```

DELETE
DELETE FROM TREATMENT WHERE DOCTOR=3;



```
mysql> delete from treatment where doctor=3;
Query OK, 2 rows affected (0.00 sec)
```

TRUNCATE
TRUNCATE OPS;

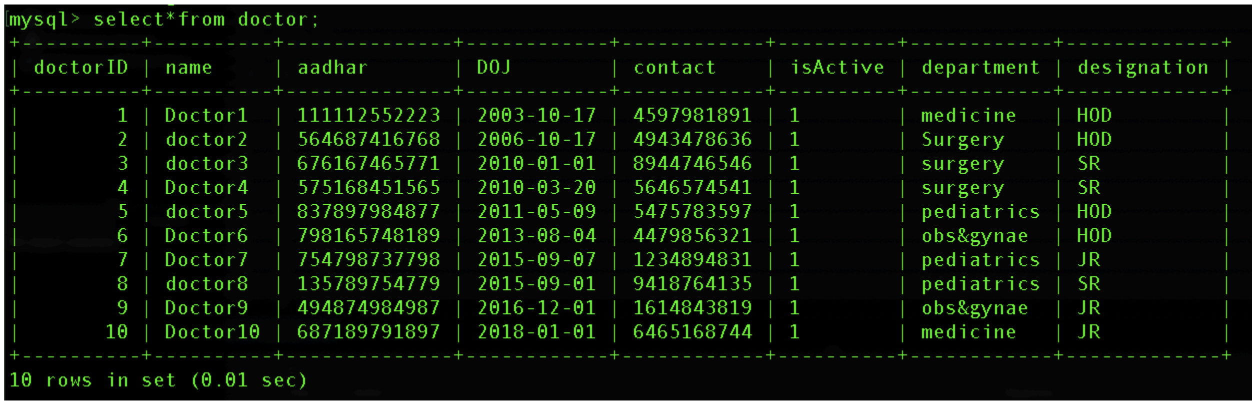


```
mysql> select*from ops;
+-------+-----------+
| staff | equipment |
+-------+-----------+
|     2 |         2 |
+-------+-----------+
1 row in set (0.00 sec)

mysql> truncate ops;
Query OK, 0 rows affected (0.02 sec)

mysql> select*from ops;
Empty set (0.01 sec)
```

Practical 4: To implement SELECT statements

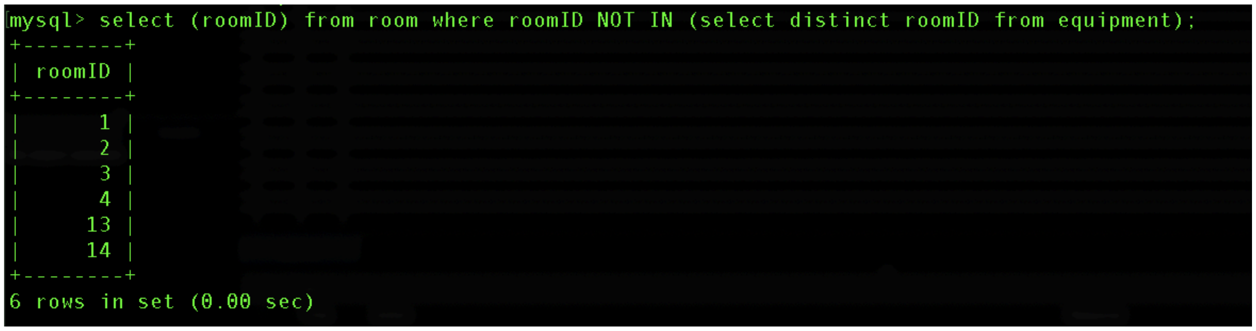
1. Simple
2. WHERE clause + IN / NOTIN
3. Aggregate functions
4. Group By + Having
5. Order By
6. Views
7. In-Built functions (e.g. Date)

SIMPLE SELECT STATEMENT
*SELECT * FROM DOCTOR;*



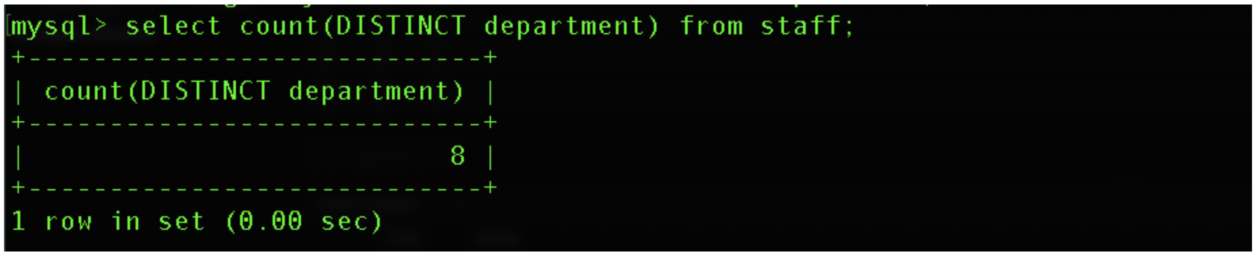
```
mysql> select*from doctor;
+----------+----------+--------------+------------+------------+----------+------------+-------------+
| doctorID | name     | aadhar       | DOJ        | contact    | isActive | department | designation |
+----------+----------+--------------+------------+------------+----------+------------+-------------+
|        1 | Doctor1  | 111112552223 | 2003-10-17 | 4597981891 | 1        | medicine   | HOD         |
|        2 | doctor2  | 564687416768 | 2006-10-17 | 4943478636 | 1        | Surgery    | HOD         |
|        3 | doctor3  | 676167465771 | 2010-01-01 | 8944746546 | 1        | surgery    | SR          |
|        4 | Doctor4  | 575168451565 | 2010-03-20 | 5646574541 | 1        | surgery    | SR          |
|        5 | doctor5  | 837897984877 | 2011-05-09 | 5475783597 | 1        | pediatrics | HOD         |
|        6 | Doctor6  | 798165748189 | 2013-08-04 | 4479856321 | 1        | obs&gynae  | HOD         |
|        7 | Doctor7  | 754798737798 | 2015-09-07 | 1234894831 | 1        | pediatrics | JR          |
|        8 | doctor8  | 135789754779 | 2015-09-01 | 9418764135 | 1        | pediatrics | SR          |
|        9 | Doctor9  | 494874984987 | 2016-12-01 | 1614843819 | 1        | obs&gynae  | JR          |
|       10 | Doctor10 | 687189791897 | 2018-01-01 | 6465168744 | 1        | medicine   | JR          |
+----------+----------+--------------+------------+------------+----------+------------+-------------+
10 rows in set (0.01 sec)
```

WHERE CLAUSE + NOT IN
Select roomID from room where roomID not in (select distinct roomID from equipment);



```
mysql> select (roomID) from room where roomID NOT IN (select distinct roomID from equipment);
+--------+
| roomID |
+--------+
|      1 |
|      2 |
|      3 |
|      4 |
|     13 |
|     14 |
+--------+
6 rows in set (0.00 sec)
```

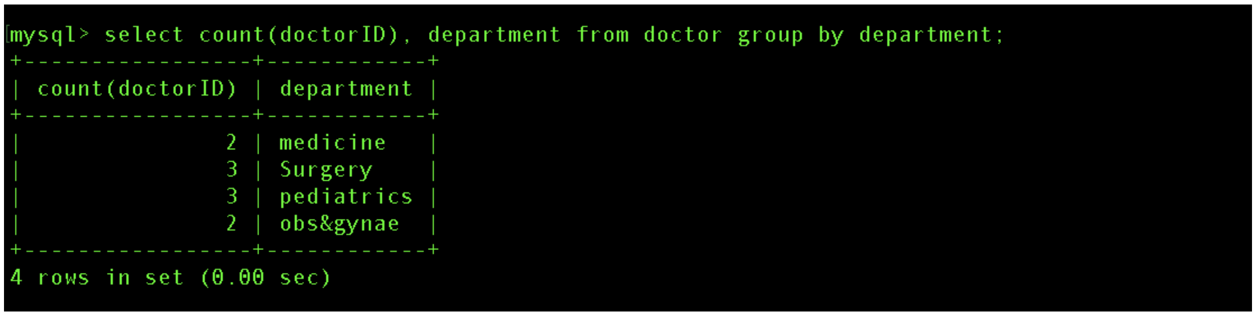
AGGREGATE FUNCTION
Select count(DISTINCT department) from staff;



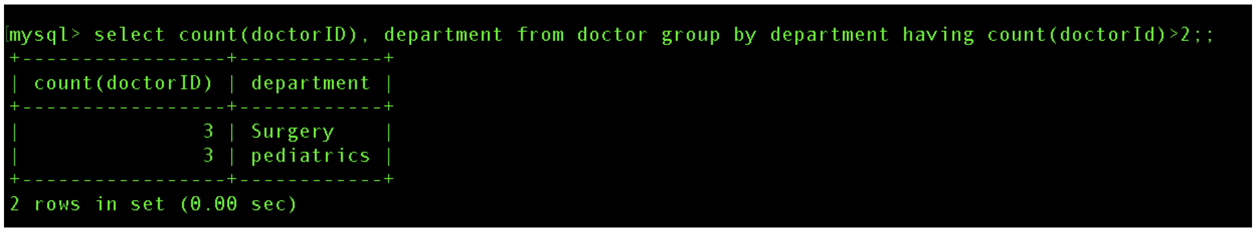
```
mysql> select count(DISTINCT department) from staff;
+----------------------------+
| count(DISTINCT department) |
+----------------------------+
|                          8 |
+----------------------------+
1 row in set (0.00 sec)
```

GROUP BY + HAVING

Select count(doctorID), department from doctor group by department;



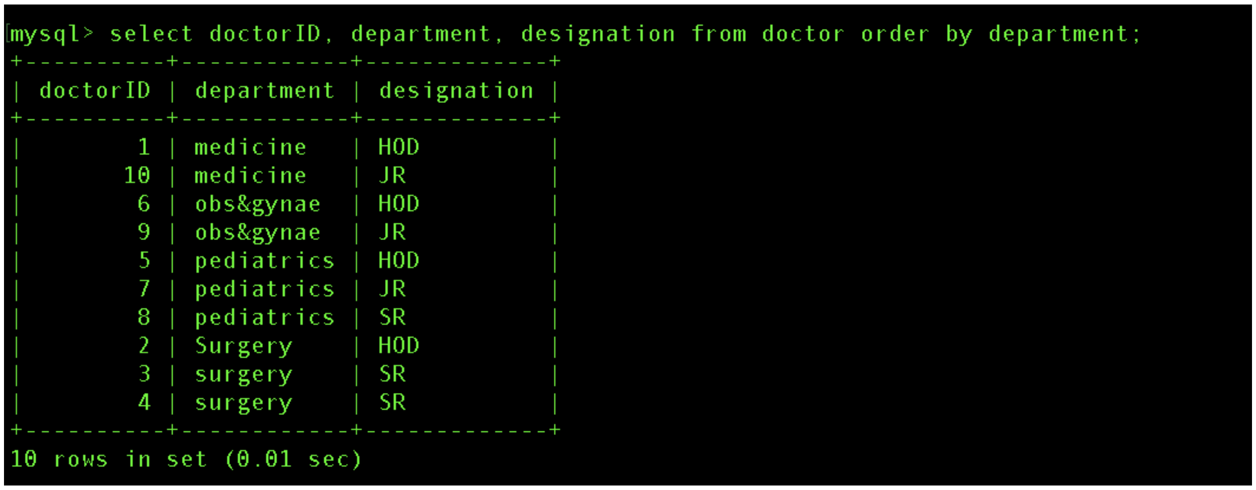
```
[mysql> select count(doctorID), department from doctor group by department;
+-----------------+------------+
| count(doctorID) | department |
+-----------------+------------+
|               2 | medicine   |
|               3 | Surgery    |
|               3 | pediatrics |
|               2 | obs&gynae  |
+-----------------+------------+
4 rows in set (0.00 sec)
```



```
[mysql> select count(doctorID), department from doctor group by department having count(doctorId)>2;;
+-----------------+------------+
| count(doctorID) | department |
+-----------------+------------+
|               3 | Surgery    |
|               3 | pediatrics |
+-----------------+------------+
2 rows in set (0.00 sec)
```

ORDER BY

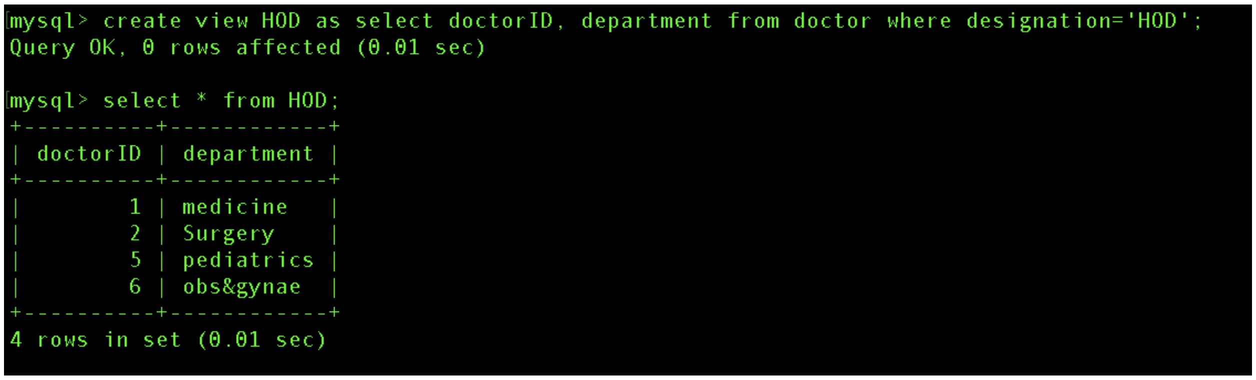
Select doctorID, department, designation from doctor order by department;



