THE OPEN UNIVERSITY OF SRI LANKA
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

FINAL EXAMINATION 2009
BACHELOR OF TECHNOLOGY – LEVEL 5

ECX5240 – INFORMATION SYSTEMS

DATE: MARCH 31, 2010	TIME: 1400-1700 HRS

This question paper consists of eight questions.

Answer **only five** questions.

1.

a) List three emerging database technologies along with one target application.

[3 Marks]

b) Briefly explain the significance of *application domain knowledge* in optimizing a query.

[4 Marks]

c) Briefly explain three advantages of data replication in a distributed database.   [6 Marks]

d) Briefly explain the advantages of using a database view for faster retrieval of a frequently generated report based on complex queries.

[7 Marks]

2.

a) List four tasks of a database administrator to ensure the security of a Database System.

[4 Marks]

b) A multi-user DBMS needs proper admission control policy mainly to avoid disc trashing. Briefly explain how disc trashing reduces the DBMS throughput.   [7 Marks]

c) X and Y are two tables in a database. T1 and T2 are two database transactions. Assume T1 reads X and Y and then writes to X and Y. T2 reads X and Y and then writes to X.

  i. Give an example of an inconsistency that could occur in the database if T1 and T2 transactions execute concurrently.   [3 Marks]

  ii. Name a transaction management protocol that you can use to avoid the above anomaly. Briefly explain how to overcome the above situation by the application of the above mentioned protocol.   [6 Marks]

3.

a) Briefly explain how to check whether a given relation is normalized up to BCNF.

[3 Marks]

b) Identify and list the steps of hash join algorithm.

[4 Marks]

c) Hash join is to be used to join P and Q relations. Assume P and Q are respectively spanned over M and N blocks in memory. Buffer consists of L pages. Calculate the total number of block I/O required for the entire join operation.

State your assumptions and provide descriptive comments whenever required. Assume no pages of P or Q overflows while partitioning.

[8 Marks]

d) Briefly explain how to increase the query execution performance by increasing the buffer size.

[5 Marks]

4.

a) List the ACID properties of a database transaction.

[4 Marks]

b) Briefly explain the significance of checkpoints in efficient database recovery.

[4 Marks]

c) Following table structure (figure 1) is used to record the grades of the students for the courses offered at the Department of Electrical and Computer Engineering for a particular academic year.

```
+------------------+                                    +-------------------------+
| Students         |                                    | Courses                 |
+------------------+                                    +-------------------------+
| Reg No.  (PK)    |         +-------------------+      | Course Code   (PK)      |
| Name             |         | Student_Courses   |      | Credit Rating           |
| Stream of study  |         +-------------------+      | Name                    |
| Level of Study   |         | Course Code  (CPK)|      | Level                   |
+------------------+         | Reg No.    (CPK)  |      +-------------------------+
                             | Grade             |
                             +-------------------+
```
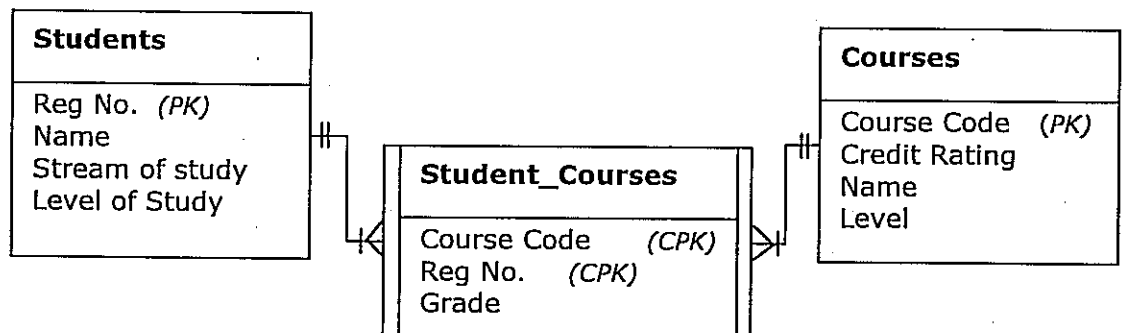
Figure 1

Write relational algebra queries for following statements.

i. List the names of the students who have obtained a B+ grade for a level 5 course.

[4 Marks]

ii. List the names of students who have registered for at least one course in both level 5 and level 6.

[4 Marks]

iii. List the Reg Nos of students who have registered for all courses offered in level 5.

[4 Marks]

5.

a) List 3 advantages of using XML databases over relational databases. [3 Marks]

b) Briefly explain why a traditional RDBMS fails in serving today's rapidly growing database application requirements. [5 Marks]

c) Write SQL queries for following statements by using the table structure shown in **figure 1 (Q4)**.

    i. List the names of the students who have obtained a B+ grade for the course ECX5240. [4 Marks]

    ii. List the registration numbers of the students whose stream of study is *'Computer'* and have not followed ECX5240. [4 Marks]

    iii. Select the name and the registration number of the student who had followed the highest number of courses (in case if there is more than one student who had followed the highest number of courses, your query should list all of them). [4 Marks]

6.

a) List 3 features that a multimedia database management system should provide in addition to a traditional relational database management system. [6 Marks]

b) "SOA makes re-using easier with respect to traditional approaches. Designing pluggable services also favours the integration of processes, and guarantees a high degree of flexibility over time and technology changes." Briefly explain the advantages of service oriented architectures (SOAs) mentioned in the above statement. [9 Marks]

c) Students table in a database is created using the following SQL statement. There are two indices attached to the table on the field *Reg_No* and *age*. The table is populated by about 25,000 records.

```
CREATE TABLE Students (
    Reg_No int(9) NOT NULL,
    Name varchar(45) NOT NULL,
    Stream of Study int(2) NOT NULL,
    Level of Study int(1) NOT NULL,
    PRIMARY KEY (Reg_No),
    KEY (age)
)
```

How many records of the above table will be accessed if the following query is executed? Briefly justify your answer.

SELECT Name FROM **Students** WHERE Reg_No = 59863389

Assume a matching record exists in the Students table. [5 Marks]

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7.
a) List and briefly explain 3 objectives of an effective information security policy of an organisation. [8 Marks]

b) Briefly describe one design issue for each of the following in the process of designing a distributed computer system: communication, synchronization and fault-tolerance. [6 Marks]

c) Identify and briefly explain three critical factors to be considered in order to design an appropriate strategy for extraction, transformation, and loading processes (ETL) in a data warehouse project. [6 Marks]

8.
a) List the main components of a relational query processor of a DBMS. [4 Marks]

b) As a computer engineering undergraduate of a university which delivers in distance mode increasingly via ICT intensive applications, write a brief account justifying the need to comply with the intellectual property rights related to the computer software. Propose sustainable initiatives- for you and for the University- to minimize predictable consequences of violating intellectual property rights. [10 Marks]

c) Briefly describe the following two models in relation to cloud computing: Software as a service *(SaaS)* and Infrastructure as a Service *(IaaS)*. [6 Marks]