UNIVERSITY EXAMINATIONS
EXAMINATION FOR JANUARY/APRIL 2015/2016 FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE
RCCS 207   DATABASE SYSTEMS

DATE: 11th April 2016.   TIME: 2 HOURS

GENERAL INSTRUCTIONS:
Students are NOT permitted to write on the examination paper during reading time.
This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:
This examination paper consists Questions in Section A followed by section B.
Answer **Question 1 and any Other Two** questions.
QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. **PLEASE start the answer to EACH question on a NEW PAGE.**
2. **Keep your phone(s) switched off at the front of the examination room.**
3. **Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material before or during the course of the examination.**
4. **ALWAYS show your working.**
5. **Marks indicated in parenthesis i.e. ( ) will be awarded for clear and logical answers.**
6. **Write your REGISTRATION No. clearly on the answer booklet(s).**
7. **For the Questions , write the number of the question on the answer booklet(s) in the order you answered them.**
8. **DO NOT use your PHONE as a CALCULATOR .**
9. **YOU are ONLY ALLOWED to leave the exam room 30minutes to the end of the Exam.**
10. **DO NOT write on the QUESTION PAPER. Use the back of your BOOKLET for any calculations or rough work.**

QUESTION 1 (30 MARKS).

A coffee shop chain has a number of shops in different locations in the city. Each shop sells a number of different types of coffee, but may not sell every type of coffee. Several staff works in each shop. Each staff member is only assigned to work in one store.
You are required to complete the following:

a) Create a conceptual ER diagram for the above description **(5 marks)**
b) Create a relational schema from the conceptual ER diagram **(5 marks)**

c) There are a number of problems that concurrency can cause. With the aid of a diagram and example, explain the "lost update problem". **(10 marks)**

d) Explain the term normalization **(2 marks)**

e) Define the three normal forms **(6 marks)**
f) Expand the acronym DCL and explain its application in databases giving a relevant example **(2 marks)**

Question 2

a) The Short Course Institute (SCI) offers training courses on various IT subjects. The diagram below is part of a conceptual schema of the SCI database. It states that a client may book a room any number of times. Each Client and Room identified a unique identifier which is. A booking is identified by the composite primary key (ClientID, Room ID). Identify the main types of relationship constraint that are shown in the ERD below and briefly describe their purposes and give an example of each. **(8 marks)**


Figure 1 Section from an Entity Relationship Diagram for booking a room
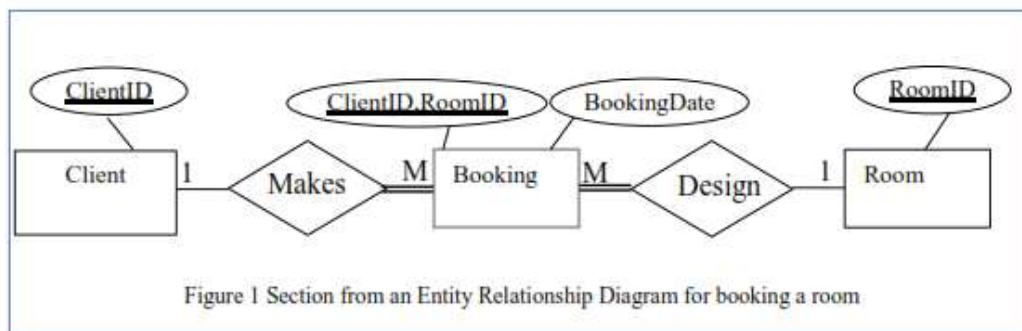
b) Explain the term deadlock and explain the approaches of avoiding a deadlock during transaction processing. **(6 Marks)**

c) Explain three types of threats that are likely to cause data loss in a database
(6 Marks)

Question 3

a) Give an example of a relation (table) that is not in third normal-form, but is in first and second normal-form. **(3 marks)**

b) Decompose this relation into third normal-form and state the specific advantages of the decomposition. **(9 marks)**

c) During the execution of some transactions the database fails at time tc. Assuming that transactions t2 and t3 had already been written into the secondary storage explain the actions that should be taken for the transactions t1, t4, t5, t6.
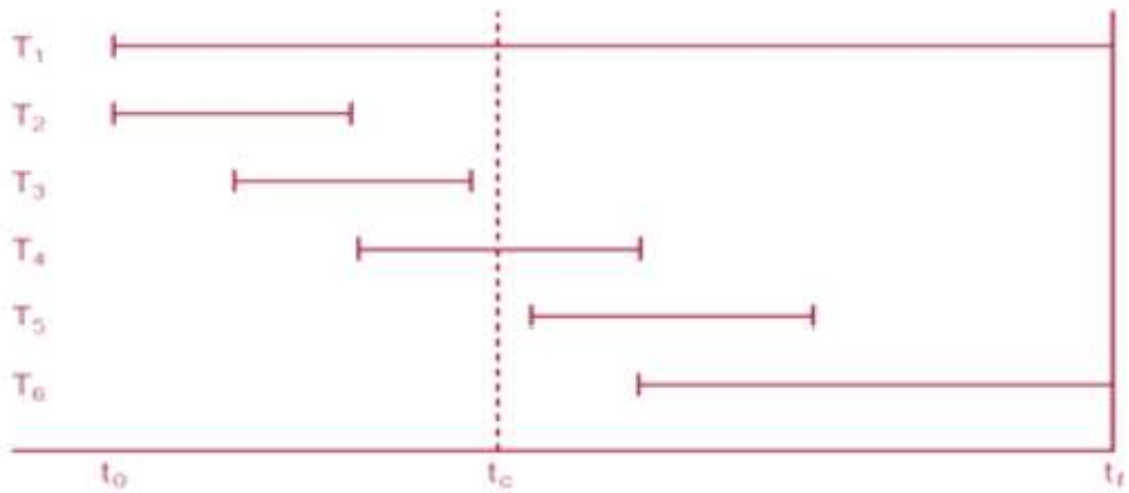
(8 marks)

QUESTION 4

The ACID properties of database transactions are an important issue in concurrency management. Define what is meant by **A**tomicity, **C**onsistency, **I**solation, and **D**urability. For each of the four properties outline the problems that can occur when not adhering to the property. **(20 Marks)**

QUESTION 5

Consider the following relational schema that models students, the courses that they are enrolled in, and the textbooks that are recommended for each course:

STUDENT (Ssn, Name, Programme, Date_birth)
COURSE (Course#, Course_name, Dept)
ENROLL (Ssn, Course#, Year, Term, Grade)
RECOMMENDED_READING (Course#, Year, Term, Book_isbn)
TEXT (Book_isbn, Book_title, Publisher, Author)

a) All primary keys are underlined. Write SQL statements for the following:

The student with an Ssn of *000653433* enrols in *Computer Programming*, which has a course number *1306*, in term 1 of 2014. Record this fact in the database. **(6 marks)**

b) List the details (title and author) of all the textbooks that are recommended for courses that have the string '*databases*' in their course name for all terms in 2014. **(7 marks)**

c) List all the courses that student *000653433* has been enrolled in. **(7 marks)**