```
[mysql> select doctorID, department, designation from doctor order by department;
+----------+------------+-------------+
| doctorID | department | designation |
+----------+------------+-------------+
|        1 | medicine   | HOD         |
|       10 | medicine   | JR          |
|        6 | obs&gynae  | HOD         |
|        9 | obs&gynae  | JR          |
|        5 | pediatrics | HOD         |
|        7 | pediatrics | JR          |
|        8 | pediatrics | SR          |
|        2 | Surgery    | HOD         |
|        3 | surgery    | SR          |
|        4 | surgery    | SR          |
+----------+------------+-------------+
10 rows in set (0.01 sec)
```

VIEWS

Create view HOD as select doctorID, department from doctor where designation=‘HOD’;

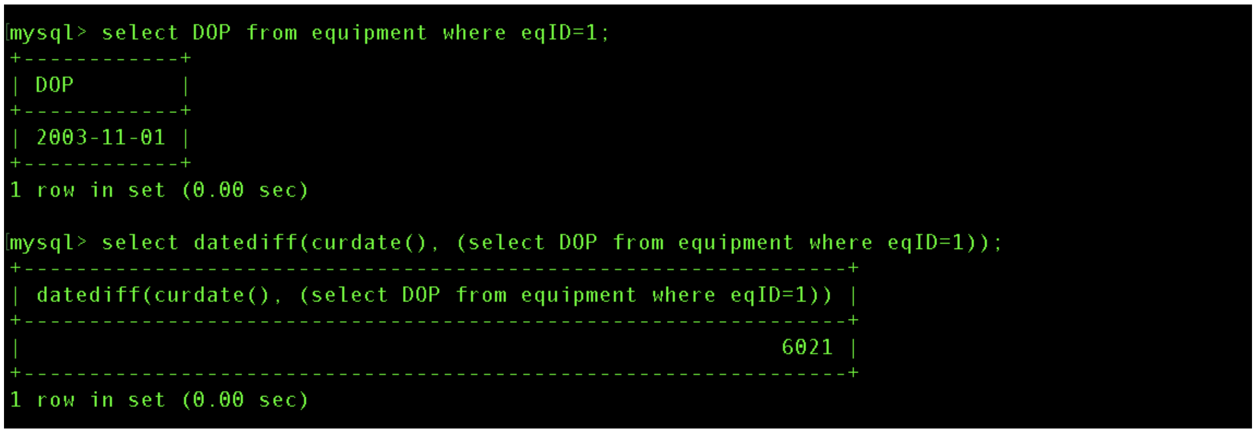


```
[mysql> create view HOD as select doctorID, department from doctor where designation='HOD';
Query OK, 0 rows affected (0.01 sec)

[mysql> select * from HOD;
+----------+------------+
| doctorID | department |
+----------+------------+
|        1 | medicine   |
|        2 | Surgery    |
|        5 | pediatrics |
|        6 | obs&gynae  |
+----------+------------+
4 rows in set (0.01 sec)
```

IN-BUILT FUNCTIONS (DATE)

Select DOP from equipment where eqID=1;

Select DATEDIFF(curdate(), (select DOP from equipment where eqID=1));



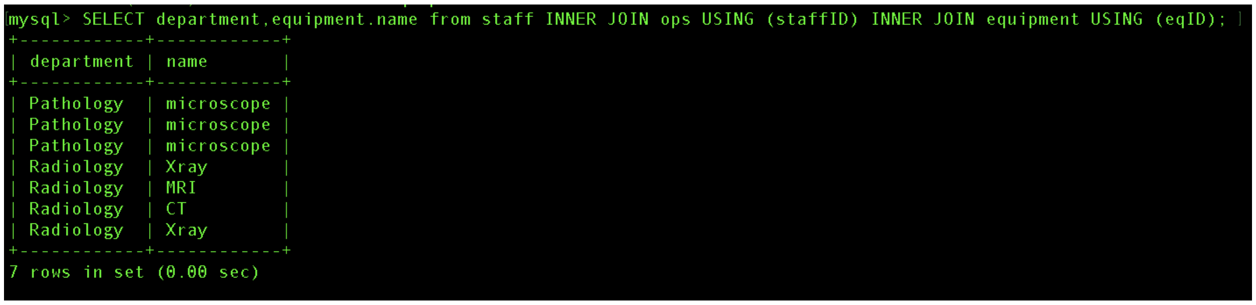
```
mysql> select DOP from equipment where eqID=1;
+------------+
| DOP        |
+------------+
| 2003-11-01 |
+------------+
1 row in set (0.00 sec)

mysql> select datediff(curdate(), (select DOP from equipment where eqID=1));
+----------------------------------------------------------------+
| datediff(curdate(), (select DOP from equipment where eqID=1)) |
+----------------------------------------------------------------+
|                                                           6021 |
+----------------------------------------------------------------+
1 row in set (0.00 sec)
```

Practical 5: TO IMPLEMENT NESTED QUERIES

1. INNER JOIN
2. LEFT JOIN
3. RIGHT JOIN

INNER JOIN

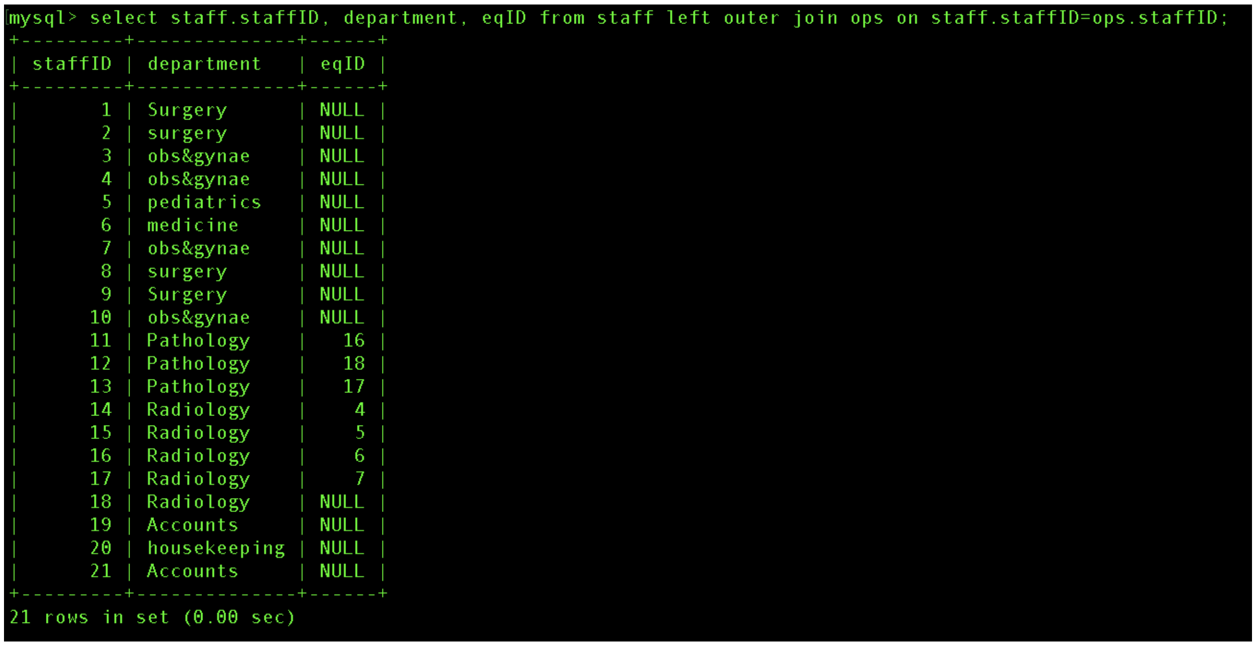
Select department, equipment.name from staff inner join ops using (staffID) inner join equipment using (eqID);



```
mysql> SELECT department,equipment.name from staff INNER JOIN ops USING (staffID) INNER JOIN equipment USING (eqID);
+------------+------------+
| department | name       |
+------------+------------+
| Pathology  | microscope |
| Pathology  | microscope |
| Pathology  | microscope |
| Radiology  | Xray       |
| Radiology  | MRI        |
| Radiology  | CT         |
| Radiology  | Xray       |
+------------+------------+
7 rows in set (0.00 sec)
```

LEFT OUTER JOIN

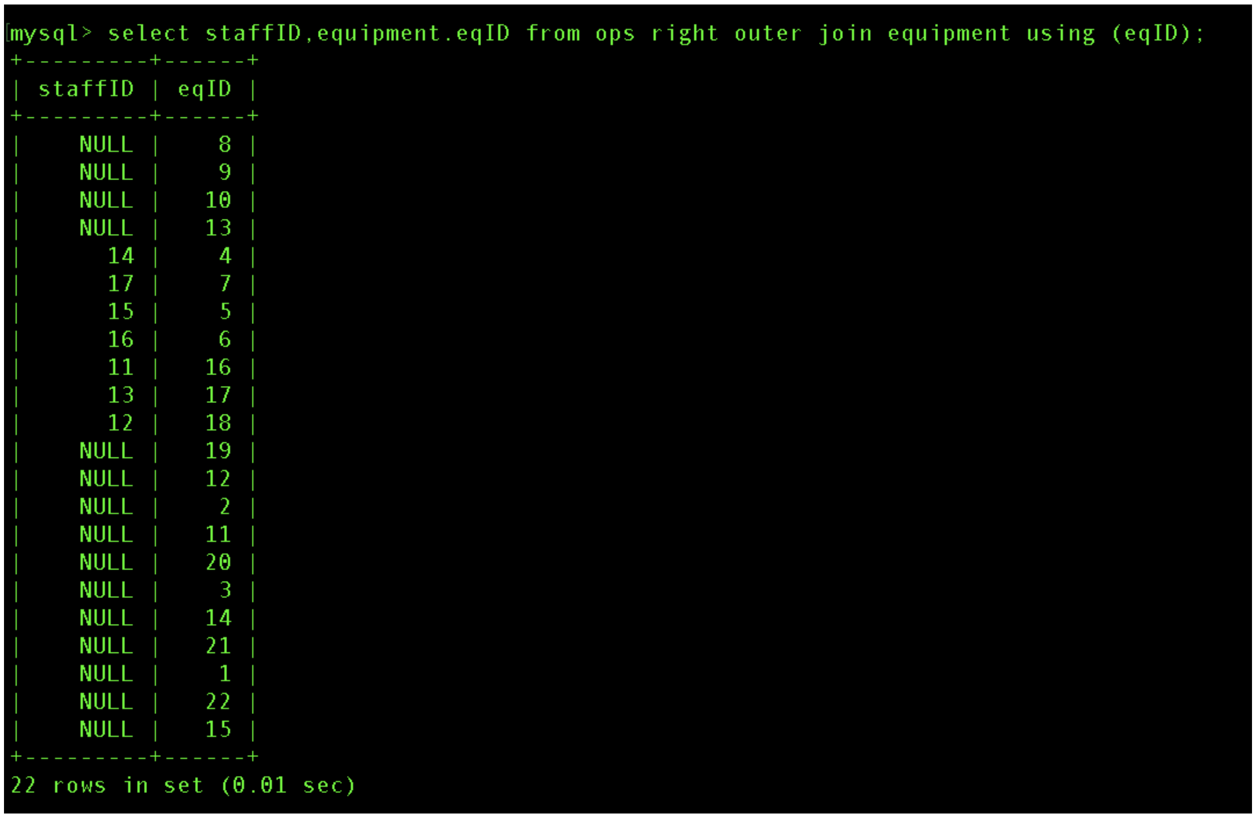
Select staff.staffID, department, eqID from staff left join ops on staff.staffID=ops.staffID;



