The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Study Programme	: Bachelor of Software Engineering Honours & Bachelor of Science Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEI4366/EEX4366 Data Modelling and Database Systems**
Academic Year	: 2023/2024
Date	: 26th Jan 2025
Time	: 0930-1230hrs
Duration	: **3 hours**

General Instructions

- This question paper contains **Four (04)** compulsory questions.
- This is a **CLOSED BOOK** test (CBT)
- Answers should be in clear handwriting.
- Do NOT write in RED.

Question 1 (30 Marks)

A. Create an EERD for the following scenario: ***(Marks: 12)***

- Patient: Patient ID, First Name, Last Name, Date of Birth, Email, Contact Number.
- Doctor: Doctor ID, First Name, Last Name, Specialization, Contact Number, Department.
- Department: Department ID, Name, Location.
- Appointment: Appointment ID, Appointment Date, Time, Purpose, Status.

Relationships and Constraints:

- A patient can have multiple appointments, and each appointment is associated with one doctor.
- A doctor can have appointments with multiple patients. A doctor can be a Surgeon or a General Practitioner
- Each doctor is assigned to one department, but a department can have multiple doctors.
- A patient can either be an Inpatient or an Outpatient, but not both.

B. Enhance the EERD using the following requirements:

1. Create specializations for "Surgeon" and "General Practitioner" under the "Doctor" entity. Include attributes like SurgeryType for surgeons and PatientLoad for general practitioners. *(Marks: 3)*
2. Create a new entity linked to the "Patient" entity to store emergency contact details such as Name, Relation, and Phone Number. Each patient can have one or more emergency contacts. *(Marks: 6)*
3. Design a new entity to capture historical data for patients, including attributes like RecordID, Diagnosis, Treatment, and Date. Link this entity to the "Patient" and "Doctor" entities. *(Marks: 6)*
4. For the Appointment Status attribute, allow only specific values such as Scheduled, Completed, or Cancelled. *(Marks: 3)*

Question 2 (30 Marks)

Consider the following table and write SQL queries for the questions given below.

CREATE TABLE Customer (CustomerID INT PRIMARY KEY, Name VARCHAR(255) NOT NULL, ContactNumber VARCHAR(20));
CREATE TABLE DiningArea (AreaID INT PRIMARY KEY, AreaName VARCHAR(255) NOT NULL);
CREATE TABLE TableInfo (TableID INT PRIMARY KEY, Seats INT NOT NULL, AreaID INT, FOREIGN KEY (AreaID) REFERENCES DiningArea(AreaID));
CREATE TABLE Reservation (ReservationID INT PRIMARY KEY, ReservationDate DATE NOT NULL, CustomerID INT, TableID INT, ReservationStatus VARCHAR(50) NOT NULL, FOREIGN KEY (CustomerID) REFERENCES Customer(CustomerID), FOREIGN KEY (TableID) REFERENCES TableInfo(TableID));

1. Find the customers who made reservations in multiple dining areas. *(Marks: 6)*
2. Find the most popular dining area (the area with the most reservations). *(Marks: 8)*
3. List all tables that have been reserved for every day in the last week. *(Marks: 4)*
4. Calculate the total number of seats reserved in each dining area for a specific date. *(Marks: 8)*
5. List all customers who have not made any reservations. *(Marks: 4)*

Question 3 (15 Marks)

1. Explain the concept of database normalization and discuss its role in reducing redundancy and improving data integrity. Include an example where a poorly normalized database impacts performance. *(5 marks)*
2. Define data anomalies and analyze how they can disrupt database operations. Use a scenario involving a poorly designed database to illustrate insertion, deletion, and update anomalies. *(6 marks)*
3. Describe the purpose of database triggers and critically evaluate their impact on database performance and maintainability. Provide an example of a scenario where a trigger might be misused. *(4 marks)*

Question 4 (25 Marks)

1. Identify and evaluate three strategies used by database administrators to ensure data security, focusing on the trade-offs between usability and security. *(6 marks)*
2. How does the creation of an index affect the performance of INSERT, UPDATE, and DELETE operations in a database? *(5 marks)*
3. XML schemas are vital in maintaining structured data in database applications. Analyze their role in defining data constraints and ensuring interoperability across systems. *(4 marks)*
4. Write brief notes on the following advanced database concepts:
    i. Inheritance in ER modeling (subclass and superclass): *(2 marks)*
    ii. Transactional commands (Rollback and Revoke): *(4 marks)*
    iii. Advantages and limitations of stored procedures: *(4 marks)*