

**University of Ruhuna - Faculty of Technology**  
**Bachelor of Information & Communication Technology Degree**  
**Level 1 (Semester 2) Examination**  
**December 2017**

**Course Unit: ICT1213, Database Management Systems**

**Time Allowed: 02 hours**

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This question paper contains **04** pages including this instruction page

**IMPORTANT INSTRUCTIONS:**

1. The medium of this examination is English.
2. This is a **Closed Book** examination.
3. This Examination consists of **four (04)** questions that are given equal marks.
4. You must answer **all four (04)** questions in this examination.

### Question 01

- (a) Draw an Entity Relationship(ER) Diagram to model the following requirement of the "Faculty of Technology" operating in the government university system. You need to identify and model **Entities, Attributes, Key Attributes, and Relationships** and clearly mention the **Cardinality Ratios** of the relationships.

The Faculty is organized into departments. Each department has a unique name, a unique identification code, and a senior lecturer as the head of the department to manage the department activities. The department keeps records of appointment dates when appointing a head of the department.

A department offers a number of course units. A course unit has a unique code, a unique name and a type.

Faculty stores each lecturer's name, upf number (unique to a lecturer), designation, address, salary, gender, contact numbers and birth date. In the faculty a lecturer is assigned to only one department. One lecturer teaches several course units and some course units are taught by more than one lecturer. The department keeps the number of teaching hours per week for each course unit by each lecturer.

Each and every lecturer has only one advisor who may be a senior lecturer or a peer lecturer. One advisor has several lecturers under him/her.

Faculty keeps family member's information of each lecturer for insurance purposes. These information are family member's first name, gender, birth date, and relationship to the lecturer.

- (b) Convert above Entity Relationship(ER) Diagram you have drawn in (a) into a Relational Schema.

### Question 02

- (a) Briefly describe four (04) "Relational Algebra Operations" with their notation.
- (b) The schema given below shows information about Lecturers, Departments and Course Modules offered by the Faculty of Technology. Answer the following questions using the given schema.

LECTURER(<sup>a</sup>lec\_id, <sup>b</sup>f\_name, <sup>c</sup>l\_name, <sup>d</sup>address, <sup>e</sup>dob, <sup>f</sup>dept\_no)  
DEPARTMENT(<sup>g</sup>d\_id, <sup>h</sup>d\_name, <sup>i</sup>d\_head\_id, <sup>j</sup>d\_head\_start\_date)  
COURSE(<sup>k</sup>c\_code, <sup>l</sup>c\_name, <sup>m</sup>c\_credits, <sup>n</sup>c\_hours, <sup>o</sup>c Lec\_id)



Write down "Relational Algebra" expressions to retrieve following information.

- List the first name, birthday and address of all lecturers who works for the department of "ICT".
- List the names of lecturers who are teaching more than one (01) course unit.
- List the names of lecturers who are not teaching any course unit.

(c) Answer following questions using above schema.

- Write the "Tuple Relational Calculus" expression to retrieve following information.  
"The lecturer id, address and birthday of the lecturer whose name is "Asela Karunarathne" who works for the department no "01" "
- Write the "Domain Relational Calculus" expression to retrieve following information.  
"The lecturer id, address and birthday of the lecturer whose name is "Asela Karunarathne" who works for the department of "ICT" "

### Question 03

Answer the following questions, using the un-normalized relation "Semester I Results" given below.

Student ID	Student Name	Address	Degree	Course ID	Course Name	Grade	Coordinator	Coordinator Address
TG150	Bima	Matara	IC	ICT1113	OS	A	Jayasinghe	Matara
			T	ICT1123	DBMS	A	Pathirana	Galle
				ICT1132	MIS	A	Weerasinghe	Rathnapura

Semester I Results

- Using examples from "Semester I Results", Explain the following anomalies.
  - Insertion anomaly
  - Deletion anomaly
  - Modification anomaly
- Normalize the "Semester I Results" relation up to Third Normal Form (3NF), using normalization concepts.  
Note:
  - If you have identified any functional dependencies write them down.
  - You have to mention step by step transformation from each normal form to the other normal form.

**Question 04**

- (a) List down the six (06) phases of database design.
- (b) Briefly describe four (04) desirable properties of a database.
- (c)
  - (i) What do you mean by "Data Independence"?
  - (ii) Briefly describe "Logical Data Independence" and "Physical data Independence".
- (d) Briefly describe following terms relates with theories/concepts of databases.
  - i. Candidate Keys
  - ii. Primary Key
  - iii. Composite Attribute
  - iv. Degree of a Relationship Type
  - v. Mini world