```
mysql> select staff.staffID, department, eqID from staff left outer join ops on staff.staffID=ops.staffID;
+---------+--------------+------+
| staffID | department   | eqID |
+---------+--------------+------+
|       1 | Surgery      | NULL |
|       2 | surgery      | NULL |
|       3 | obs&gynae    | NULL |
|       4 | obs&gynae    | NULL |
|       5 | pediatrics   | NULL |
|       6 | medicine     | NULL |
|       7 | obs&gynae    | NULL |
|       8 | surgery      | NULL |
|       9 | Surgery      | NULL |
|      10 | obs&gynae    | NULL |
|      11 | Pathology    |   16 |
|      12 | Pathology    |   18 |
|      13 | Pathology    |   17 |
|      14 | Radiology    |    4 |
|      15 | Radiology    |    5 |
|      16 | Radiology    |    6 |
|      17 | Radiology    |    7 |
|      18 | Radiology    | NULL |
|      19 | Accounts     | NULL |
|      20 | housekeeping | NULL |
|      21 | Accounts     | NULL |
+---------+--------------+------+
21 rows in set (0.00 sec)
```

RIGHT OUTER JOIN

select staffID, equipment.eqID from ops right outer join join equipment using (eqID);

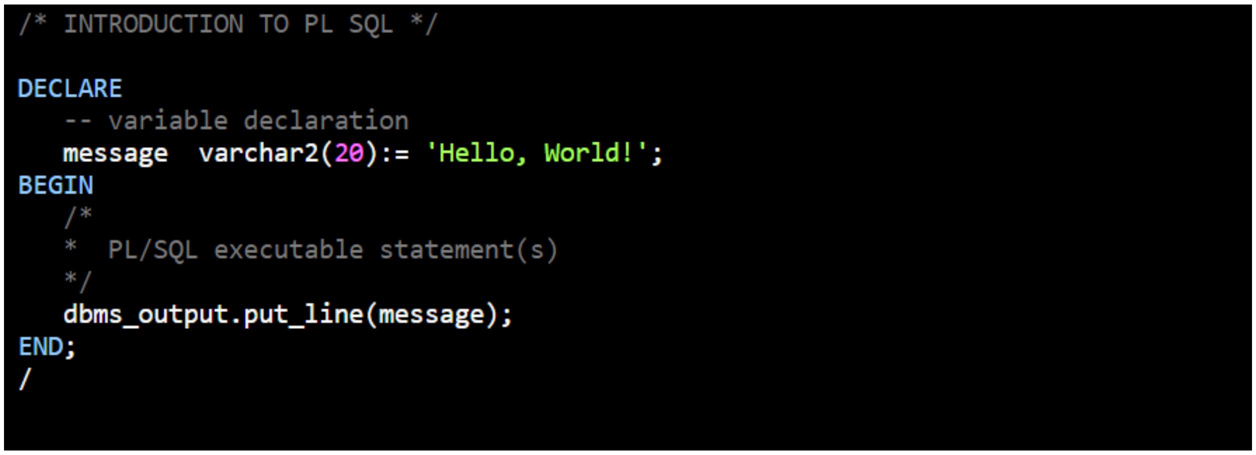


```
mysql> select staffID,equipment.eqID from ops right outer join equipment using (eqID);
+---------+------+
| staffID | eqID |
+---------+------+
|    NULL |    8 |
|    NULL |    9 |
|    NULL |   10 |
|    NULL |   13 |
|      14 |    4 |
|      17 |    7 |
|      15 |    5 |
|      16 |    6 |
|      11 |   16 |
|      13 |   17 |
|      12 |   18 |
|    NULL |   19 |
|    NULL |   12 |
|    NULL |    2 |
|    NULL |   11 |
|    NULL |   20 |
|    NULL |    3 |
|    NULL |   14 |
|    NULL |   21 |
|    NULL |    1 |
|    NULL |   22 |
|    NULL |   15 |
+---------+------+
22 rows in set (0.01 sec)
```

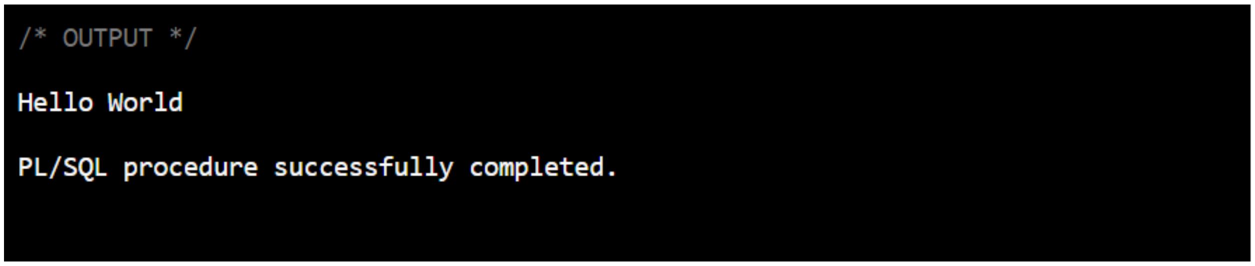
Practical 6: INTRODUCTION TO PL/SQL

CREATE A PL/SQL BLOCK AND IMPLEMENT THE FOLLOWING:
1. VARIABLES
2. PROCEDURES
3. FUNCTIONS
4. PACKAGES

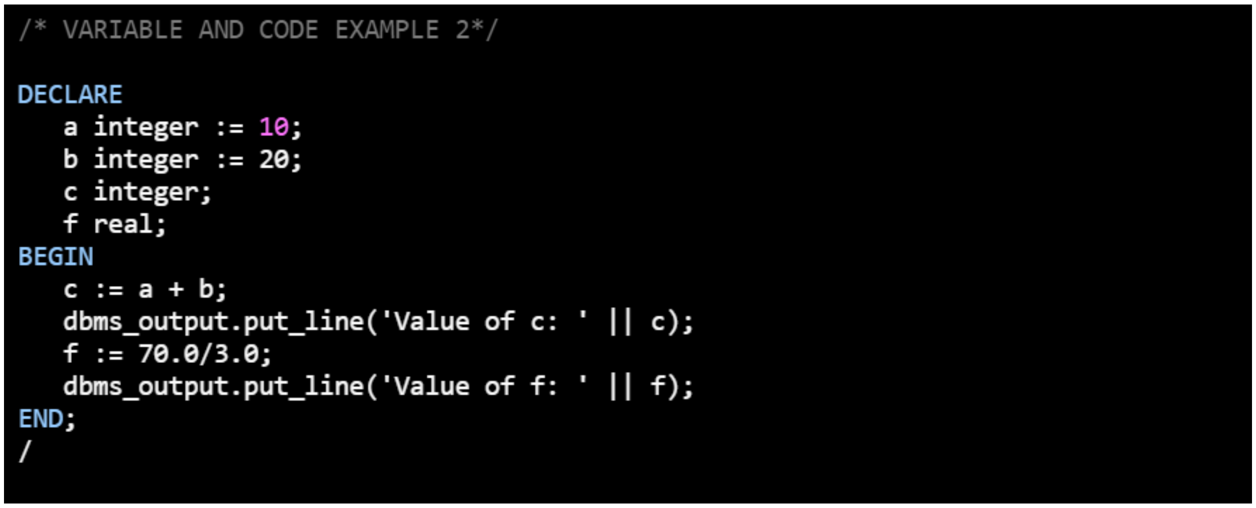
VARIABLE



```
/* INTRODUCTION TO PL SQL */

DECLARE
   -- variable declaration
   message  varchar2(20):= 'Hello, World!';
BEGIN
   /*
   *  PL/SQL executable statement(s)
   */
   dbms_output.put_line(message);
END;
/
```



```
/* OUTPUT */

Hello World

PL/SQL procedure successfully completed.
```



```
/* VARIABLE AND CODE EXAMPLE 2*/

DECLARE
   a integer := 10;
   b integer := 20;
   c integer;
   f real;
BEGIN
   c := a + b;
   dbms_output.put_line('Value of c: ' || c);
   f := 70.0/3.0;
   dbms_output.put_line('Value of f: ' || f);
END;
/
```

```
/* OUTPUT */
Value of c: 30
Value of f: 23.333333333333333333

PL/SQL procedure successfully completed.
PI CONSTANT NUMBER := 3.141592654;
```

```
/*EXAMPLE 3 */

DECLARE
   -- constant declaration
   pi constant number := 3.141592654;
   -- other declarations
   radius number(5,2);
   dia number(5,2);
   circumference number(7, 2);
   area number (10, 2);
BEGIN
   -- processing
   radius := 9.5;
   dia := radius * 2;
   circumference := 2.0 * pi * radius;
   area := pi * radius * radius;
   -- output
   dbms_output.put_line('Radius: ' || radius);
   dbms_output.put_line('Diameter: ' || dia);
   dbms_output.put_line('Circumference: ' || circumference);
   dbms_output.put_line('Area: ' || area);
END;
/
```

```
/* GENERAL QUERY EXAMPLE */

DECLARE
   d_id DOCTORS.id%type := 1;
   d_name  DOCTORS.name%type;
   d_addr DOCTORS.address%type;
   d_sal  DOCTORS.salary%type;
BEGIN
   SELECT name, address, salary INTO d_name, d_addr, d_sal
   FROM DOCTORS
   WHERE id = d_id;
   dbms_output.put_line('Doctor is ' || d_name || ' from ' || d_addr || ' earns '
END;
/
```

PROCEDURES

```
/*PROCEDURE*/

CREATE OR REPLACE PROCEDURE greetings
AS
BEGIN
   dbms_output.put_line('Hello World!');
END;
/

EXECUTE greetings;
```

```
/*OUTPUT*/
Hello World!

PL/SQL procedure successfully completed.
```

```
/* CODE EXAMPLE 2 */

DECLARE
   a number;
   b number;
   c number;
PROCEDURE findMin(x IN number, y IN number, z OUT number) IS
BEGIN
   IF x < y THEN
      z:= x;
   ELSE
      z:= y;
   END IF;
END;
BEGIN
   a:= 23;
   b:= 45;
   findMin(a, b, c);
   dbms_output.put_line('Minimum of (23, 45) : ' || c);
END;
/
```

```
/* OUTPUT */
Minimum of (23, 45) : 23

PL/SQL procedure successfully completed.
```

FUNCTIONS

```
/*FUNCTIONS*/

CREATE OR REPLACE FUNCTION totalDoctors
RETURN number IS
   total number(2) := 0;
BEGIN
   SELECT count(*) into total
   FROM DOCTOR;

   RETURN total;
END;
/
```

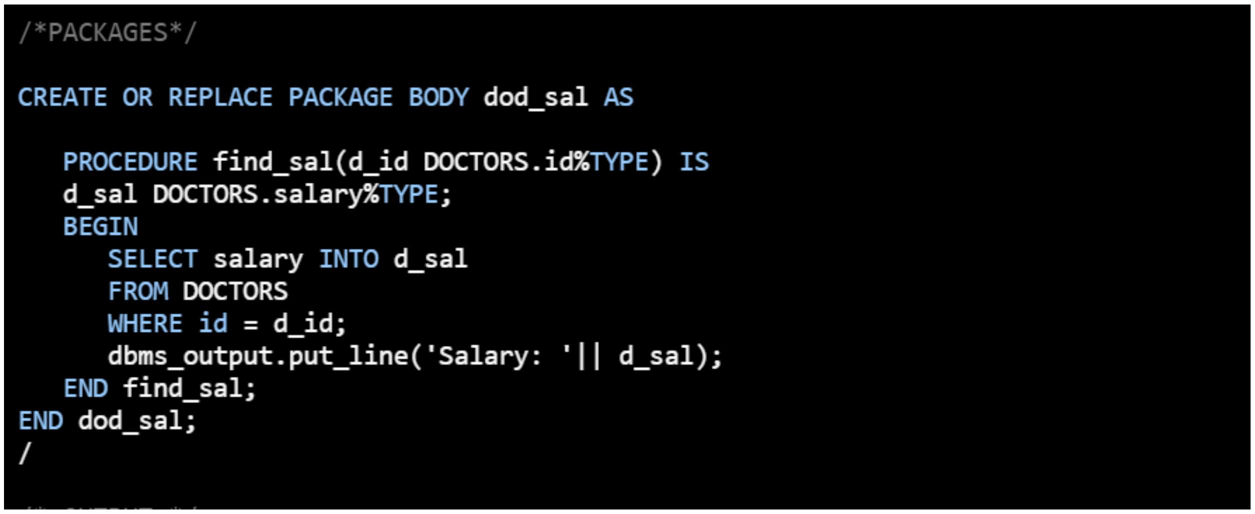
```
/* OUTPUT */
Function created.

/* EXAMPLE*/
DECLARE
   c number(2);
BEGIN
   c := totalDoctors();
   dbms_output.put_line('Total no. of Doctors: ' || c);
END;
/
```

```
/* OUTPUT */

Total no. of Doctors: 6

PL/SQL procedure successfully completed.
```

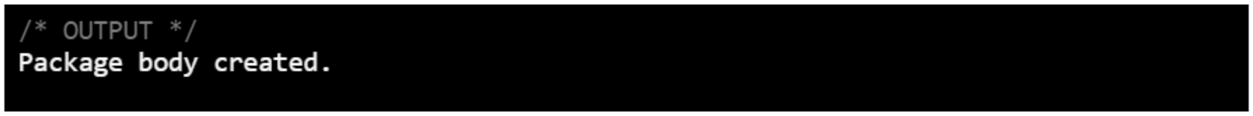
```
/* WRITE A FUNCTION TO COMPUTE THE FACTORIAL OF A NUMBER */

DECLARE
   num number;
   factorial number;

FUNCTION fact(x number)
RETURN number
IS
   f number;
BEGIN
   IF x=0 THEN
      f := 1;
   ELSE
      f := x * fact(x-1);
   END IF;
RETURN f;
END;

BEGIN
   num:= 6;
   factorial := fact(num);
   dbms_output.put_line(' Factorial '|| num || ' is ' || factorial);
END;
/
```

