



**KISII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**

**THIRD YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF**  
**BACHELOR OF SCIENCE IN APPLIED COMPUTER SCIENCE**  
**SECOND SEMESTER 2023/2024**  
**[JAN - APRIL, 2024]**

**COMP 306: ADVANCED DATABASE MANAGEMENT SYSTEMS**

**STREAM: Y3 S2**

**TIME: 2 HOURS**

**DAY: TUESDAY, 9:00 - 11:00 A.M.**

**DATE: 09/04/2024**

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**INSTRUCTIONS**

- 1. Do not write anything on this question paper.**
- 2. Answer question ONE (Compulsory) and any other TWO questions.**

**QUESTION ONE [30 MARKS]**

- a. Consider the following representation of relations in a relational database  
Department (DeptNo, DeptName, Building)  
COD (PFNo, Fname, Lname,)
  - i. Assuming that there was a one to one relationship between COD and Department, which primary key of one relation goes to the other as the foreign key? Justify your reasoning. [2 Marks]
  - ii. Write the SQL code to illustrate how the foreign key will be implemented in the ALTER TABLE command. [2 Marks]
- b. While referring to Patient and Ward entities, use appropriate illustrations to distinguish between the following:
  - i. Disjoint and overlapping constraints [2 Marks]
  - ii. Partial and total completeness constraints [2 Marks]
- c. When using indexes, it's important to create indexes with high selectivity. Describe three guidelines to adhere to when creating indexes in order to attain high index selectivity [3 Marks]

- d. Although locks prevent serious data inconsistencies, they can lead to two major problems. Describe these problems and explain how the DBMs resolves these problems [4 Marks]
- e. Distinguish between the different types of distribution transparencies [3 Marks]
- f. With the use of an example distinguish between one-to-many and one-to-few relationships in MongoDB schema design. In each, demonstrate how they are implemented [4 Marks]
- g. What is Sharding and how does it affect concurrency in MongoDB [2 Marks]
- h. Assume you have created a Student collection in your database. Illustrate how you can create an index on an array field in MongoDB [3 Marks]
- i. Consider the following SQL query:  
*SELECT DeptCode, SUM(Salary) AS TotalSalary  
 FROM Employee  
 GROUP BY DeptCode  
 ORDER BY TotalSalary;*  
 Write the MongoDB equivalent of this query [3 Marks]

## **QUESTION TWO [20 MARKS]**

Assume you have the following relations in a relational database

Student (RegNo, fname, Lname, Gender, CourseCode)

Course(CourseCode, CourseName, Duration, Deptcode)

Department(DeptCode, DeptName).

Write queries using SQL to perform the following:

- i. Obtain RegNo, fname, CourseCode, CourseName, DeptName for all Female students [4 Marks]
- ii. Illustrate how to perform a full outer join in MYSQL between the student and course table(use columns RegNo, Fname, CourseCode, CourseName only) [4 Marks]
- iii. Obtain the Number of students in each course who are pursuing courses whose duration is more than four years [4 Marks]

- iv. Create a virtual table for only students who belong to computing science department [4 Marks]
- v. Obtain the department with the highest number of students [4 Marks]

### **QUESTION THREE [20 MARKS]**

- a. Suppose you have been tasked to design and implement a distributed database management system for a new bank in the country. Assume you have a CUSTOMER table containing the attributes ACCOUNTNO, CUST\_NAME, DOB, ADDRESS, GENDER & OPENING\_DATE. The CUSTOMER data are distributed over three different locations: Kisii, Nakuru, and Kisumu.
  - i. Describe the data Fragmentation strategy that will be appropriate for this case [2 marks]
  - ii. Suppose you want to get details of customers who opened their accounts in the year 2022, Write the queries to demonstrate that the distributed database supports:
    - a) Fragmentation Transparency [2 Marks]
    - b) Location Transparency [3 Marks]
    - c) Local mapping transparency [3 Marks]
- b. Discuss various issues within a DBMS environment which may constrain its efficiency in processing user queries within reasonable time [10 Marks]

### **QUESTION FOUR [20 MARKS]**

- a. Suppose you are modeling data about people, their hobbies and their job history. Compare and contrast how this data could be represented in MySQL database and in MongoDB databases in terms of:
  - i. Modeling [10 Marks]
  - ii. Implementation [10 Marks]

### **QUESTION FIVE [20 MARKS]**

- a. Describe methods available for running a database on the cloud [4 Marks]
- b. With the use of an illustration describe the cloud DBMS architecture [6 Marks]
- c. Discuss the various risk factors associated with the use of Cloud databases and mechanisms which should be put in place to mitigate such risks [10 Marks]