Lab Comprehensive Test
Database Systems
21st April 2018

General Instructions (In addition to those provided):
- **There are 4 questions.(12+12+12+4)**

- **Make sure to copy the query and the result (both) in a text file failing which you will be given 0 for that question. The text file you save in your system will be the only thing available for the TAs to check your solutions.**
- **Any malpractices will be taken seriously and strict action will be taken.**

You have been provided a new database that contains Employee details. Follow the FAQ to source the new database to your Mysql account.

FAQ

1. **How do I source the employee database?**

Unzip the archive compre.zip. Keep the sql file (emp.sql), that you just downloaded, in the desktop.

Open Terminal (CTRL+ALT+T)

> cd Desktop;

> mysql -u root -p

password: 123456

Now, drop all available EMDB, EMPLOYEE, Employee, Emp, EMP, MYEMPLOYEE

databases (if any). Don't delete other databases and schemas. [caution]

Now create a database: EMPDB

mysql> CREATE DATABASE EMPDB;

mysql> USE EMPDB;

Source the emp.sql from EMPDB database.

mysql> source emp.sql

mysql> SHOW TABLES;

2. Is there partial marking?

No. Marking scheme: 0 or full .

3. What is the duration of the test?

1 Hr. 15 Minutes; You must switch off the monitor once announced and leave the lab immediately.

4. Can we get help from TAs or instructors?

Only in case of situations which prove extremely beneficial to society.

5. What is the penalty for malpractice?

You will be awarded 0 in today's test. The person with whom do you share and from whom did you copy will also get 0.

-EMPDB SCHEMA-

The EMPDB database contains the following relations.

EMPLOYEE (empno, name, job, boss, hiredate, salary, comm, deptno);

DEPARTMENT (deptno, name, location);

SALARYGRADE (grade, losal, hisal);

BONUS (ename, job, sal, comm);

PROJECT (projectno, description, start_date, end_date);

PROJECT_PARTICIPATION (projectno, empno, start_date, end_date, role_id);

ROLE (role_id, description);

For more information, you should use SHOW TABLES query.

QUESTIONS

Q1. The employees went on for a strike against the company for their low wages. As a data analyst, you are being hired to analyze the employee database and provide suitable increase in the wages of the employees.

You have to create a procedure "Proposal" which will analyze the participation of the employees in the various projects of the company. In this stored procedure, you are to do the following things.

You are required to make a new table "New_proposal" which contains the following columns:

1. Employee Number (empno) 2. Old Salary 3. New Salary 4. New Salary Grade

You have to analyze the PROJECT_PARTICIPATION and SALARYGARDE tables and compute the new salary as follows:

- If the employee is still working on a project, then salary will not be changed.

- If the employee has worked on any project for more than 30 days only then the salary will be changed.

- If the role of an employee in a project is a developer, then the salary will be increased by 400, but his salary grade should not be changed. If the grade is changing by adding 400 to current salary, then make the highest salary of the current grade to the new salary.

- If the role of an employee in a project is a researcher, then the salary will be increased by 400, but his salary grade can be changed.

- If the role of an employee in a project is a project manager,

then the salary grade of the employee should be changed, i.e, the new salary should be the lowest salary of the next salary grade.

• If an employee has worked on more than one project, you have to do the above steps for all the projects. Note: The highest salary grade is 5. If your salary grade is increasing beyond 5, then make the new salary to the highest salary of the grade 5. You should print the values of this table for evaluation. Only a single table will be checked.

Q.2
Welcome to the Roman Empire. The king of Rome, **Debius Tirthius**, is a very rich man. He is good with Roman Numbers but unfortunately not with normal numbers. He will give a very good prize to the person who helps him solve the problem he is facing. Make sure it's you!

The question contains 2 parts:

PART-1

Given number of days passed(**in roman numbers**) in a given year(**in roman numbers**) and the month(**in normal numbers**), print "**True**" or "**False**" if that day occurs in that month. For example,
call p1('X', 'X', 1, @ans);
select @ans;
     This should print "True"

Logic :
No. of days passed - 10
Year - 10
Month - 1 (January)
This is true.

call p1('XXXII', 'X', 1, @ans);
select @ans;
     This should print "False"

Logic :
No. of days passed - 32
Year - 10
Month - 1 (January)
This is false.

call p1('LX', 'X', 2, @ans);
select @ans;
     This should print "False"

Logic :

No. of days passed - 60
Year - 10
Month - 2 (February)
This is false.

call p1('LX', 'XII', 2, @ans);
select @ans;
      This should print "True"

Logic :
No. of days passed - 60
Year - 12 (Leap Year)
Month - 2 (February)
This is true.