```
/* OUTPUT */

Factorial 6 is 720

PL/SQL procedure successfully completed.
```

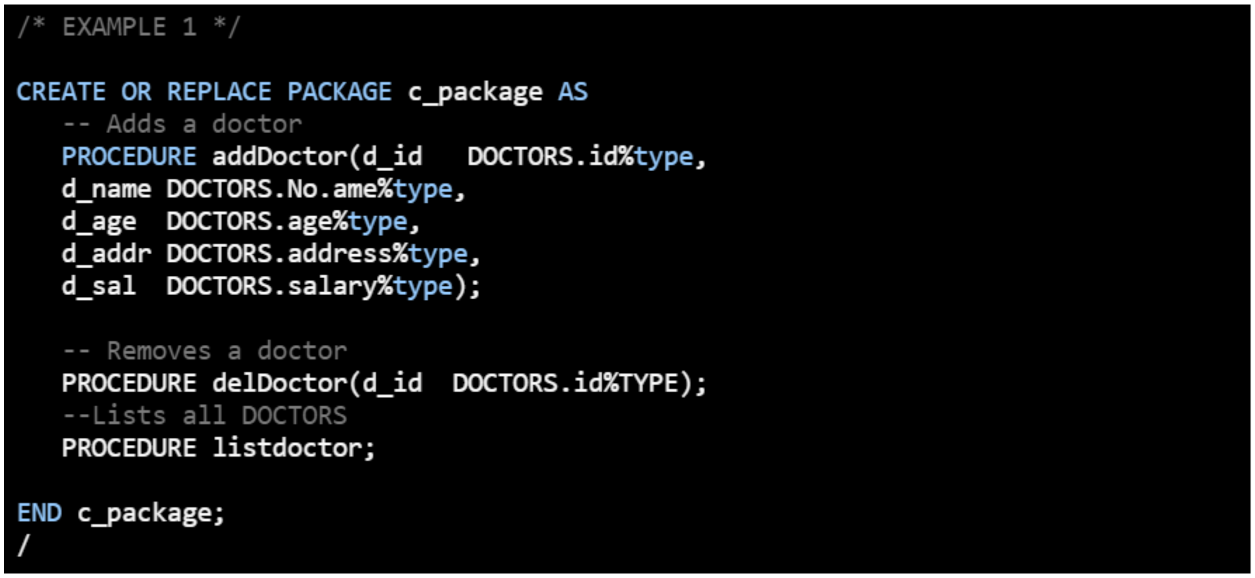
PACKAGES



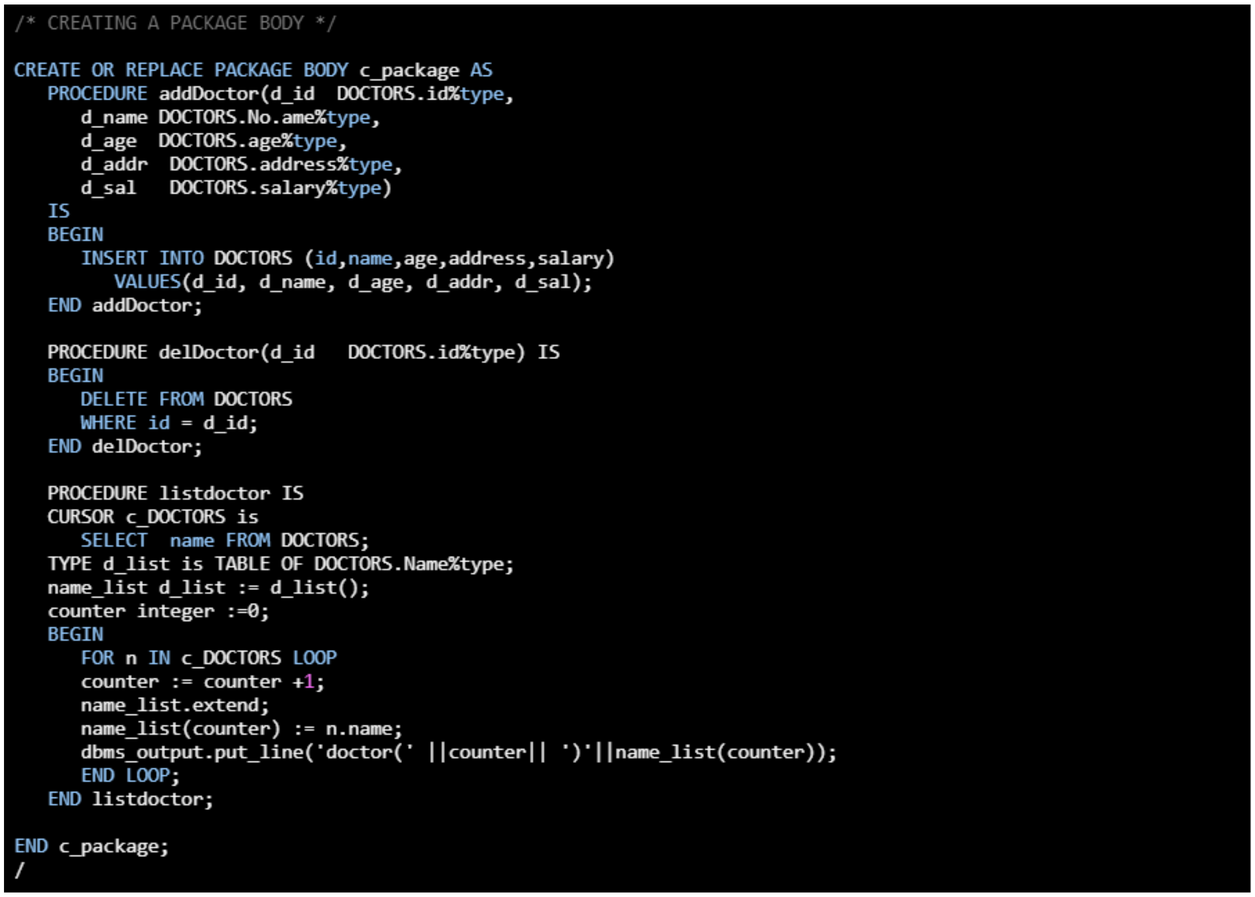
```
/*PACKAGES*/

CREATE OR REPLACE PACKAGE BODY dod_sal AS

   PROCEDURE find_sal(d_id DOCTORS.id%TYPE) IS
   d_sal DOCTORS.salary%TYPE;
   BEGIN
      SELECT salary INTO d_sal
      FROM DOCTORS
      WHERE id = d_id;
      dbms_output.put_line('Salary: '|| d_sal);
   END find_sal;
END dod_sal;
/
```



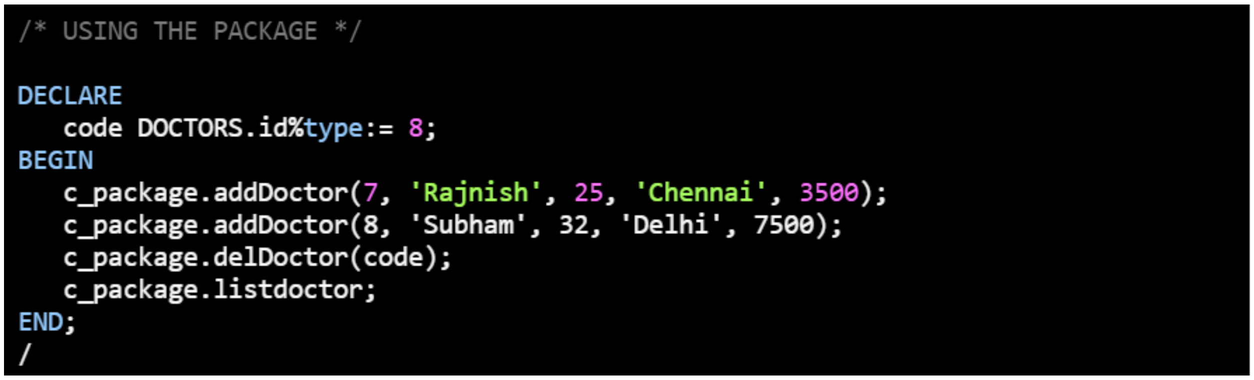
```
/* OUTPUT */
Package body created.
```



```
/* EXAMPLE 1 */

CREATE OR REPLACE PACKAGE c_package AS
   -- Adds a doctor
   PROCEDURE addDoctor(d_id   DOCTORS.id%type,
   d_name DOCTORS.No.ame%type,
   d_age  DOCTORS.age%type,
   d_addr DOCTORS.address%type,
   d_sal  DOCTORS.salary%type);

   -- Removes a doctor
   PROCEDURE delDoctor(d_id  DOCTORS.id%TYPE);
   --Lists all DOCTORS
   PROCEDURE listdoctor;

END c_package;
/
```

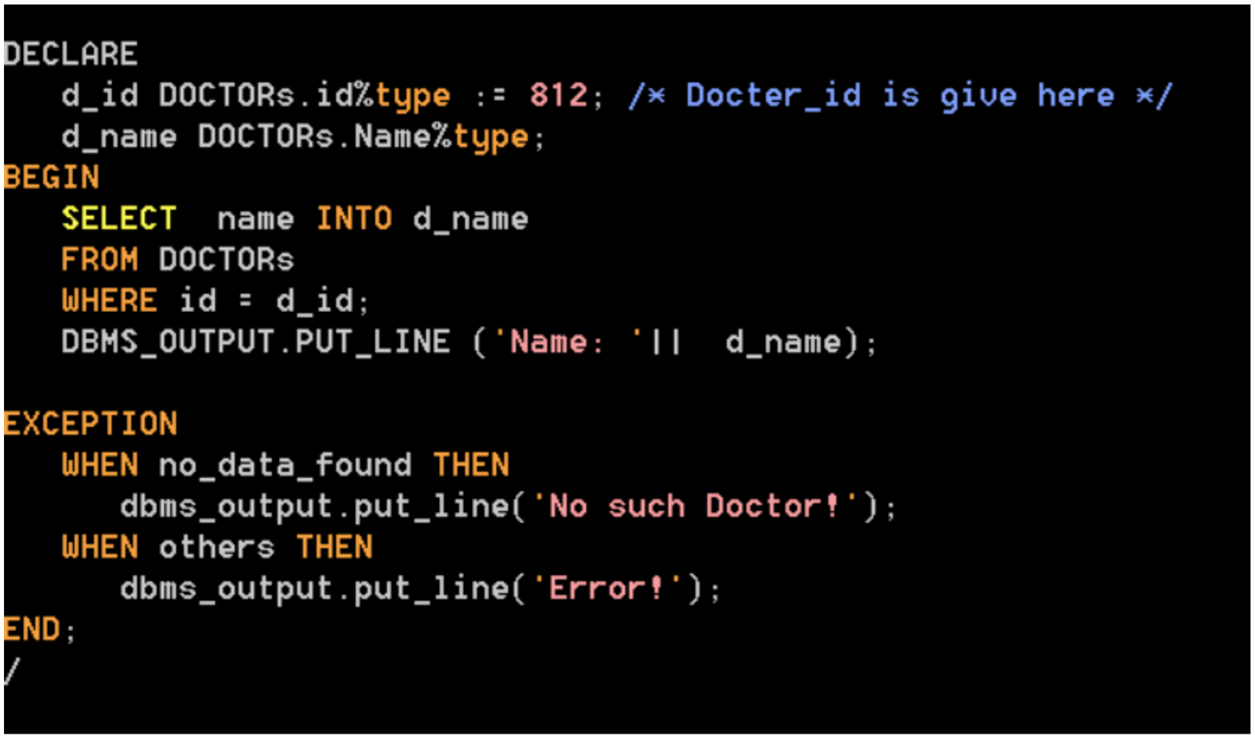


```
/* CREATING A PACKAGE BODY */

CREATE OR REPLACE PACKAGE BODY c_package AS
   PROCEDURE addDoctor(d_id  DOCTORS.id%type,
      d_name DOCTORS.No.ame%type,
      d_age  DOCTORS.age%type,
      d_addr  DOCTORS.address%type,
      d_sal   DOCTORS.salary%type)
   IS
   BEGIN
      INSERT INTO DOCTORS (id,name,age,address,salary)
         VALUES(d_id, d_name, d_age, d_addr, d_sal);
   END addDoctor;

   PROCEDURE delDoctor(d_id   DOCTORS.id%type) IS
   BEGIN
      DELETE FROM DOCTORS
      WHERE id = d_id;
   END delDoctor;

   PROCEDURE listdoctor IS
   CURSOR c_DOCTORS is
      SELECT  name FROM DOCTORS;
   TYPE d_list is TABLE OF DOCTORS.Name%type;
   name_list d_list := d_list();
   counter integer :=0;
   BEGIN
      FOR n IN c_DOCTORS LOOP
      counter := counter +1;
      name_list.extend;
      name_list(counter) := n.name;
      dbms_output.put_line('doctor(' ||counter|| ')'||name_list(counter));
      END LOOP;
   END listdoctor;

