JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF INFORMATICS AND INNOVATIVE SYSTEMS

DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN SECURITY AND FORENICS AND BUSINESS INFORMATION SYSTEMS

2ND YEAR 1ST SEMESTER 2024/2025 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: **ICB 1203**

COURSE TITLE: **DATABASE ADMINISTRATION AND DESIGN**

EXAM VENUE:LAB 4 **STREAM: BSC COMP. SECURITY & BIS**

DATE:13/1/25 **EXAM SESSION:14-16.00 HRS**

TIME: **2.00 HOURS**

INSTRUCTIONS:

1. **Answer Question 1 (Compulsory) and ANY other two questions**
2. **Candidates are advised not to write on the question paper**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room**

QUESTION ONE **[30 MARKS]**

(a) Explain the difference between the following terms and concepts. [4 Marks]
   (i) *Data Physical Format* and *Data Logical Format* as applies to **data dependence**.
   (ii) *Data Inconsistency* and *Data Anomalies* as applies to **data redundancy**.

(b) "The Database Administrator (DBA) must be prepared to recover data to a usable point, no matter what the cause, and to do so as quickly as possible.". Name and explain the **three** types of data recovery referred to here. [6 Marks]

(c) When asked by their lecturer why they think studying relational algebra and relational calculus is important in Database Design and Administration, the following students responded as below. [4 Marks]

Grace Relational Algebra provides the relational model with a flexible way to query a database.

Peter Relational Calculus is the foundation of Query-By-Example.

Briefly comment in support of the above statements given by Grace and Peter.

(d) Give **three** common characteristics that data models must have in order to be widely accepted. [3 Marks]

(e) "When implementing a physical database from a logical data model, there is need to consider how the database will perform when applications make requests to access and modify data.". Discuss this statement with emphasis on techniques that are employed to allow data be accessed in the database more rapidly. [4 Marks]

(f) Explain **two** ways in which views can be used to implement data security. [2 Marks]

(g) A relational database can be used for text retrieval as follows. The database needs two tables. The first, **Documents**, has two attributes, DID and Text; one is a unique document identifier, the other is the full text of a document. The other, **Words**, also has two attributes, Word and DID; the first is a word (that is, a string), the other is the identifier of a document containing that word.
   (i) Explain how a Boolean query on the text of a document could be formulated in SQL on such a database, giving examples. [4 Marks]
   (ii) Would you expect such querying to be reasonably fast? Why? Consider possible costings and possible queries. [3 Marks]

QUESTION TWO **[20 MARKS]**

(a) Give **two** advantages and **two** disadvantages of *hierarchical database model*. [4 marks]

(b) With a specific database management system (DBMS) in mind; [8 Marks]
   i) Explain any **two** important functions it performs that guarantee the integrity and consistency of data in the database.
   ii) **One** technical and **one** non-technical DBMS strategy an organization can adopt in establishing a usable database environment.
   iii) **Two** considerations needed in understanding the DBMS requirements and preparation of the environment for the new DBMS in the organization.
   iv) **One** benefit and **one** risk in upgrading the DBMS in organizations database environment.

(c) Consider the relation R(A,B,C,D,E,F,G,H,I,J,K) which is in First Normal Form (1NF). Suppose its dependencies are A,B→C B,D→E,F A,D→G,H A→J H→K.
   i) Identify the key of R. [2 Marks]
   ii) Decompose R into 2NF relations. [3 Marks]
   iii) Then decompose R into 3NF relations. [3 Marks]

QUESTION THREE **[20 MARKS]**

(a) Below are relations lifted from a database. Study them and use them to answer questions that follow. [10 Marks]

Sailors (sid, sname, rating, age)
Boats (bid, bname, color)
Reserves (sid, bid, day)

Represent the query below in **Relational Algebra**, **Tuple Relational Calculus**, **Domain Relational Calculus** and **Structured Query Language (SQL).**

Find the names of sailors who reserved boat #119.

(b) Draw an Entity-Relationship (ER) diagram showing entities, attributes, relationships, cardinality and participation. State any assumptions necessary here. [10 Marks]

A worksite at a particular *address* has several *named* workers with *tax file numbers* and *tasks*. Building materials of certain *types* and *quantities* are delivered by *named* trucking companies on a *date* to a *supervisor* at the worksite; there are several manufacturers of each kind of material, each with their own business *name* and *address*.

QUESTION FOUR **[20 MARKS]**

(a) Using a suitable example of SQL statement in each case, achieve the following as applies to database design and administration.

i) Deleting table rows [2 Marks]
ii) Changing attributes characteristics [2 Marks]
iii) Adding a column to a table [2 Marks]
iv) Primary key designation [2 Marks]

(b) Data Control Language (DCL) is one of the subtype of SQL. Name and explain the significance of the **two** basic types of DCL statements as used in database security. [4 Marks]

(c) Explain any **two** types of privileges that can be granted and revoked from database users. In each case, give a sample SQL statement to support your explanation. [4 Marks]

(d) Give sample SQL statements that demonstrate the creation of a **trigger** and a **stored procedure** in databases. [4 Marks]

QUESTION FIVE **[20 MARKS]**

(a) Explain the **four** important properties of transactions that a DBMS must ensure to maintain data in the face of concurrent access and system failures. [8 Marks]

(b) Consider a database objects A and B and assume that there are two transactions T1 and T2. Transactions T1 reads objects P and Q and then writes object P. Transactions T2 reads object P and Q and then writes objects P and Q. Give an example schedule with actions of transactions T1 and T2 on objects P and Q that results in a write-read conflict. [4 Marks]

(c) "The database administrator (DBA) plays an important role in enforcing the security related aspects of database design". Discuss. [4 Marks]

(d) Name and explain the difference between the **two** methods used for accessing relational data from a Java program. [4 Marks]

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