KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE AWARD OF THE

DEGREE OF BACHELOR OF SCIENCE IN APPLIED COMPUTER SCIENCE
FIRST SEMESTER, 2023/2024

(AUGUST-DECEMBER, 2023)

ACMP 353: ADVANCED DATABASE SYSTEMS

STREAM: Y3 S1 **TIME: 2 HOURS**

DAY: THURSDAY, 9.00–11:00 AM **DATE: 28/11/2023**

INSTRUCTIONS

1. Do not write anything on this question paper.
Answer Question ONE [Compulsory] and any other TWO Questions

QUESTION ONE [30 MARKS]

a. With justification, give the type of NoSQL database that will be appropriate for each of the applications below;
   i. Shopping cart [2 Marks]
   ii. Blogging site [2 Marks]
   iii. Library card catalog [2 Marks]

b. Rewrite the following expressions inorder to make the optimizer's work easier thus reduce the overall time taken to execute the query. [3 Marks]

   i.
   ```
   UPDATE course
   SET fee=(fee+fee*0.02);
   ```

   ii.
   ```
   SELECT *
   FROM staff
   WHERE Gender NOT 'F';
   ```

   iii.
   ```
   SELECT *
   FROM student
   WHERE Gender='F' AND Course='BIT';
   ```

c. While referring to Patient and Doctor entities, use appropriate illustrations to distinguish between the following:
   i. Disjoint and overlapping constraints [4 Marks]
   ii. Partial and total completeness constraints [4 Marks]

d. Assume there are two conflicting transactions T1 and T2 with time stamps T001 and T002 respectively. Describe the options available for the DBMS to resolve that conflict using the wait/die & wound/wait schemes [4 Marks]

e. When using indexes, it's important to create indexes with high selectivity.

   i. What is index selectivity [2 Marks]

   ii. Explain four guidelines to adhere to when creating indexes in order to attain high index selectivity [4 Marks]

f. Distinguish between the different types of distribution transparency [3 Marks]

QUESTION TWO [20 MARKS]

a. Consider the scenario below and use it to answer the questions that follow

   In a hospital, patients can be outpatient or inpatients. Inpatients can be assigned a private ward or a general ward. Patients can be treated by doctors who are consultants or general doctors. Consultants can be Residents or Locums. Locums only attend to inpatients with special cases where a specialist for such a case is not available in the hospital at that moment. Each ward has nurses assigned to them to attend to patients. Nurses can either be Trainees of Registered Nurses.

   i. Identify all the entities and categorize them as super and sub entities [6 Marks]
   ii. Develop an advanced EERD using a specialization hierarchy [6 Marks]

b. Describe four issues within the DBMS environment which may constrain it's efficiency in processing user queries within reasonable time [8 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. Assume you are withdrawing money (10000) from your Mpesa account and at the same time someone is depositing money(15000) to your Mpesa account. Illustrate how a lost update can happen incase those two transactions are not properly coordinated. [10 Marks]

QUESTION FOUR [20 MARKS]

Consider 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 students for all Female students [4 Marks]

ii. Illustrate how to perform a full outer join in MYSQL between the student and course tables. (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 FIVE [20 MARKS]

a. Suppose you are modeling information about people, the cities they live, the restaurant they attend and the games they prefer watching. Model how this can be represented in a graph based database. [12 Marks]
b. Explain four features of NoSQL databases that makes them suitable in handling large volumes of data compared to the relational DBMS [8 Marks]