END c_package;
/
```

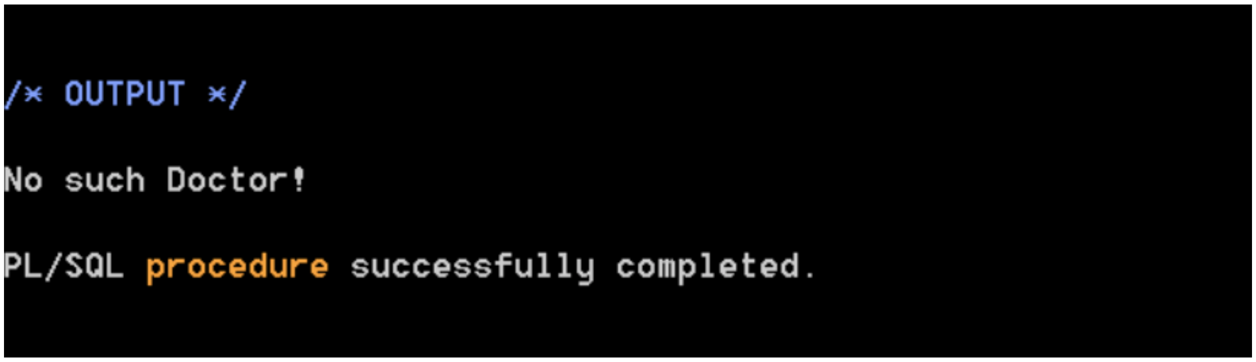


```
/* USING THE PACKAGE */

DECLARE
   code DOCTORS.id%type:= 8;
BEGIN
   c_package.addDoctor(7, 'Rajnish', 25, 'Chennai', 3500);
   c_package.addDoctor(8, 'Subham', 32, 'Delhi', 7500);
   c_package.delDoctor(code);
   c_package.listdoctor;
END;
/
```

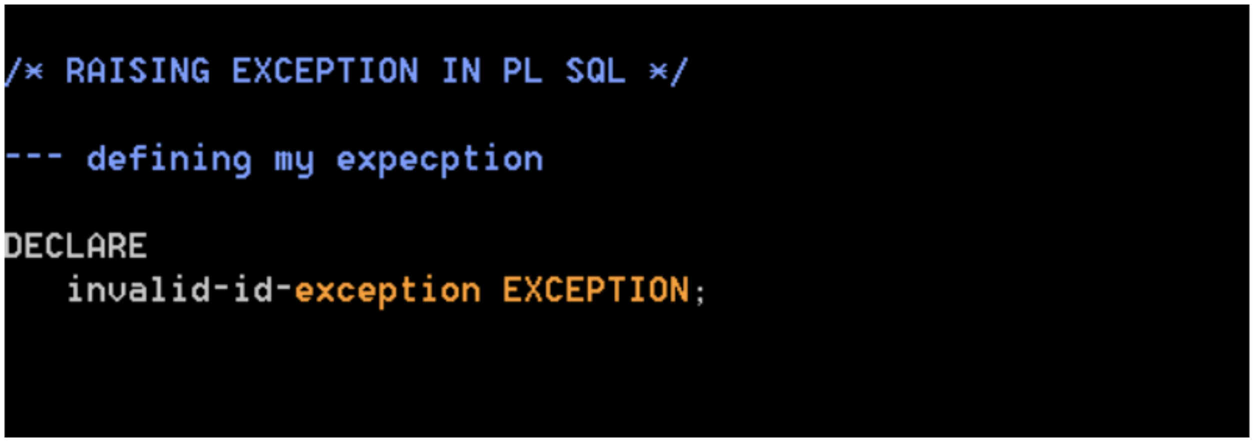
Practical 7: EXCEPTIONAL HANDLING IN PL/SQL



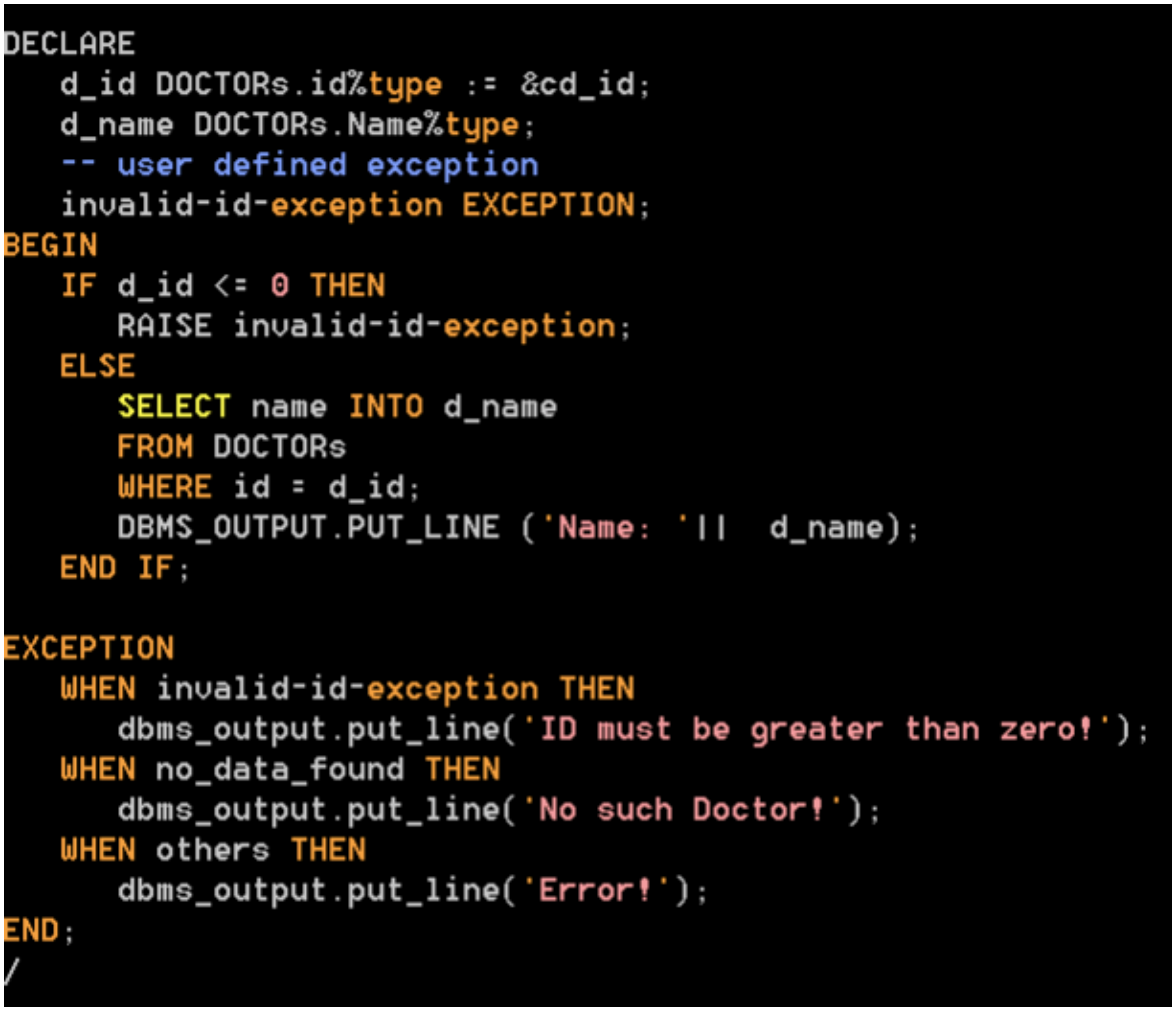
```
DECLARE
   d_id DOCTORs.id%type := 812; /* Docter_id is give here */
   d_name DOCTORs.Name%type;
BEGIN
   SELECT  name INTO d_name
   FROM DOCTORs
   WHERE id = d_id;
   DBMS_OUTPUT.PUT_LINE ('Name: '||  d_name);

EXCEPTION
   WHEN no_data_found THEN
      dbms_output.put_line('No such Doctor!');
   WHEN others THEN
      dbms_output.put_line('Error!');
END;
/
```



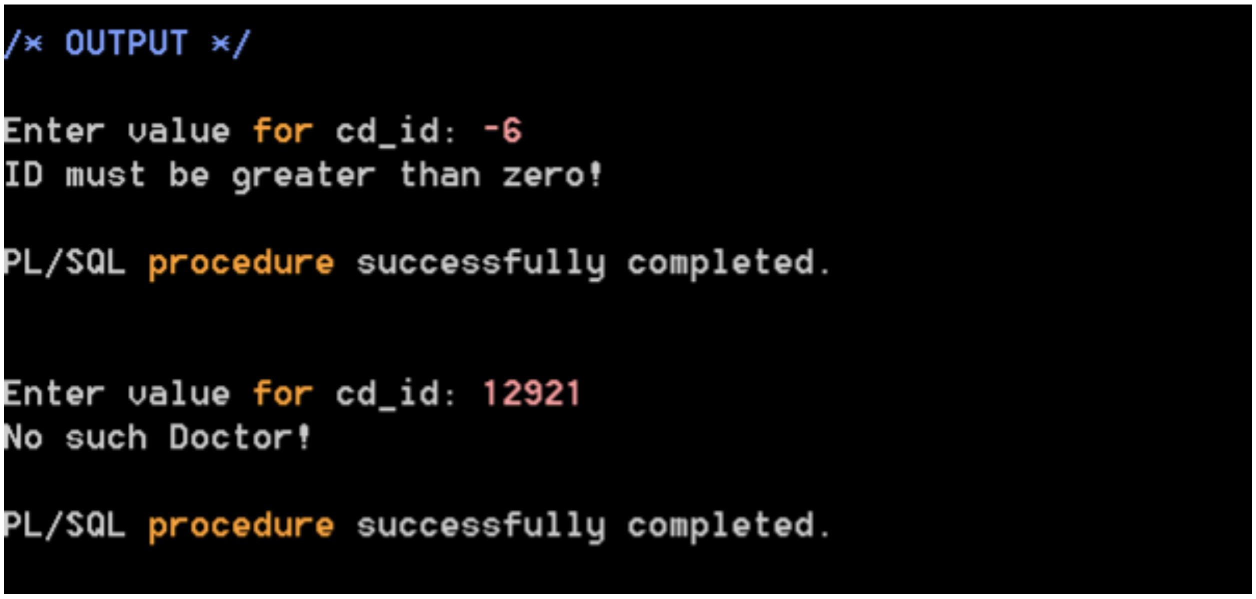
```
/* OUTPUT */

No such Doctor!

PL/SQL procedure successfully completed.
```



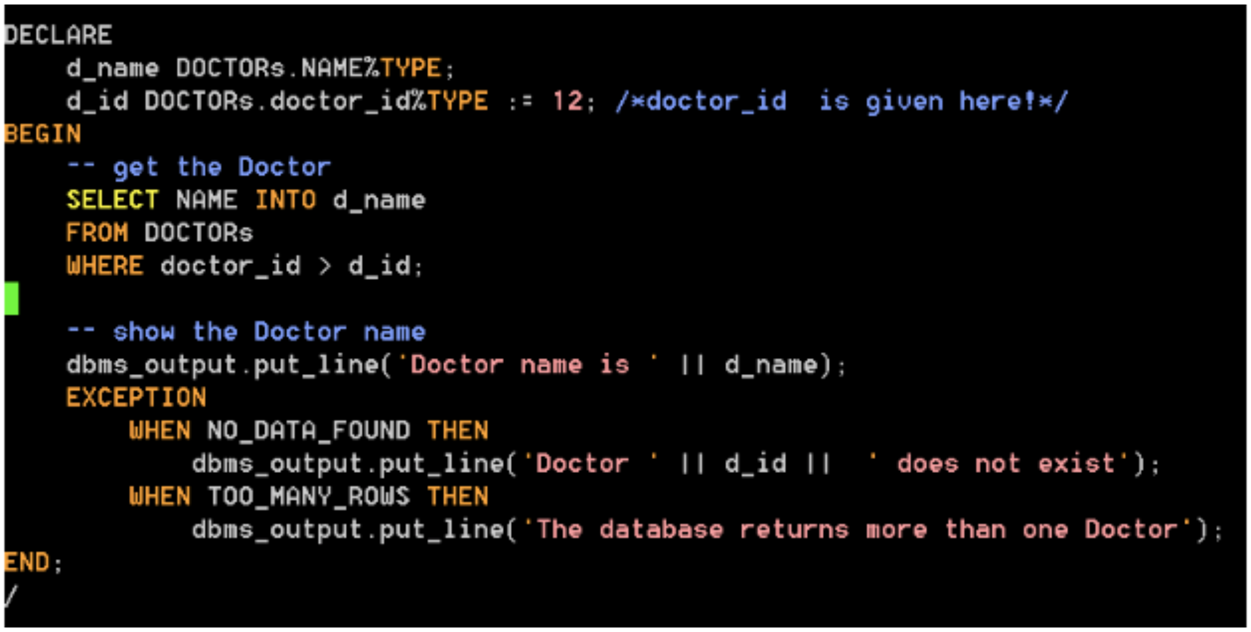
```
/* RAISING EXCEPTION IN PL SQL */

--- defining my expecption

DECLARE
   invalid-id-exception EXCEPTION;
```



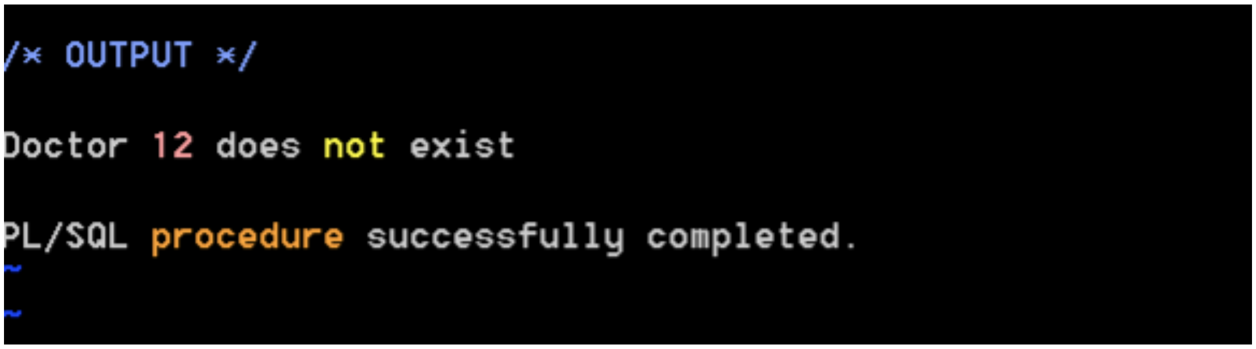
```
DECLARE
   d_id DOCTORs.id%type := &cd_id;
   d_name DOCTORs.Name%type;
   -- user defined exception
   invalid-id-exception EXCEPTION;
BEGIN
   IF d_id <= 0 THEN
      RAISE invalid-id-exception;
   ELSE
      SELECT name INTO d_name
      FROM DOCTORs
      WHERE id = d_id;
      DBMS_OUTPUT.PUT_LINE ('Name: '||  d_name);
   END IF;

EXCEPTION
   WHEN invalid-id-exception THEN
      dbms_output.put_line('ID must be greater than zero!');
   WHEN no_data_found THEN
      dbms_output.put_line('No such Doctor!');
   WHEN others THEN
      dbms_output.put_line('Error!');
END;
/
```



```
/* OUTPUT */

Enter value for cd_id: -6
ID must be greater than zero!

