UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: July 2016

Module Number: EE5203 **Module Name: Data Management Systems**

[Three Hours]

[Answer all questions. Each question carries 10 marks]

Q1 a) Explain clearly, with examples ER to relational mapping algorithm of following types.

i. Multivalued attributes
ii. Binary 1:N relationship types
iii. Weak entity types

[3 Marks]

b) Design an Entity Relationship (ER) model for the Faculty of Engineering, of University of Ruhuna to capture the following information.

- Faculty has many departments
- Each department can offer any number of modules
- Many lecturers can work in a department
- A lecturer can work only in one department
- For each department there is a Head who is also a lecturer
- A lecturer can be head of only one department
- Each lecturer can take any number of modules
- A module can be taken by only one lecturer
- A student can enroll for any number of modules
- Each module can have any number of students

[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) Select ii) Project
iii) Rename iv) Cartesian product

[2 marks]

b) Following four relations are part of a database schema which is used to store information about employees

- lives(emp-name, street,city)
- works(emp-name, company-name, salary)
- located(company-name, city)
- manages(emp-name, manager-name).

Write down relational algebra expressions to retrieve the following information.

i) Find the name of all employees who work for the 'Hapugala Hardware' company.
ii) Find the name and city of all employees who work for 'Hapugala Hardware' company.
iii) Find the name, street and city of all employees who work for 'Hapugala Hardware' and earn more than 90,000.
iv) Find all employees who live in the same city as the company they work for.
v) Find all persons who do not work for 'Hapugala Hardware'
vi) Find all employees who live in the same city and on the same street as their manager.

[8 marks]

Q3 a) Explain clearly the difference between the following privileges granted to a user.

i) System privileges
ii) Object privileges

[2 marks]

b) Kamal, Raja, and Rani are working for the same company. Kamal 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.

Kamal: create table salary (eid number(2), salary number(4));
Kamal: insert into salary values (1, 1234);
Kamal : Savepoint a;
Kamal :select * from salary ;
Kamal: grant select on salary to rani with grant option ;
Rani: grant select on kamal.salary to raja ;
Raja: select *from kamal.salary;
Kamal: grant insert, delete on salary to raja;
Raja : insert into kamal.salary values(4,4321);
Raja: Savepoint a;
Raja: select * from kamal.salary ;
Raja: rollback to a;
Kamal: insert into salary values (3, 1432) ;
Raja: commit;
Rani: select * from kamal.salary;
Kamal: rollback to a;
Kamal:commit;
Kamal: select * from salary;
Raja: Insert into kamal.salary values (7, 4567);
Rani : Select * from kamal.salary;
Raja : commit;
Kamal: Revoke select on salary from rani ;
Raja: select * from kamal.salary;
Kamal: revoke select on salary from Rani;
Raja: select * from kamal.salary;
Raja: insert into kamal.salary values (1,1111);

Kamal: select * from salary;
Raja : Commit;
Kamal:commit;
Kamal: select * from salary;
Rani: select * from kamal.salary;

Write down the output from the select statements. (one mark for each correct output)

[8 marks]

Q4 a) Discuss the situations under which creating indexes may slow down the performance of a database.

[2 marks]

b) University administration office has created a table to store student data. This table has information about the students including registration number, name, address. People working in the office run three types of queries on this table.

Q1) Given the registration number, to retrieve all information about a student
Select * from student where reg_no = 12345 ;

U1) Students find that their names not correctly spelt in the database. They run a statement similar to the one given below to correct the names.
Update student set name = ' Amal Liyanage' where name = 'Amali Liyanage';

I1) Insert new records. This is run primarily when new students arrive.
Insert into student values (12346, 'Raj Kumara', '123 Wackwella Road, Hapugala', 'M', 3.44.....)

You are required to improve the overall performance. Currently there are no indexes on the student table.

During normal operation, the ratio of the time statements Q1, U1 and I1 executed are 0.8, 0.15 and 0.05 respectively. During the arrival time of new students the corresponding ratios are 0.1, 0.1 and 0.8 respectively. Considering this variation you decided to have two different sets of indexes during normal operation and during the arrival of new students.

Currently the data are stored in 25 data blocks. If an index is created, it requires 5 data blocks. What indexes will you create,(if any) to improve performance

a) during normal operation?
b) during the arrival of new students? (Answers without supporting calculations will carry no marks)

[8 marks]

Q5 a) Explain the difference between an 'instance' and a 'database' .

[2 marks]

b) The university database has two tables named students and exams. About 20% of the students are females rest are males. Maximum GPA a student could obtain is 4. About 25% of the students come from Galle District. Youngest student is 20 years old and the oldest is 35 years. First and last names of the students are entered in upper case. There are three departments EE, ME and CE and each has 30% of the students. The other 10% are not yet assigned to a department. Maximum and minimum monthly income of a student are 20000 and 50000 respectively. The structures of the two tables are given below.

Students(sid, dob, lname, fname, nic, dept. gpa, income, sex, district)
Exams(sid, module_no, grade, semester , year)

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 students s, exams e
WHERE  s.sid = e.sid
AND income +  30000 <  70000
AND dob < '12-Dec-99'
AND gpa*10 <= 33
AND sex <> 'M'
AND income <= (select max(income) from students )
AND dept is null;
```

```
SELECT lname, fname,  dept
FROM students
WHERE (income <=45000
AND income >=35000)
OR  district = 'Galle'
OR sex <> 'F'
OR  dept = 'CE'
OR upper(lname) like '_E%'
OR  dob > '01-jan-1997'
OR sex = 'M' ;
```

```
SELECT Lname, Fname
FROM students s, exams e
WHERE  s.sid = e.sid
AND (dob < '01-jan-2000'
OR dob > '04-apr-1999')
AND sex = 'M'
AND lower(lname) like 'S%'
AND semester > 3
AND gpa -1 > 1
AND (income/2)  < 33333  ;
```

```
SELECT Lname, Fname , nic
FROM students s, exams e
WHERE  s.sid = e.sid
AND lower(substr(lname,2,2)) = 'ch'
AND dob > '01-jan-2000'
AND dept not in ('CE', 'ME', 'EE')
AND sex='M' ;
```

[4X2 = 8 marks]