



# UNIVERSITY OF RUHUNA

## Faculty of Engineering

End-Semester 5 Examination in Engineering: August 2015

Module Number: EE5203

Module Name: Data Management Systems  
[Three Hours]

[Answer all questions. Each question carries 10 marks]

Q1 You are given the following requirements of a database for the Sri Lanka Volleyball Federation (SLVF).

- The SLVF has many teams
- each team has a name, a city, a coach, a captain, and a set of players,
- each player belongs to only one team,
- each player has a name, a position, a skill level, and a set of injury records,
- a team captain is also a player,
- a game is played between two teams (referred to as host\_team and guest\_team) and has a date and a score
- SLVF maintains a directory of referees

Design an ER diagram to capture the above information.

[10 marks]

Q2 a) Explain the functionality of the following operations used in relational algebra. Your answer should indicate any special properties of the resulting relation.

- |               |               |
|---------------|---------------|
| i) Select     | ii) Union     |
| iii) Equijoin | iv) Cartesian |

[2 marks]

b) Following three relations are part of a database schema which is used to track student registrations.

Student (sid, fname, lname, sex, semester, dept)

Modules(code, name)

registered(sid, code)

Write down relational algebra expressions to retrieve the following information.

- List the codes of modules in which at least one student is registered
- List the first name(fname) and last name(lname) of all students in semester 6 who are in the 'ME' department
- List the codes of courses for which no student is registered
- List the first name and last name of the students who are registered for 'Data Management Systems'.
- List the last names of the students in the 'EE' department, who are registered for the module 'Introduction to Astronomy'.
- List the name of the module 'EE5203'

- vii) List the last names of male students who are registered for module 'IS3207' or EE5203..
- viii) List the first names of female students who are registered for modules 'IS3207' and 'EE5203'.

[8 marks]

- Q3 a) Discuss briefly the problems that a Data Base Administrator might encounter in granting system privileges with 'admin' option.

[1 mark]

- b) Ulman, Raja and Rani are working for the same company. Ulman is the database administrator and has full privileges on the database. All three of them simultaneously log on to the database and issue following commands.

```
Ulman > create table exam (sid number(3) , marks number(2) );
```

```
Ulman > grant all on exam to Raja with grant option ;
```

```
Raja > grant all on ulman.exam to Rani ;
```

```
Rani > insert into ulman.exam values (1 , 11) ;
```

```
Rani > Savepoint a;
```

```
Rani > select * from ulman.exam ;
```

```
Rani > update ulman.exam set marks=22 where sid=1 ;
```

```
Raja > select * from ulman.exam ;
```

```
Raja > insert into exam values (2, 34) ;
```

```
Raja > select * from ulman.exam ;
```

```
Raja > savepoint b;
```

```
Ulman > select * from exam ;
```

```
Ulman > insert into exam values (9, 77) ;
```

```
Ulman > commit ;
```

```
Rani > rollback to a;
```

```
Rani > commit ;
```

```
Rani > select * from ulman.exam ;
```

```
Raja > commit ;
```

```
Raja > update exam set marks=marks+12 where sid=7 ;
```

```
Rani > select * from ulman.exam ;
```

```
Rani > insert into ulman.exam values (3, 33) ;
```

```
Ulman > update exam set marks= marks + 1 ;
```

```
Ulman > select * from exam;
```

```
Raja > select * from ulman.exam ;
```

```
Ulman > rollback ;
```

```
Rani > rollback ;
```

```
Raja > rollback ;
```

```
Raja > select * from ulman.exam;
```

```
Rani > select * from ulman.exam;
```

Write down the output from the select statements.

[9 marks]

Q4 a) List the characteristics of a primary index.