PL/SQL procedure successfully completed.


Enter value for cd_id: 12921
No such Doctor!

PL/SQL procedure successfully completed.
```



```
DECLARE
    d_name DOCTORs.NAME%TYPE;
    d_id DOCTORs.doctor_id%TYPE := 12; /*doctor_id  is given here!*/
BEGIN
    -- get the Doctor
    SELECT NAME INTO d_name
    FROM DOCTORs
    WHERE doctor_id > d_id;

    -- show the Doctor name
    dbms_output.put_line('Doctor name is ' || d_name);
    EXCEPTION
        WHEN NO_DATA_FOUND THEN
            dbms_output.put_line('Doctor ' || d_id ||  ' does not exist');
        WHEN TOO_MANY_ROWS THEN
            dbms_output.put_line('The database returns more than one Doctor');
END;
/
```



```
/* OUTPUT */

Doctor 12 does not exist

PL/SQL procedure successfully completed.
~
~
```

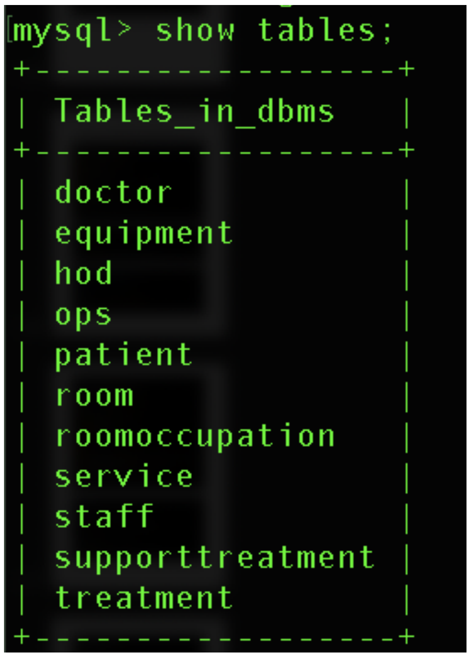
Practical 8: PROJECT REPORT

The aim of this project is to simulate a Hospital Management System in accordance with the following requirements:

1. Maintaining a record of all doctors and staff of the hospital, including their rank and role in the organization.
2. Maintaining a record of all rooms, Machines and life-saving equipment in the hospital.
3. Record keeping of all patients visiting the hospital and details of their treatment and status of being admitted.
4. Maintaining a record of which equipment was utilized during the treatment of which patient.
5. Maintaining details of staff assigned to a room or equipment for cleaning and assisting respectively.
6. Details of list Doctors and shift of doctors assigned to a patient and same for hospital staff.

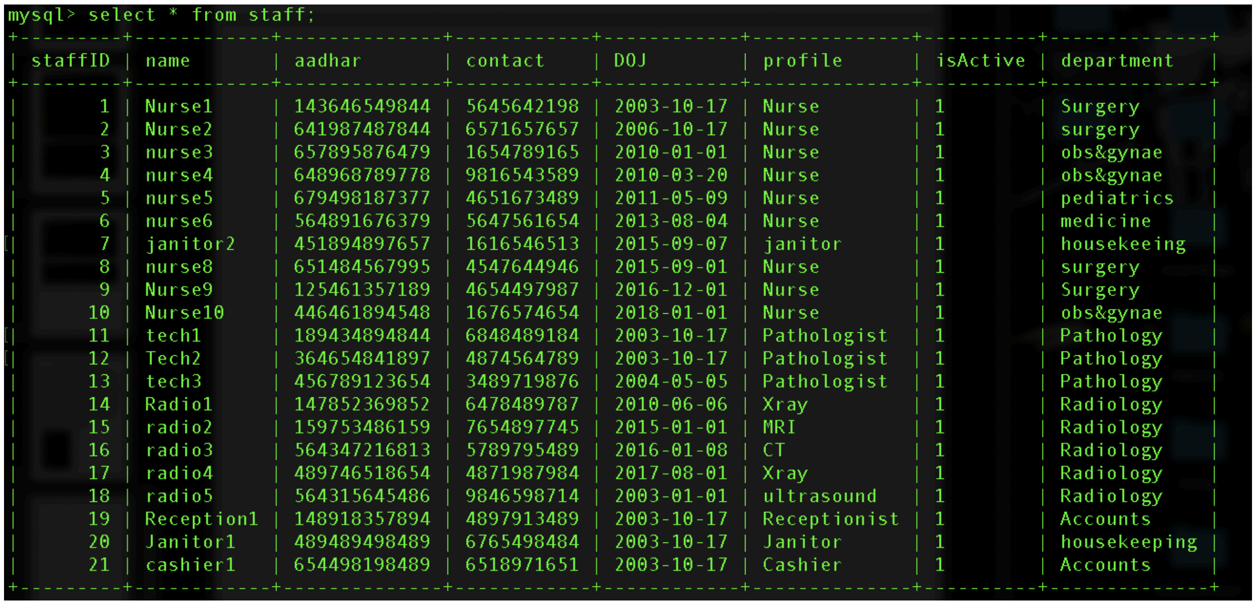
The database is implemented in SQL technology

Tables



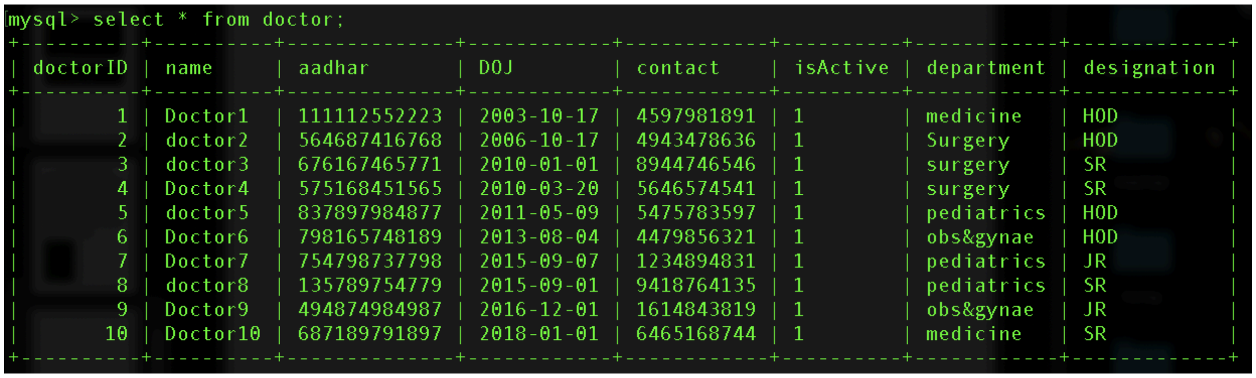
```
mysql> show tables;
+-------------------+
| Tables_in_dbms    |
+-------------------+
| doctor            |
| equipment         |
| hod               |
| ops               |
| patient           |
| room              |
| roomoccupation    |
| service           |
| staff             |
| supporttreatment  |
| treatment         |
+-------------------+
```

Staff details



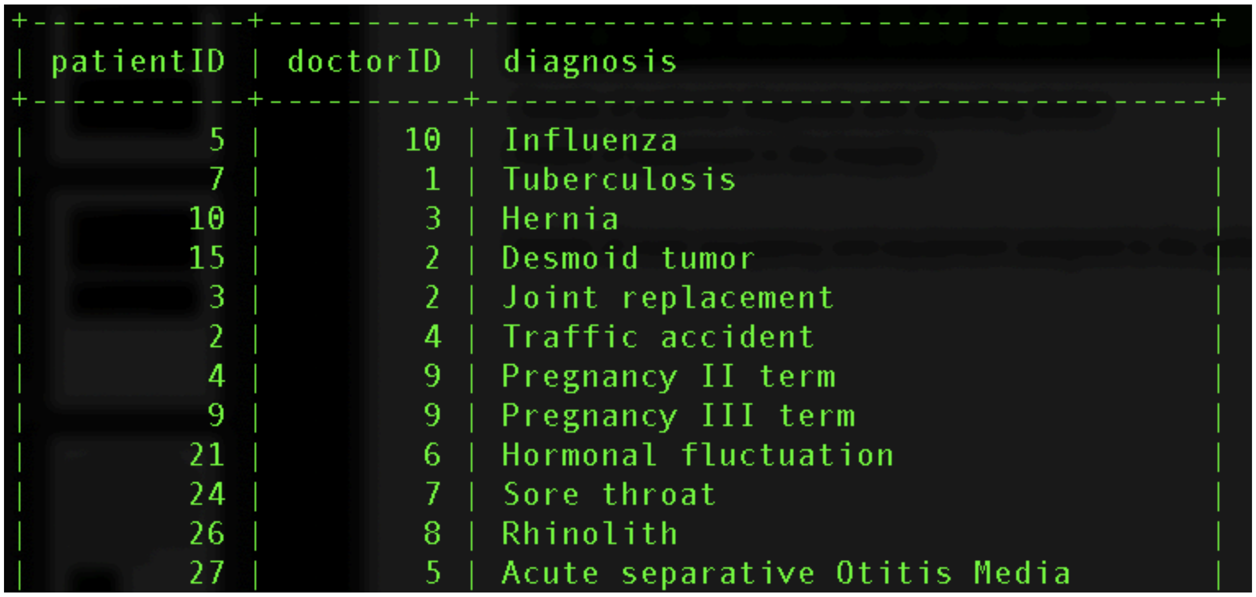
```
mysql> select * from staff;
+---------+-------------+--------------+------------+------------+--------------+----------+--------------+
| staffID | name        | aadhar       | contact    | DOJ        | profile      | isActive | department   |
+---------+-------------+--------------+------------+------------+--------------+----------+--------------+
|       1 | Nurse1      | 143646549844 | 5645642198 | 2003-10-17 | Nurse        | 1        | Surgery      |
|       2 | Nurse2      | 641987487844 | 6571657657 | 2006-10-17 | Nurse        | 1        | surgery      |
|       3 | nurse3      | 657895876479 | 1654789165 | 2010-01-01 | Nurse        | 1        | obs&gynae    |
|       4 | nurse4      | 648968789778 | 9816543589 | 2010-03-20 | Nurse        | 1        | obs&gynae    |
|       5 | nurse5      | 679498187377 | 4651673489 | 2011-05-09 | Nurse        | 1        | pediatrics   |
|       6 | nurse6      | 564891676379 | 5647561654 | 2013-08-04 | Nurse        | 1        | medicine     |
|       7 | janitor2    | 451894897657 | 1616546513 | 2015-09-07 | janitor      | 1        | housekeeing  |
|       8 | nurse8      | 651484567995 | 4547644946 | 2015-09-01 | Nurse        | 1        | surgery      |
|       9 | Nurse9      | 125461357189 | 4654497987 | 2016-12-01 | Nurse        | 1        | Surgery      |
|      10 | Nurse10     | 446461894548 | 1676574654 | 2018-01-01 | Nurse        | 1        | obs&gynae    |
|      11 | tech1       | 189434894844 | 6848489184 | 2003-10-17 | Pathologist  | 1        | Pathology    |
|      12 | Tech2       | 364654841897 | 4874564789 | 2003-10-17 | Pathologist  | 1        | Pathology    |
|      13 | tech3       | 456789123654 | 3489719876 | 2004-05-05 | Pathologist  | 1        | Pathology    |
|      14 | Radio1      | 147852369852 | 6478489787 | 2010-06-06 | Xray         | 1        | Radiology    |
|      15 | radio2      | 159753486159 | 7654897745 | 2015-01-01 | MRI          | 1        | Radiology    |
|      16 | radio3      | 564347216813 | 5789795489 | 2016-01-08 | CT           | 1        | Radiology    |
|      17 | radio4      | 489746518654 | 4871987984 | 2017-08-01 | Xray         | 1        | Radiology    |
|      18 | radio5      | 564315645486 | 9846598714 | 2003-01-01 | ultrasound   | 1        | Radiology    |
|      19 | Reception1  | 148918357894 | 4897913489 | 2003-10-17 | Receptionist | 1        | Accounts     |
|      20 | Janitor1    | 489489498489 | 6765498484 | 2003-10-17 | Janitor      | 1        | housekeeping |
|      21 | cashier1    | 654498198489 | 6518971651 | 2003-10-17 | Cashier      | 1        | Accounts     |
+---------+-------------+--------------+------------+------------+--------------+----------+--------------+
```

Doctors details



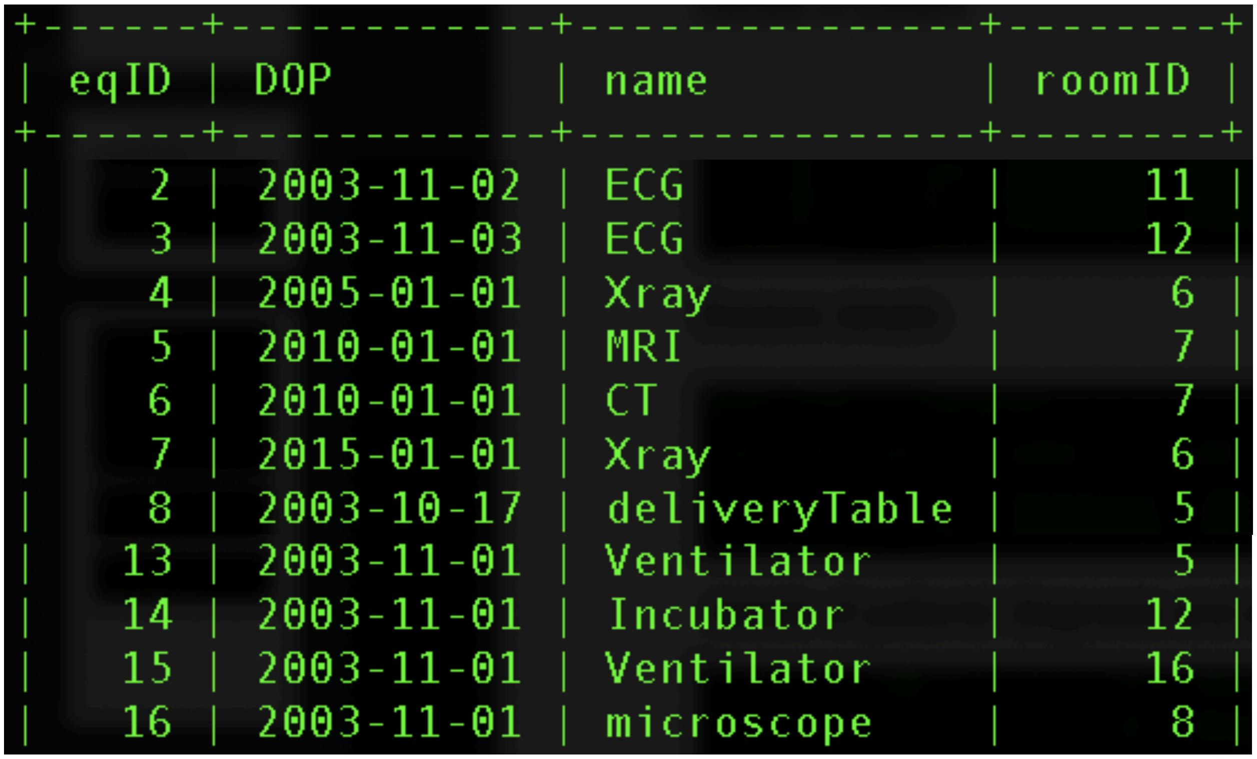
```
mysql> select * from doctor;
+----------+----------+--------------+------------+------------+----------+------------+-------------+
| doctorID | name     | aadhar       | DOJ        | contact    | isActive | department | designation |
+----------+----------+--------------+------------+------------+----------+------------+-------------+
|        1 | Doctor1  | 111112552223 | 2003-10-17 | 4597981891 | 1        | medicine   | HOD         |
|        2 | doctor2  | 564687416768 | 2006-10-17 | 4943478636 | 1        | Surgery    | HOD         |
|        3 | doctor3  | 676167465771 | 2010-01-01 | 8944746546 | 1        | surgery    | SR          |
|        4 | Doctor4  | 575168451565 | 2010-03-20 | 5646574541 | 1        | surgery    | SR          |
|        5 | doctor5  | 837897984877 | 2011-05-09 | 5475783597 | 1        | pediatrics | HOD         |
|        6 | Doctor6  | 798165748189 | 2013-08-04 | 4479856321 | 1        | obs&gynae  | HOD         |
|        7 | Doctor7  | 754798737798 | 2015-09-07 | 1234894831 | 1        | pediatrics | JR          |
|        8 | doctor8  | 135789754779 | 2015-09-01 | 9418764135 | 1        | pediatrics | SR          |
|        9 | Doctor9  | 494874984987 | 2016-12-01 | 1614843819 | 1        | obs&gynae  | JR          |
|       10 | Doctor10 | 687189791897 | 2018-01-01 | 6465168744 | 1        | medicine   | SR          |
+----------+----------+--------------+------------+------------+----------+------------+-------------+
```

Details of patients’ diagnosis and attending doctor



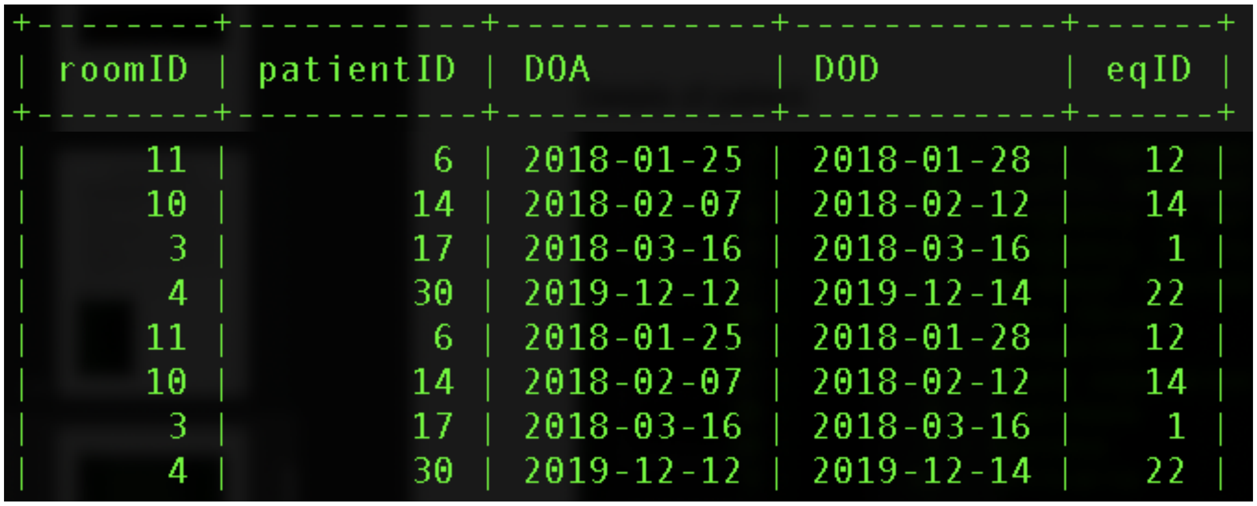
```
+-----------+----------+-----------------------------------+
| patientID | doctorID | diagnosis                         |
+-----------+----------+-----------------------------------+
|         5 |       10 | Influenza                         |
|         7 |        1 | Tuberculosis                      |
|        10 |        3 | Hernia                            |
|        15 |        2 | Desmoid tumor                     |
|         3 |        2 | Joint replacement                 |
|         2 |        4 | Traffic accident                  |
|         4 |        9 | Pregnancy II term                 |
|         9 |        9 | Pregnancy III term                |
|        21 |        6 | Hormonal fluctuation              |
|        24 |        7 | Sore throat                       |
|        26 |        8 | Rhinolith                         |
|        27 |        5 | Acute separative Otitis Media     |
```

Details of equipment in the hospital



