



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 5 Examination in Engineering: July 2017

Module Number: EE5203

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) Primary key
- ii) Foreign key
- iii) Candidate key

[3 marks]

b) Construct an E-R diagram for the Registrar's office of a university, which maintains data about the following entities:

- i) Module: number, title, no of credits, course outline, prerequisites
- ii) Module offerings: number, semester, department number, lecturer id, lecture times, and classroom
- iii) Students: student-id, first name, last name, sex, date of birth, address and department
- iv) Lecturers: lecturer-id, first name, last name, department

Further, the enrollment of students in modules and grades awarded to students in each module they are enrolled for must be appropriately modeled. 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) Project
- ii) Cartesian join
- iii) Intersection
- iv) Select

[2 marks]

b) Following three relations are part of a database schema.

```
emp(fname, lname, empid, address, supervisorid, sex, dob, salary, deptno)
dept(dno, dname, location, managerid);
project(pno, pname, city, depnum);
works_on(empid, pno, hours)
```

dependent(empid, depen_name, sex, bdate, relationship)

Write down relational algebra expressions to retrieve the following information.

- i) Find the names and addresses of employees who work for the 'Civil' Department
- ii) For every project located in 'Galle' list the project number, controlling department number, department manager's last name, address and date of birth
- iii) Find the names of employees who work on all projects controlled by department 3.
- iv) List of project numbers for projects that involve an employee whose last name is 'Fernando' either as a worker or as a manager of the department that controls the project.
- v) List of employees who do not have dependents.
- vi) List of female managers who have at least one dependent.
- vii) List of employees who were born before '01/01/1980' or who earn less than 30000.
- viii) List of all managers, their salary, address and date of birth.

[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, Malini and Kamal 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 sal (eid number(2) , salary number(4));
ULMAN>grant select on sal to malini with grant option ;
ULMAN>insert into sal values (1, 3450) ;
MALINI>select * from ulman.sal ;
MALINI>grant select on ulman.sal to nimal ;
ULMAN>savepoint A ;
ULMAN>insert into sal values (2, 4350) ;
ULMAN>select * from sal ;
KAMAL>select * from ulman.sal ;
ULMAN>update sal set salary=salary+150 where eid=2 ;
ULMAN>select * from sal ;
ULMAN>rollback to a ;
ULMAN>select * from sal ;
NIMAL>select * from ulman.sal ;
ULMAN>commit ;
KAMAL>select * from ulman.sal ;
ULMAN>update sal set salary=salary+500 ;
```

```
ULMAN>select * from sal ;
MALINI>select * from ulman.sal ;
ULMAN>commit;
KAMAL>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(WSDB) of Southern Province has created a database to manage their projects. In this database there is a table named 'projects' which stores the data about projects, whose structure is given below.

```
PROJECTS(projectid, village, latitude, longitude, agadiv, description)
```

There are 400 projects in the Southern province. These projects are scattered over 10 AGA divisions. Each division has about 40 projects. Table data are stored in 40 blocks. If an index is created it will occupy two blocks.

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

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

```
(Q2) Select projectid, village
FROM projectss
WHERE agadiv = 'Kahawa' ;
```

```
(U1) Update tanks
SET longitude = 79.32456 , village = 'Ailai'
WHERE village = 'Allai'
```

You guessed that the number of times the statements Q1, Q2 and U1 are run per hour is about 40, 35 and 5 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 45 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 "

- b) A company database has two tables named dept and emp. Dept table has 25 rows and emp table has about 10000 rows. Average and maximum salary of an employee are 25000 and 70000 respectively. About 5% of the employees are females. The youngest employee is 26 years and the oldest is 62 years old. The age of employees are uniformly distributed. All employees 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 e.lname, e.fname, d.department
from emp e, dept d
where e.did=d.did
and Sex <> 'F'
and salary + 30000 > 100000
and age - 10 < 20
and upper(lname) like 'P%';
```

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

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

```
Select lname, fname
from emp, dept
where substr(fname,1,3) = 'Cha'
and age >= 30
and age <= 45
and dept || location = 'AdminKandy'
or lower(lname) like '%s%';
```