

University of Ruhuna - Faculty of Technology
Bachelor of Information & Communication Technology Degree
Level 1 (Semester 2) Examination
September 2020

Course Unit: ICT1213, Database Management Systems

Time Allowed: 02 hours

This question paper contains **05 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.

01. a. Draw an Entity Relationship (ER) Diagram that captures the following requirements by indicating relevant attributes along with the primary keys. Also specify the cardinality ratio and participation constraints. State any assumptions you have made.

Due to COVID-19 pandemic in Sri Lanka, the government established dedicated COVID-19 treatment hospitals around the country. Each dedicated hospital has a unique identification number, name and an appointed director who is also a doctor to manage the hospital activities. The hospital keeps the appointment date of the directors for future references. Hospitals record total number of confirmed, recovered and death cases separately due to COVID-19 on daily basis.

Each hospital conducts number of testes to identify and to treat the COVID-19 patients. Each Test has a unique code, type and the cost associated with it. Each test is conducted by more than one employee and the time spend by each employee for a given test is also recorded.

Government keeps data about employees who are working only in the COVID-19 dedicated treatment hospitals in the system. A unique registration number, name, designation (ex: Doctor, Nurse, Tester etc.) and their contact numbers are stored. One employee is involving in treatments to many COVID-19 patients. Employees are conducting many tests in daily basis.

Hospital keeps patients' name, NIC number and the address for current and future statistical references. A patient is taken cared by many employees during the COVID-19 treatment process.

Hospital keeps a patients' immediate relatives' name, unique contact number and the relationship to the patient in order to use in emergency situations.

[70 marks]

- b. Map the ER diagram you obtained in part (a.) into a set of relations. Specify all primary keys and foreign keys of each relation.

[30 marks]

02. a. Consider the following two relations and fill in the blanks of the following "Table 1".

Relations are R1 and R2 and
 R1 contains N1 tuples and R2 contains N2 tuples
 Where $N2 > N1 > 0$

| Expression | Number of Tuples in the Result set | Assumptions (If any) |
|----------------|------------------------------------|----------------------|
| $R2 - R1$ | | |
| $R1 \times R2$ | | |

Table: Table 1

[15 marks]

- b. Consider the following relations to develop a system for a Pharmacy.
Answer the following questions using the given schema.

Supplier(sid, sname)
Medicine(mid, mname, mfd, exp)
Invoice(sid, mid, qty, cost)

sid - unique id for the supplier
sname - name of the supplier
mid - unique id for the medicine
mname - name of the medicine
mfd - manufacture date of the medicine
exp - expire date of the medicine
qty - quantity of the purchased medicine
cost - cost of the purchased medicine

Express the following queries in Relational Algebra.

- i. Find the name of the supplier whose supplier id is "S001".
[10 marks]
- ii. List the suppliers (sid) who are supplying every "Paracetamol" or "Aspirin" medicines.
[10 marks]
- iii. List the suppliers (sname) of suppliers who are supplying "Augmentin" that costs less than 100 rupees.
[15 marks]

Express the following queries in Tuple Relational Calculus.

- iv. List the names of the medicines which are manufactured after "01-01-2020".
[10 marks]
- v. List the suppliers (sname) who are not providing "Penicillin".
[15 marks]

Express the following queries in Domain Relational Calculus.

- vi. List the names of the medicines which will expires before "01-01-2025".
[10 marks]
- vii. List the names of suppliers (sname) who are supplying "Insulin".
[15 marks]

03. a. Normalization is the process of minimizing redundancy from a relation or a set of relations.
- List down two (02) disadvantages of Data Redundancy. *[10 marks]*
 - What is meant by a table in second normal form(2NF)? *[10 marks]*

- b. Answer the following questions, using The Dependency Diagram in the following figure.

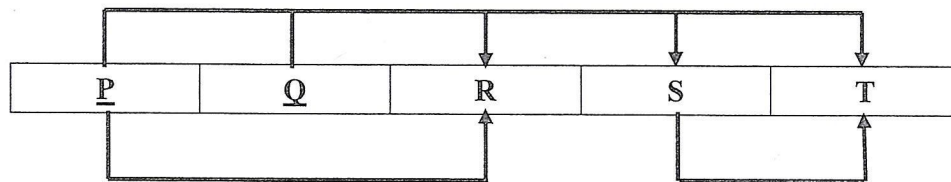


Figure: The Dependency Diagram

Explain the following dependencies using the above dependency diagram.

- Functional Dependency *[10 marks]*
 - Partial Dependency *[10 marks]*
 - Transitive Dependency *[10 marks]*
- c. Answer the following questions, using the relation “DoctorAllocation” given below.

| <u>d_no</u> | <u>h_no</u> | d_name | h_name | hours |
|-------------|-------------|--------|---------|-------|
| D001 | H001 | Saman | Colombo | 10 |
| D003 | H005 | Kamal | Matara | 12 |
| D105 | H030 | Neela | Vavniya | 15 |
| D200 | H050 | Shehan | Malambe | 08 |

Relation: DoctorAllocation

d_no: Registration no of the doctor
h_no: Registration no of the hospital
d_name: Name of the doctor
h_name: Name of the hospital
hours: No of working hours for a day in each hospital for a doctor

- What is the Normal Form of the given “DoctorAllocation” relation? Justify your answers. *[10 marks]*

- ii. Normalize the “DoctorAllocation” relation in to Third Normal Form (3NF). Show your intermediate steps clearly.

[40 marks]

04. a. i. List the ACID properties of a Database.

[10 marks]

- ii. Illustrate the Three Schema Architecture of the database systems using a suitable diagram.

[20 marks]

- b. i. List the six (06) phases of database development lifecycle.

[10 marks]

- ii. Suppose that you are required to manage information about your faculty. State four (04) reasons for selecting a DBMS over a File Management system as a solution to this.

[10 marks]

- c. i. Briefly describe the RAID technology used in databases.

[10 marks]

- ii. Briefly describe RAID Level 1 technology using a suitable diagram.

[10 marks]

- iii. Write down one (01) advantage and one (01) disadvantage of RAID level 1.

[10 marks]

- d. i. Briefly describe the following terms in database states.

- Initial Database State
- Valid State

[10 marks]

- ii. Write down one (01) advantage and one (01) disadvantage of Stored Procedures.

[10 marks]

***** End *****