```
+------+------------+---------------+--------+
| eqID | DOP        | name          | roomID |
+------+------------+---------------+--------+
|    2 | 2003-11-02 | ECG           |     11 |
|    3 | 2003-11-03 | ECG           |     12 |
|    4 | 2005-01-01 | Xray          |      6 |
|    5 | 2010-01-01 | MRI           |      7 |
|    6 | 2010-01-01 | CT            |      7 |
|    7 | 2015-01-01 | Xray          |      6 |
|    8 | 2003-10-17 | deliveryTable |      5 |
|   13 | 2003-11-01 | Ventilator    |      5 |
|   14 | 2003-11-01 | Incubator     |     12 |
|   15 | 2003-11-01 | Ventilator    |     16 |
|   16 | 2003-11-01 | microscope    |      8 |
```

Details of room occupancy and equipment assigned to the patient



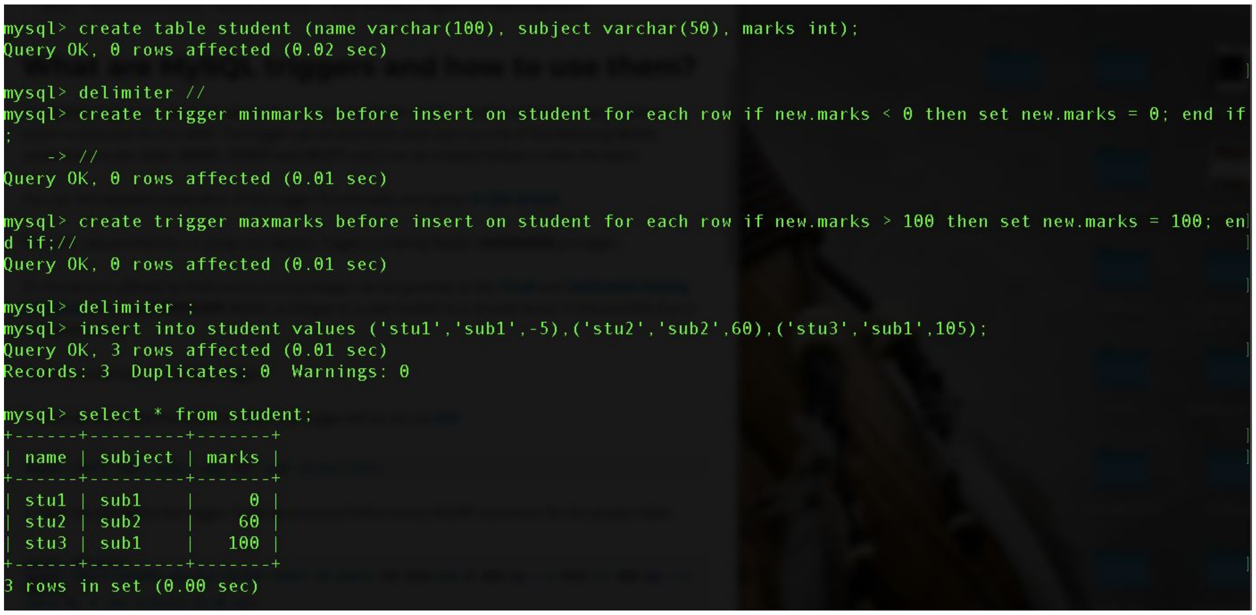
```
+--------+-----------+------------+------------+------+
| roomID | patientID | DOA        | DOD        | eqID |
+--------+-----------+------------+------------+------+
|     11 |         6 | 2018-01-25 | 2018-01-28 |   12 |
|     10 |        14 | 2018-02-07 | 2018-02-12 |   14 |
|      3 |        17 | 2018-03-16 | 2018-03-16 |    1 |
|      4 |        30 | 2019-12-12 | 2019-12-14 |   22 |
|     11 |         6 | 2018-01-25 | 2018-01-28 |   12 |
|     10 |        14 | 2018-02-07 | 2018-02-12 |   14 |
|      3 |        17 | 2018-03-16 | 2018-03-16 |    1 |
|      4 |        30 | 2019-12-12 | 2019-12-14 |   22 |
```

The Hospital management system is implemented in MySQL using the relational database model.

Operations and functionalities are as discussed in the previous practicals.

Practical 9: IMPLEMENTING TRIGGERS IN SQL

A trigger is a special type of stored procedure that automatically runs when an event occurs in the database.



```
mysql> create table student (name varchar(100), subject varchar(50), marks int);
Query OK, 0 rows affected (0.02 sec)

mysql> delimiter //
mysql> create trigger minmarks before insert on student for each row if new.marks < 0 then set new.marks = 0; end if
;
    -> //
Query OK, 0 rows affected (0.01 sec)

mysql> create trigger maxmarks before insert on student for each row if new.marks > 100 then set new.marks = 100; en
d if;//
Query OK, 0 rows affected (0.01 sec)

mysql> delimiter ;
mysql> insert into student values ('stu1','sub1',-5),('stu2','sub2',60),('stu3','sub1',105);
Query OK, 3 rows affected (0.01 sec)
Records: 3  Duplicates: 0  Warnings: 0

