



SCHOOL OF COMPUTING AND ENGINEERING SCIENCES (SCES)
BACHELORS OF ELECTRICAL AND ELECTRONICS ENGINEERING
END OF SEMESTER EXAMINATION
CNS 1201: DATABASE AND ENTERPRISE SYSTEMS
EXAMINER: C. OJIAMBO

DATE: 19th December 2024

Time: 08:00-10:00 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

Question 1: Relational Model and Schema Design

a) Define the relational model and explain its main components. (5 marks)

b) Consider the following scenario:

A university database stores information about Students, Courses, and Enrollments.

Students have attributes: StudentID, Name, DOB, and Major.

Courses have attributes: CourseID, CourseName, and Credits.

Enrollments have attributes: StudentID, CourseID, and Grade.

i) Identify and explain the primary keys for each table. (5 marks)

ii) Write an SQL query to retrieve all students enrolled in a course named "Database Systems".
(10 marks)

Total (20 Marks)

Question 2: SQL and Query Optimization

a) Write an SQL query to perform the following operations: (10 marks)

Retrieve the names of employees earning a salary greater than the average salary in the Employees table.

b) Explain the concept of query optimization in database management systems. Describe any two techniques used for query optimization. (10 marks)

Total (20 Marks)

Question 3: Database Normalization

a) Define the term normalization and explain why it is important in database design. (5 marks)

b) The following table has redundancy and anomalies:

StudentID	StudentName	Course	Instructor	Department
101	Alice	DBMS	Dr. Smith	IT
102	Bob	OS	Dr. Clark	CS
101	Alice	OS	Dr. Clark	CS

i) Identify the anomalies present in the table. (5 marks)

ii) Normalize the table up to 3NF. Clearly show the steps. (10 marks)

Total (20 Marks)

Question 4: Transaction Management and Concurrency Control

a) Explain the concept of a transaction in the context of a database management system. Highlight its four key properties (ACID). (8 marks)

b) Discuss the problems that can arise in a database system without proper concurrency control. Illustrate using examples. (6 marks)

c) Describe how the two-phase locking protocol ensures serializability in transactions. (6 marks)

Question 5: Database Security and Privacy

a) List and describe three common security threats to database systems. (6 marks)

b) Explain the role of authentication and authorization in database security. Provide examples of each. (6 marks)

c) A bank database system maintains sensitive customer information. Outline the best practices that should be implemented to ensure data privacy and compliance with legal regulations. (8 marks)

Total (20 Marks)