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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR FIRST YEAR, FIRST SEMESTER EXAMINATION FOR THE BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY <u>KCS 2103 – DATABASE DESIGN</u>

Date: 11TH December 2024 Time: 8:30AM – 10:30AM

(4 Marks)

<u>INSTRUCTIONS TO CANDIDATES</u> <u>ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS</u> QUESTION ONE (30 MARKS)

- a) Define what a database is and explain its purpose providing two examples of databases used in realworld applications. (3 Marks)
- b) Provide three key advantages of using a database system over a flat file system. (3 Marks)
- c) Explain the entity-relationship Model (ERD), and its role in database design. (3 Marks)
- d) Write SQL query to create a table named Employees with columns EmpID, EmpName, DOB, and City. (5 Marks)
- e) What is normalization in database systems? Explain the three different normalization forms used in databases namely; 1NF, 2NF, 3NF). (3 Marks)
- f) Explain the ACID properties in database transactions.
- g) Differentiate between data integrity and data consistency as used in database systems. (2 Marks)
- h) Highlight four best practices for implementing a database backup and recovery strategy. (4 Marks)
- i) Define a distributed database system. What are two key advantages of using a distributed database over a centralized database? (3 Marks)

QUESTION TWO (20 MARKS)

a) Study the following table extract from a hotel management system and answer the questions that follow;

Room_ID	Room_Type	Capacity	Price_Per_Night	Availability
101	Single	1	50	Available
102	Double	2	80	Occupied
103	Suite	4	150	Available
104	Single	1	60	Available
105	Double	2	90	Occupied
106	Suite	4	170	Available

Hotel_Rooms table:

Required: Write SQL codes to;

i)	Insert the following data into the Hotel_Rooms table: Room_ID = 107, Room_Type = Double,		
	Capacity = 2, Price_Per_Night = 100, Availability = Available.	(3 Marks)	
ii)	Display all the records from the Hotel_Rooms table.	(2 Marks)	
iii)	Find all rooms that are available (Availability = 'Available').	(2 Marks)	
iv)	Find all rooms where the price per night is greater than 80.	(3 Marks)	
v)	Update the Price_Per_Night for Room_ID = 101 to 55.	(3 Marks)	
vi)	Delete the record where Room_ID is 105.	(3 Marks)	
b)	Differentiate between entity integrity and referential integrity as used in database systems. Provide		
	an example of each.	(4 Marks)	

QUESTION THREE (20 MARKS)

A small business wants to back up its customer data stored in a database to prevent data loss in case of system failure.

- a) What is a **database backup**, and why is it important for the business? (4 Marks)
- b) Explain the difference between a **full backup, differential backup** and an **incremental backup**.
- (6 Marks)c) Which backup method would you recommend to this organization? Support your answer.(2 Marks)
- d) Explain three database recovery strategies the business would employ to restore the database in case the system crashes and the data is lost. (4 Marks)
- e) Explain two types of failures that could affect this organizational database and the mitigation measures to curb the same. (4 Marks)

QUESTION FOUR (20 MARKS)

A healthcare clinic stores sensitive patient data, including personal details and medical histories, in a database. To protect this information from unauthorized access and ensure compliance with regulations like HIPAA, the clinic implements security measures such as user authentication, access control, data encryption, audit trails, and backup and recovery strategies.

- a) **Define what database security** is and explain why it is crucial for the clinic. (4 Marks)
- b) What is data encryption? How can it help protect sensitive patient's information?
- c) Advise the clinic how they could protect their database from hackers. (3 Marks) (4 Marks)
- d) Explain how multi-factor authentication could enhance the security of the healthcare clinic's database system. (4 Marks)
- e) List and explain five key roles of the healthcare clinic database administrator.

(5 Marks)

QUESTION FIVE (20 MARKS)

A small online store uses a distributed database to manage customer orders and inventory across multiple locations. Two employees experience a deadlock while simultaneously updating inventory records for different products. The store needs to implement transaction management and deadlock resolution strategies to prevent disruptions in its system.

- a) Define what a database transaction is.
- b) What is a deadlock in a transaction system, and how does it occur? Explain two strategies to prevent such issues. (6 Marks)
- c) Highlight and explain four issues that could arise in this distributed database. (4 Marks)
- d) Explain four solutions that can be employed to solve the issue cited in (c) above. (4 Marks)
- e) Discuss the concept of data replication in a distributed database system. Why is it important?

(4 Marks)

(2 Marks)