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub1    |     0 |
| stu2 | sub2    |    60 |
| stu3 | sub1    |   100 |
+------+---------+-------+
3 rows in set (0.00 sec)
```

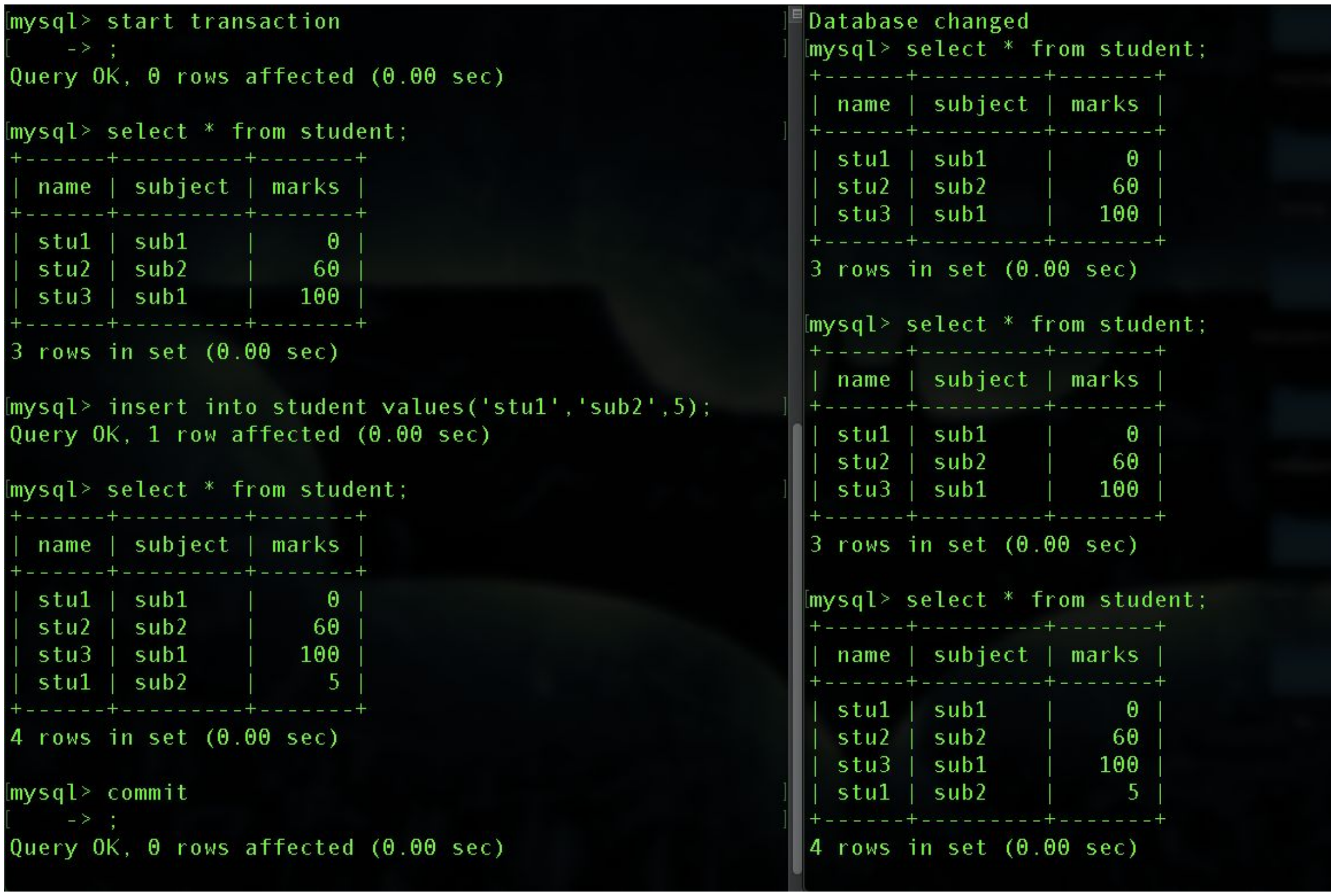
A table is created as Student(name, subject, marks)
Triggers are defined:

- Min marks - set marks to 0 if marks entered < 0
- Max marks - set marks to 100 if marks entered > 100
- The triggers execute before INSERT DML statement (as defined)

Practical 10: TRANSACTION STATEMENTS

Implementing the following transactional statements :
1. Commit
2. Rollback
3. Savepoint

COMMIT

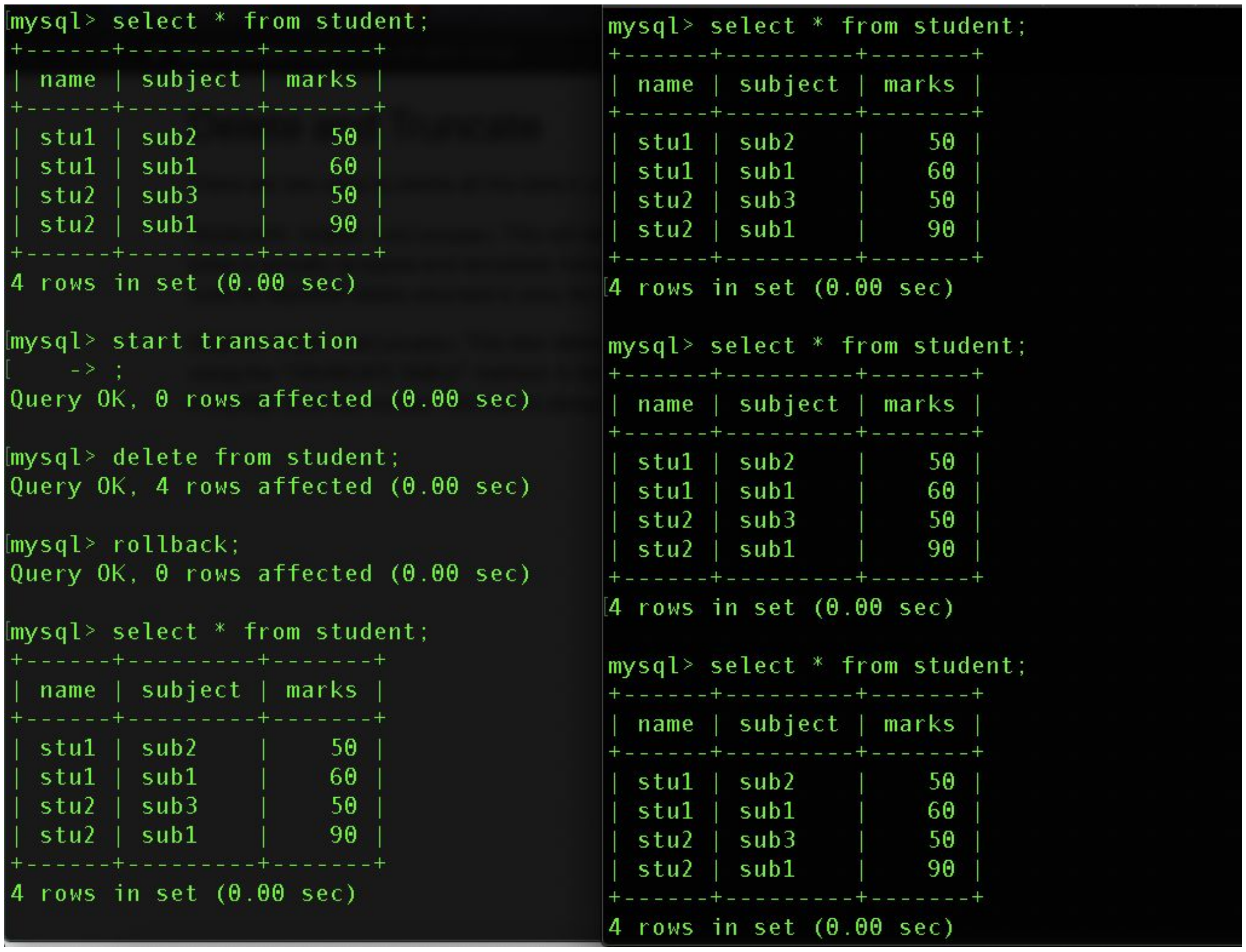


```
mysql> start transaction
    -> ;
Query OK, 0 rows affected (0.00 sec)

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub1    |     0 |
| stu2 | sub2    |    60 |
| stu3 | sub1    |   100 |
+------+---------+-------+
3 rows in set (0.00 sec)

mysql> insert into student values('stu1','sub2',5);
Query OK, 1 row affected (0.00 sec)

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub1    |     0 |
| stu2 | sub2    |    60 |
| stu3 | sub1    |   100 |
| stu1 | sub2    |     5 |
+------+---------+-------+
4 rows in set (0.00 sec)

mysql> commit
    -> ;
Query OK, 0 rows affected (0.00 sec)
```

```
Database changed
mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub1    |     0 |
| stu2 | sub2    |    60 |
| stu3 | sub1    |   100 |
+------+---------+-------+
3 rows in set (0.00 sec)

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub1    |     0 |
| stu2 | sub2    |    60 |
| stu3 | sub1    |   100 |
+------+---------+-------+
3 rows in set (0.00 sec)

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub1    |     0 |
| stu2 | sub2    |    60 |
| stu3 | sub1    |   100 |
| stu1 | sub2    |     5 |
+------+---------+-------+
4 rows in set (0.00 sec)
```

A transaction does not reflect in another session (shell) until committed. The insert statement reflects in another session only after the transaction is committed i.e the changes written to the database.

ROLLBACK



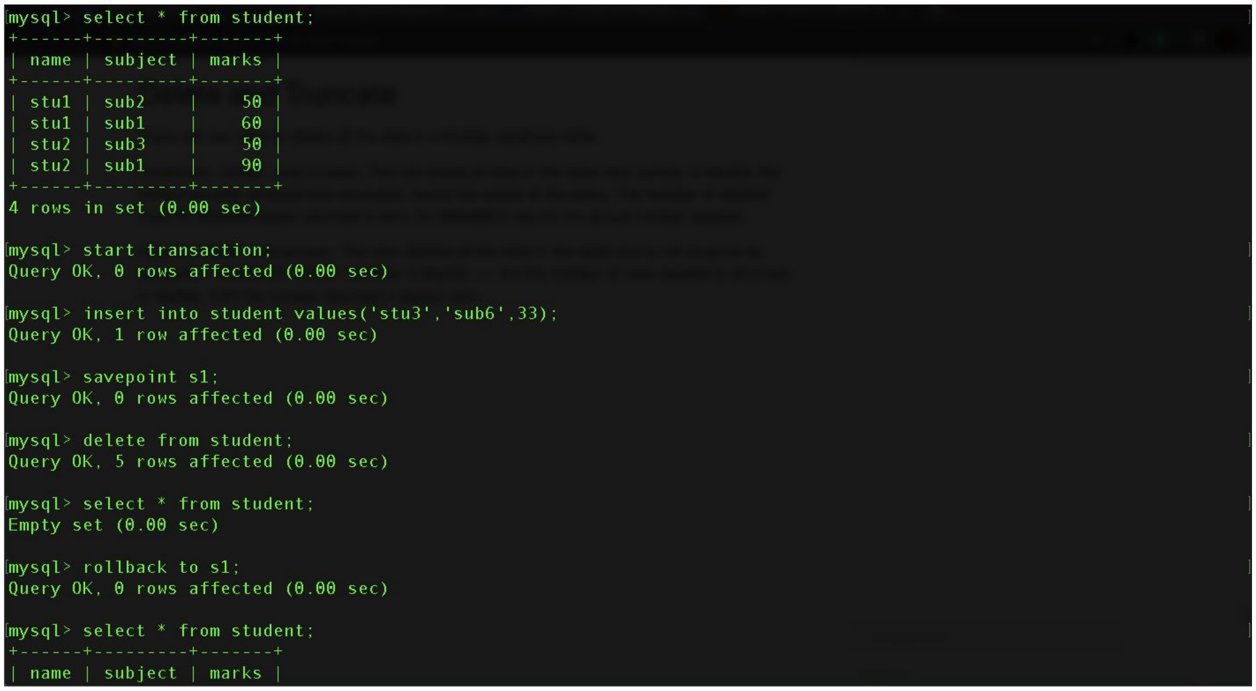
```
[mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub2    |    50 |
| stu1 | sub1    |    60 |
| stu2 | sub3    |    50 |
| stu2 | sub1    |    90 |
+------+---------+-------+
4 rows in set (0.00 sec)

[mysql> start transaction
[    -> ;
Query OK, 0 rows affected (0.00 sec)

[mysql> delete from student;
Query OK, 4 rows affected (0.00 sec)

[mysql> rollback;
Query OK, 0 rows affected (0.00 sec)

[mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub2    |    50 |
| stu1 | sub1    |    60 |
| stu2 | sub3    |    50 |
| stu2 | sub1    |    90 |
+------+---------+-------+
4 rows in set (0.00 sec)
```

```
mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub2    |    50 |
| stu1 | sub1    |    60 |
| stu2 | sub3    |    50 |
| stu2 | sub1    |    90 |
+------+---------+-------+
[4 rows in set (0.00 sec)

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub2    |    50 |
| stu1 | sub1    |    60 |
| stu2 | sub3    |    50 |
| stu2 | sub1    |    90 |
+------+---------+-------+
[4 rows in set (0.00 sec)

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub2    |    50 |
| stu1 | sub1    |    60 |
| stu2 | sub3    |    50 |
| stu2 | sub1    |    90 |
+------+---------+-------+
4 rows in set (0.00 sec)
```

Rollback is an important feature as it allows to undo certain commands and ensure atomicity of the transaction Here the data in table student is deleted, which reflects only in the session executing the transaction Rollback restores the table to the state before the transaction i.e. the changes are discarded and not written to the database.

Another window shows no change in the output as the transaction is not reflected in the database.

SAVEPOINTS



```
mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
+------+---------+-------+
| stu1 | sub2    |    50 |
| stu1 | sub1    |    60 |
| stu2 | sub3    |    50 |
| stu2 | sub1    |    90 |
+------+---------+-------+
4 rows in set (0.00 sec)

mysql> start transaction;
Query OK, 0 rows affected (0.00 sec)

mysql> insert into student values('stu3','sub6',33);
Query OK, 1 row affected (0.00 sec)

mysql> savepoint s1;
Query OK, 0 rows affected (0.00 sec)

mysql> delete from student;
Query OK, 5 rows affected (0.00 sec)

mysql> select * from student;
Empty set (0.00 sec)

mysql> rollback to s1;
Query OK, 0 rows affected (0.00 sec)

mysql> select * from student;
+------+---------+-------+
| name | subject | marks |
```

A need for partial rollback may arise in certain scenarios where the transaction needs to be restored to a state reached in the execution. Savepoint lets user create such a state to which a transaction may be restored. Here savepoint s1 is created after inserting a row in the original table.