



# UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 6 Examination in Engineering: December 2015

Module Number: EE6237

Module Name: Data Management Systems

[Three Hours]

[Answer all questions. Each question carries 10 marks]

Q1 a) Explain the following terms used in database design

- i) Key
- ii) Super key
- iii) Candidate key

[3 marks]

b) Construct an E-R diagram for the Hapugala Hospital which maintains data about the following entities:

- i) Doctors: including id number, name, telephone no, address, specialization
- ii) Patients: including NIC number, name, sex, address, date admitted, date discharged, doctor, tests
- iii) Tests: including id, patient id, test, result, date, time, technician

Note down any unspecified requirements, and make appropriate assumptions to make the specification complete.

[7 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) Projection
- ii) Natural join
- iii) Cartesian join
- iv) Select

[2 marks]

b) Following relations are part of a database schema.

patients (patient-id, name, address, sex, date-admitted, date-checked-out);

doctors (doctor-id, name, specialization)

test (testid, testname, date, time, result)

doctor-patient (patient-id, doctor-id)

test-log (testid, patient-id)

performed-by (testid, doctor-id)

Write down relational algebra expressions to retrieve the following information.

- i) Names and addresses of patients who were admitted on 01<sup>st</sup> Dec, 2015
- ii) Names of patients who are in charge of Dr. 'Nimal Perera'
- iii) List of tests performed by Dr. 'Ranjith Silva'
- iv) Names of patients who were tested for 'Glucose Level'
- v) List of patients who were in the hospital for more than two weeks
- vi) List of male patients who are currently in the hospital
- vii) List of Dr 'Nimal Pereras' patients who were in the hospital for more than 10 days
- viii) List of all 'neurologists'

[8 marks]

Q3 a) Explain clearly the difference between following two options in granting privileges

- i) Grant with admin option;
- ii) Grant with grant option ;

[1 mark]

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

```

ULMAN>create table sal (eid number(2) , salary number(4));
ULMAN>grant select on sal to nalini with grant option ;
ULMAN>insert into sal values (1, 2250) ;
NALINI>select * from ulman.sal ;
NALINI>grant select on ulman.sal to nimal ;
ULMAN>savepoint A ;
ULMAN>insert into sal values (2, 4350) ;
ULMAN>select * from sal ;
NIMAL>select * from ulman.sal ;
ULMAN>update sal set salary=salary+150 ;
ULMAN>select * from sal ;
ULMAN>rollback to a ;
ULMAN>select * from sal ;
NIMAL>select * from ulman.sal ;
ULMAN>commit ;
NIMAL>select * from ulman.sal ;
ULMAN>update sal set salary=salary+500 where eid=2;
ULMAN>select * from sal ;
NALINI>select * from ulman.sal ;
ULMAN>commit;
NIMAL>select * from ulman.sal ;

```

Write down the output from the select statements.

[9 marks]

- Q4 a) Explain clearly the difference between a dense index and a sparse index . [2 marks]
- b) Water Supply and Drainage Board of the Southern Province has created a database to manage the information about the wells used to supply water. In this database there is a table named wells which stores the data about the wells, whose structure is given below.

WELLS(wellid, village, latitude, longitude, agadiv, description)

There are 398 wells in the Southern province. These wells are scattered over 10 AGA divisions. Each division has about 10 wells. Table data are stored in 40 blocks. If an index is created it will occupy two blocks.

You notice that the Board is running three types of statements.

```
(Q1) Select latitude, longitude
FROM wells
WHERE village = 'Mahawa' ;
```

```
(Q2) Select wellid, village
FROM wells
WHERE agadiv = 'Kahawa' ;
```

```
(U1) Update wells
SET latitude = 6.002135 , village = 'Allai'
WHERE village = 'Ailai'
```

You guessed that the number of times the statements Q1, Q2 and U1 are run per hour is about 40, 30 and 2 respectively. What indexes(if any), you will create to improve the performance?

Later you realized that your guess was wrong. You were informed that the actual number of times the statements Q1, Q2 and U1 are run is about 20, 5 and 50 respectively. Under this new information received, what indexes(if any) will you create to improve the performance?

(Answers without supporting calculations will carry no marks).

[8 marks]

- Q5 a) Comment on the following statement. "it is better to create as many indexes as possible, since they speed up data select, update and insert operations " [2 marks]
- b) A university database has two tables named dept and students. Dept table has 9 rows and students table has about 8000 rows. Average and maximum family

income of a student are 21200 and 68000 respectively. About 10% of the students are females. The youngest student is 19 years and the oldest is 42 years old. The age of students are uniformly distributed. Students' last names and first names are recorded in upper case.

You observe that the following scripts are run on the database to retrieve data. All of them are functionally correct, yield correct output but perform poorly. Rewrite these queries to improve the performance. Reason for each change should be clearly indicated.

```
Select s.lname, s.fname, d.department
from students s, dept d
where s.did=d.did
and Sex <> 'F'
and family_income + 30000 > 100000
and age - 10 < 20
and upper(lname) like 'P%';
```

```
Select lname, fname
from students
where Sex = 'F'
or family_income > 60000
or age < 40
or lower(lname) like 's%';
```

```
Select s.lname, s.fname, s.location
from dept d, students s
where family_income <=(select max(family_income) from students)
or did IN (select distinct did from dept)
or ( age < 40 and sex <> 'M') ;
```

```
Select s.lname, s.fname
From students.s, dept d
where s.did=d.did
and substr(s.fname,1,3) = 'Cha'
and age >= 30
and age <= 45
and d.dept || d.location = 'CivilHapugala'
or lower(lname) like '%s%';
```

[8 marks]