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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS, 2024/2025 ACADEMIC YEAR
FIRST YEAR, SECOND SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE (MATHEMATICS)

KCS 2207: INTRODUCTION TO DATABASE SYSTEMS

DATE: 13TH DECEMBER, 2024
TIME: 8:30AM-10:30AM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE: COMPULSORY (30 MARKS)

a) Study the following table extract from a patient management system and answer the questions that follow.

STUDENT TABLE

PatientId	FirstName	LastName	Age	Gender	Diagnosis
12/0012	Faith	Musyoki	23	F	Typhoid
12/0013	Mary	Otieno	22	F	Typhoid
12/0014	Natasha	Nganga	21	F	Typhoid
12/0015	David	Musa	23	M	Typhoid
12/0016	Abel	Mwangi	23	M	Typhoid
12/0017	Joseph	Kimani	23	M	Diabetes
12/0018	John	Mutua	22	M	Diabetes
13/0012	Alvin	Kamau	24	M	Pneumonia
12/0013	Daniel	Onyancha	27	M	Hypertension
13/0013	Ruth	Simiyu	25	F	Hypertension
14/0014	Ritah	Wekesa	25	F	Amoeba
14/0015	Mike	Mbugua	30	M	Amoeba

Required: Write SQL codes to;

i. Display all patients who have Hypertension or Amoeba. **(2 Marks)**

ii. Display patients who are not suffering from Diabetes **(2 Marks)**

iii. Display patient's name, age and the disease they are suffering from in descending order using the Age. **(2 Marks)**

iv. Change Natasha's First name (whose patient ID is 12/0014) to Rose. **(2 Marks)**

v. Remove the column named "Gender". **(2 Marks)**

vi. Insert a new column in Patients table named Doctor whose data type is Varchar and length is 50. **(2 Marks)**

b) In regards to Database management, compare the following concepts; **(6 Marks)**

    i. Entity and Attribute

    ii. Database and DBMS

    iii. Primary key and Foreign key

c) When designing a database there are three major types of cardinality that you need to be aware of. Discuss these cardinalities providing relevant examples of each. **(6 Marks)**

d) When preparing a database, we need to show how data is stored, connected accessed and updated. Discuss any three types of database models that can be used to accomplish this. **(6 Marks)**

QUESTION TWO: (20 MARKS)

Cozy Inn is a small hotel within Thika outskirts with 15 guest rooms. The management wants to create a basic database system to handle guest bookings, room details, and billing information. Each guest may make multiple bookings over time, though each booking is exclusively for a single guest. Rooms at the inn can be reserved by different guests at different times, with each booking tied to only one specific room. Once a booking is confirmed, the system automatically generates a billing record linked to that booking, detailing the payment specifics for the stay. The billing information is unique to each booking, ensuring that payment records are clear and accurately tied to the reservation. This system enables Cozy Inn's staff to manage reservations efficiently, maintain accurate billing, and quickly check room availability, all of which enhance the guest experience and streamline operations.

Required:

a). Which database model would be most suitable for the Cozy Inn hotel management system? Support your choice citing the advantages of the recommended database model. **(5 Marks)**

b). Based on the above Cozy Inn hotel data, identify all the possible entities, attributes and relationships. You should include the primary keys as well as the foreign keys. **(4 Marks)**

c). Using a notation of your choice, draw an ERD diagram for the Cozy Inn hotel. **(6 Marks)**

d). Demonstrate how Cozy Inn could use indexes in their proposed database system and its impact.
(5 Marks)

QUESTION THREE: (20 MARKS)

A new university is building a database system consisting of a number of tables namely Students,

Lecturers, Courses, Enrolments and University among other tables. You are part of the team tasked with the building of the university database.

Required:

a). Write an SQL code to create the students table. The students table should have the following columns:

StudentID, FirstName, LastName, Gender, DOB, and City. Set the primary key and it should not be null.

(5 Marks)

b). Write an SQL to insert at least 3 records in the above students table. **(4 Marks)**

c). Highlight and explain **THREE** important database security features that could be employed in the above database system. **(6 Marks)**

d). Discuss **TWO** constraints that could be deployed by the university to promote data integrity and consistency. **(2 Marks)**

e). How would normalization assist in the database design for this university ? Explain. **(3 Marks)**

QUESTION FOUR: (20 MARKS)

Global Bank, a multinational financial institution, operates numerous branches worldwide and has a robust online banking system. The bank employs a distributed database system to manage its customer data,

account transactions, and branch operations efficiently. This architecture allows Global Bank to provide seamless services to its customers while ensuring data integrity, availability, and security.

a) A power outage occurs in one of the Global Bank branches after a transaction transfer is initiated but before completion. Which ACID properties would ensure correct handling of this transaction? Explain your answer. **(4 Marks)**

b) Highlight and discuss a database backup solution /type that could be deployed at the Global Bank and its implications. Support your answer. **(4 Marks)**

c) Cite and discuss **THREE** types of failures that can occur in a distributed system like at the Global Bank. **(6 Marks)**

d) Discuss the role of data replication strategies in databases. Which **TWO** data replication strategies could be applied at the Global bank and what is the implication? **(6 Marks)**

QUESTION FIVE: (20 MARKS)

a). Given the following unnormalized student table, identify the repeating groups and explain why this table does not satisfy First Normal Form (1NF): **(4 Marks)**

StudentID	StudentName	Programme	Unit1	Lecturer1	Unit2	Lecturer2
101	Mary Wanjiru	Computer Science	Data Structures	Prof. Otieno	Networks	Dr. Mwangi
102	Linet Simiyu	Hospitality	Bakery	Ms. Achieng	Databases	Mr. Mutua
103	Amina Hassan	Computer Science	Web Design	Dr. Mugo		

b). Describe the steps to transform the unnormalized table above into First Normal Form (1NF). Then, provide the new table structure in 1NF. **(4 Marks)**

c) Explain what Second Normal Form (2NF) is and why it is important in database design. Using the table, you created in 1NF, describe any changes needed to bring it into 2NF. **(4 Marks)**

d). Define Third Normal Form (3NF) and discuss its role in reducing redundancy. Transform the table you created in 2NF into 3NF, providing the final table structures. **(4 Marks)**

e). List and briefly explain three benefits of normalizing a database. How would normalization impact data integrity and maintenance for a student database like the one provided? **(4 Marks)**