PART-2

Given the day on 1st Jan(**string**), year(**in roman numbers**) and no. of days passed(**in normal numbers**) print the current day and date. Make sure that the input is valid, else print **"INPUT IS INVALID".** For example,

      call p2('MON', 'X', 1, @ans);
      select @ans;
            This should print "MON, 1 JAN 10"

      Logic :
      No. of days passed - 1
      Year - 10

      call p2('MON', 'X', 2, @ans);
      select @ans;
            This should print "TUE, 2 JAN 10"

      Logic :
      No. of days passed - 2
      Year - 10

call p2(TUE, 'Xii', 45, @ans);
select @ans;
    This should print "THU, 14 FEB 12"

Logic :
No. of days passed - 45
Year - 12

Points to be noted:
  · Roman numbers that will be used : I(1), V(5), X(10), L(50),
    C(100)
  · V is 5, VI is 6 but IV is 4 :P
  · XL is 40, XC is 90
  · A leap year is the one which is divisible by 4 when not divisible
    by 100, and divisible by 400 when divisible by 100.
  · We need the final 2 procedures, but we do not put a restriction
    on the number of procedures you want to make

Q3)

PERCEPTRON

Many of you might be interested in taking Machine Learning/Deep Learning course next semester. Let us add some more interests to that. The task for you is to write a MySQL procedure to learn a binary classification problem with a simple Neural Network, called Perceptron. We do not expect you to have known the concept behind it. Therefore, we provide you some clear hints about it and the signature of the methods that you need to implement.

A perceptron is defined as a function approximator that takes a d-dimensional input vector X and produces a decision called y. So, X is defined as $X = (x_1, x_2, ..., x_d)$. y is usually a class label e.g. True, False; Yes, No; 1,-1; 1,0 and suchlike. A perceptron can mathematically be written as

$$y = f(x_1, x_2, ..., x_d; W)$$

where, W is the knowledge and is (d+1)-dimensional.

Learning/Training in perceptron can be defined as a process in which it generates an optimal W starting with an initial knowledge.
Prediction/Testing in preceptron can be defined as a process of producing a class label by providing the perceptron an input vector X.

For the purpose of learning and predicting, we provide you the following dataset and the goal is to Learn Bipolar 2-bit XOR.

```
x1    x2    | ytrue
--------|-------
-1    -1    | 1  <- TRAIN
-1     1    | -1 <- TRAIN
 1    -1    | -1 <- TRAIN
 1     1    | 1  <- TEST
----------------
```

The patterns marked as TRAIN are training examples. The pattern marked as TEST is called testing example.

There are two procedures that you need to write.

(1) predict():

    - Purpose: To predict a class label and a prediction error

    - Inputs: x1, x2, ytrue
    - Outputs: ypred, prediction error

    - Methodology: It first learns all the training examples shown in the above datasets for 10 epochs i.e. each example is learned thrice. If number the examples, then training examples are 1,2,3 and the test is 4. So, training happens in the sequence, 1,2,3, 1,2,3, 1,2,3, ... 10 times. A bunch of 1,2,3 is called an epoch, there are 10 such epochs. After training is finished (i.e. the epochs are finished), your learned perceptron will take inputs x1, x2, ytrue and produce the outputs ypred, and prediction error. You need to print the output only in the terminal.

(2) train():

- Purpose: To train a perceptron
- Inputs: x1, x2, ytrue, w0_old, w1_old, w2_old (i.e. inputs and past knowledge)
- Outputs: w0, w1, w2 (Updated knowledge)
- Methodology: Take the inputs x1, x2, ytrue, w0_old, w1_old, w2_old and produce a decision by following the equation:

if (w0_o + x1*w1_o + x2*w2_o) > 0, then ypred = 1;
else ypred = -1;

If ypred = ytrue, then no need to update the knowledge. The perceptron is optimal for the present input.

If ypred != ytrue, then it should learn. So, you need to update the values of w0, w1, and w2. So, without breaking your head, use the following knowledge update rules:

w0 = w0_old + eta*(ytrue - ypred);
w1 = w1_old + eta*(ytrue - ypred)*x1;
w2 = w2_old + eta*(ytrue - ypred)*x2;

Note: Set the initial weights to (w0 = 1, w1 = 0, w2 = 0).

Some example test cases:

Test case 1: call predict(-1,-1,1,@ypred,@etest)//

mysql> select @ypred,@etest//
+--------+--------+
| @ypred | @etest |
+--------+--------+
| 1 | 0 |

```
+--------+--------+
```
1 row in set (0.00 sec)

Test case 2: call predict(1,1,1,@ypred,@etest)//

mysql> select @ypred,@etest//
```
+--------+--------+
| @ypred | @etest |
+--------+--------+
|     -1 |      2 |
+--------+--------+
```
1 row in set (0.00 sec)

In case you worry, the optimal weights for my learned
perceptron are:
```
+------+------+------+
| @w0  | @w1  | @w2  |
+------+------+------+
| -0.8 | -1.8 | -1.8 |
+------+------+------+
```
1 row in set (0.00 sec)

Query OK, 0 rows affected (0.00 sec)

Q4)

The Indian Government has decided to revamp their quantum research policy. To attract more people, they have decided to increase their salary by 5% of all those who are working on quantum research. Write a mysql query to print the *Employee No., Employee Name, Old Salary,Project Description, Salary Grade(using old salary), New Salary* sorted by their new salary.

Answer Format-

```
+-------+--------+---------+-------------------------------------------------+-------+-----------+
| EMPNO | NAME   | SALARY  | DESCRIPTION                                     | GRADE | NEWSAL    |
+-------+--------+---------+-------------------------------------------------+-------+-----------+
|  7566 | JONES  | 2975.00 | Foundation of Quantum Technology  |     4 | 3123.7500 |
.
.
.
```