[2 marks]

b) Galle taxi service (GTS) has a fleet of about 1000 taxis. For the purpose of managing, the service area is divided into 30 zones. Customers call the central office, to book a taxi. The office will offer the job to a free taxi in the zone. The driver has one minute to accept the job. If not accepted job is offered to the next taxi in the zone. If there is no taxi in the zone job is offered to a taxi in the adjoining zone. GTS has created a simple database to manage the services. It has one table named taxi whose structure is given below..

```
Taxi (tid number(3), zone number(2) , driver_tel varchar2(10), free char(1),  
driv_address varchar2(100) )
```

This table has about 1000 records. The data are stored in 100 blocks. If an index is created it will occupy 2 blocks.

On a typical day GTS runs following types of statements

To find the telephone numbers of the drivers who are within a given zone.

```
Q1) Select driver_tel  
From Taxi  
Where free= 'Y'  
And zone = 13 ;
```

To update the status of a taxi when a job is accepted by a driver.

```
Q2) update  
taxi set zone=15 , free = 'N'  
where tid=33 ;
```

To insert a record when a new taxi joins the fleet.

```
I1) insert into taxi values(55, 32, '0776234567', 'Y')
```

In a given hour during open hours the number of times the three statements Q1, Q2 and I1 run are about 20, 60 and 10 respectively.

What indexes (if any) will you create to improve the performance?

(Answers without supporting calculations will carry no marks).

[8 Marks]

- Q5 a) Explain the following terms used in database architecture
- i) Pctfree
  - ii) dirty block
  - iii) Pctused
  - iv) log writer

[2 marks]

- b) An airline maintains a database to capture information on their operations. This data base includes two tables named delay and pilot, whose structures are given below. Delay (delayid, pilotid, flight, date, origin, destination, delayCategory, delayMins, aircraftType )

pilot (pilotid, lname, fname, birthDate, hiredDate, salary, flyingHours, skillLevel)

An airline serves 116 cities in Asia. Number of flights to each city can be assumed to be uniform. They have a total of about 1000 pilots out of which 23 are females. Salary of a pilot ranges from 100000 to 300000. 10% of the pilots earn more than 200000. Youngest pilot is 30 years old and eldest is 60 years. The age can be assumed to vary uniformly. Lastname and the firstname of the pilots are entered in uppercase. They observe that 90% of the delays occur on the flights originating from Colombo (CMB). Airline owns a fleet of 200 aircrafts out of which 50 are Air Bus and others Boeings.

Developers are running following queries on the database. All of them are functionally correct and yield the correct results. Rewrite these queries to improve the performance. Reason(s) for changes should be clearly indicated.

```
Select lname, fname
From pilot p, delay d
Where p.pilotid= d.pilotid
And birthDate - 100 > '01-Jan-1980'
And hiredDate + 200 < '01 - Jan - 2010'
And sex <> 'M'
And origin = 'CMB'
And sex = 'F'
And aircraftType = 'Airbus'
And delayMins > 30
And aircraftType <> 'Boeing';
```

```
Select origin, destination, delayMins
From delay
Where date + 100 > '01-jan-2013'
And date - 100 < '01-jan-2013'
And delayMins > (select avg(delayMins) from delay where aircraftType='Airbus'
OR origin='CMB' OR origin = 'BKK')
And origin = 'CMB'
And origin = 'BKK'
And DelayCategory = 19 ;
```

```
Select lname, fname, hiredDate
From pilot
Where hiredDate + 50 < '01-Mar-2010'
OR upper(lname) like 'P_%'
OR salary < (select avg(salary) from pilot where birthDate > '01-Jan-60' and sex=
'F')
OR hiredDate - birthDate < 10000
OR upper(lname) like 'PA%'
OR salary + 10000 > 150000
OR salary + 50000 < 210000 ;
```

```
Select lname, fname
From pilot p, delay d
Where p.pilotid= d.pilotid
OR delayMins < 30
OR delaymins > 10
OR aircraftType = 'Airbus'
OR hiredDate > '01-Mar-2010'
OR delayMins > 15
OR lname like 'FER%' ;
```

[8 marks]