

**MAKERERE UNIVERSITY**  
**COLLEGE OF COMPUTING & INFORMATION**  
**SCIENCES**

**SECTION A [40 Marks]**

- a) Briefly explain each of the following terms as they apply to Database Management Systems (2 Marks @)
- i. A File-based system
  - ii. A Database Management System
  - iii. Data Independence
  - iv. Data Administrator
  - v. Data Model
- b) With reference to the Three-Level ANSI-SPARC Architecture, explain the difference between the external and internal levels of abstraction (4 Marks)
- c) Briefly explain the main activities and the major output from each of the following stages of the Database Systems Development Lifecycle. (2 Marks @)
- i. Database Planning
  - ii. Requirements collection
  - iii. Database Design
- d) Describe the functionality and importance of the Integrity Enhancement Feature (IEF) of the Database Management System (DBMS). (2 Marks)
- e) Database design is made up of three main phases: conceptual, logical, and physical design. Briefly explain two main activities carried out during the logical phase. (3 Marks)
- f) State any two of the recommended steps to selecting an appropriate Database Management System during the database development lifecycle. (2 Marks)
- g) What is a database transaction? (2 Marks)
- h) State two ways by which a database transaction can be considered complete (2 Marks)
- i) State the ACID properties of a database transaction (4 Marks)
  - j) How does the database locking mechanism ensure serializability? (2 Marks)
  - i) State one distinct feature of each of the following database locking mechanisms, i.e., a Shared Lock (S-Lock), an exclusive Lock (X-Lock), and a two-phase locking (2PL) mechanism. (2 Marks)



## SECTION B [60 Marks]

[Note: Attempt any three questions from Section B]

### Question 1 (20 Marks)

Study the case study below and answer the questions that follow.

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- Identify and list four **entity types** mentioned in the case study. (4 Marks)
- Identify and list two **Relationship types** in the case study. (4 Marks)
- Create an **Entity-Relationship model** to represent the data used by the library. (8 Marks)
- For one of the entities mentioned in (a) above, write SQL implement/create it on a selected database management system. (4 Marks)

### Question 2 (20 Marks)

The table shown in Figure below lists sample dentist/patient appointment data. A patient is given an appointment at a specific time and date with a dentist located at a particular surgery. On each day of patient appointments, a dentist is allocated to a specific surgery for that day.

staffNo	dentistName	patNo	patName	appointment date time	surgery No
S1011	Tony Smith	P100	Gillian White	12-Sep-13 10.00	S15
S1011	Tony Smith	P105	Jill Bell	12-Sep-13 12.00	S15
S1024	Helen Pearson	P105	Ian MacKay	12-Sep-13 10.00	S10
S1024	Helen Pearson	P105	Ian MacKay	14-Sep-13 14.00	S10
S1032	Robin Plevin	P105	Jill Bell	14-Sep-13 16.30	S15
S1032	Robin Plevin	P110	John Walker	15-Sep-13 18.00	S13

- The table shown is susceptible to update anomalies. Briefly Explain one example of each of the following anomalies, i.e., insertion, deletion, and update anomalies. (6 Marks)
- Identify the functional dependencies represented by the attributes shown in the table. State any assumptions you make about the data and the attributes shown in the table. (4 Marks)
- Using illustrations, explain the process of normalizing the table to 3NF (Third Normal Form) relations. Identify the primary, alternate, and foreign keys in your 3NF relations. (10 Marks)



### Question 3 (20 Marks)

The following table definitions form part of a database called "uganda\_hotels" held in a relational Database Management System (DBMS). Study it and answer the questions.

Hotel (hotelNo, hotelName, city)

Room (roomNo, hotelNo, type, price)

Booking (hotelNo, guestNo, dateFrom, dateTo, roomNo)

Guest (guestNo, guestName, guestAddress)

where

Hotel contains hotel details and hotelNo is the primary key;

Room contains room details for each hotel and (roomNo, hotelNo) forms the primary key;

Booking contains details of bookings and (hotelNo, guestNo, dateFrom) forms the primary key; Guest contains guest details and guestNo is the primary key.

- Identify any two foreign keys in the "uganda\_hotels" database definition above. State a reason for each identified key. (2 Marks)
- Write Structured Query Language (SQL) statements to:
  - Create the "uganda\_hotels" database. (1 Mark)
  - Create the Room table using the integrity enhancement feature of SQL (3 Marks)
  - Insert the following record into the Hotel table, hotelNo="H001", hotelName="Sky Resort", city="Jinja". (2 Marks)
  - Update the value of city attribute in the record created in (iii) above from 'Jinja' to 'Arua'. (2 Marks)
  - Retrieve the roomNo, hotelNo, type and price of the cheapest hotel room in the database. (4 Marks)
  - Retrieve the roomNo, hotelNo of all the booked rooms in the database (4 Marks)
- Assume that all hotels are loaded, write SQL to create a view containing the cheapest hotels in the database (2 Marks)

### Question 4 (20 Marks)

- What do you understand by the term database security (2 Marks)
- With examples discuss three basic database security principles (6 Marks)
- Data base security may be ensured by putting in place measures to prevent, detect and recover from threats. Briefly explain how each of the three measures mentioned above can be achieved. (6 Marks)
- Database Management Systems should put in place mechanisms to ensure that only authorized users can access the database. Briefly explain any two access control mechanisms and explain the merits of one over the other. (6 Marks)

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