



Strathmore
UNIVERSITY

**SCHOOL OF COMPUTING AND ENGINEERING SCIENCES
BBIT & BCNS
END OF SEMESTER EXAMINATION
BBT1202/BCNS1201 DATABASE AND ENTERPRISE SYSTEMS**

DATE: 15th March 2024

Time: 15:30-17:30 Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **Question ONE (COMPULSORY)** and any other **TWO** questions.

Question ONE (30 Marks)

a) Describe the approach taken to the handling of data in the early file-based systems. Discuss the disadvantages of this approach. **(6 Marks)**

b) Consider a relation $R(A, B, C, D, E, F, G, H)$ with the following dependencies:

$$CH \rightarrow G$$

$$A \rightarrow BC$$

$$B \rightarrow CFH$$

$$E \rightarrow A$$

$$F \rightarrow EG$$

Determine all the candidate keys in the relation. Show your workings **(4 Marks)**

c) In the market today, there are many DBMS software products. For example, oracle, Postgres, MySQL, Teradata and Microsoft SQL server. This means that businesses face a hard time making a choice of what DBMS to adopt.

i) State any **TWO** functions of a DBMS **(2 Marks)**

ii) Using relevant examples, explain any **TWO** considerations an enterprise should consider before adopting a given DBMS software product. **(4 Marks)**

d) Describe how a denial-of-service attack generally occurs and what are the possible countermeasure to help mitigate this type of attack? **(4 Marks)**

e) What is SQL Injection attack? **(2 Marks)**

f) Define the two principal integrity rules for the relational model. Discuss why it is desirable to enforce these rules. **(4 Marks)**

g) All transactions done in the databases should possess certain properties known as the ACID properties. Define each of these properties **(4 Marks)**

Question TWO (15 Marks)

The following tables form part of a database held in a relational DBMS:

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.

PART A:

Using the tables above, write SQL scripts to achieve the following:

a) List the names and addresses of all guests in London, alphabetically ordered by name.

(2 Marks)

a) List the price and type of all rooms at the Grosvenor Hotel.

(3 Marks)

PART B:

Describe the relations that would be produced by the following relational algebra operations:

a) $\Pi_{\text{hotelNo}} (\sigma_{\text{price} > 50} (\text{Room}))$

(2 Marks)

b) $\sigma_{\text{Hotel.hotelNo} = \text{Room.hotelNo}} (\text{Hotel X Room})$

(2 Marks)

c) $\Pi_{\text{hotelName}} (\text{Hotel} \bowtie \text{Hotel.hotelNo} = \text{Room.hotelNo} (\sigma_{\text{price} > 50} (\text{Room})))$

(2 Marks)

d) $\text{Guest} \bowtie (\sigma_{\text{dateTo} \geq '1-Jan-2007'} (\text{Booking}))$

(2 Marks)

e) $\text{Hotel} \bowtie \text{Hotel.hotelNo} = \text{Room.hotelNo} (\sigma_{\text{price} > 50} (\text{Room}))$

(2 Marks)

Question THREE (15 Marks)

Read the following case study, which describes the data requirements for a video rental company. The video rental company has several branches throughout the USA. The data held on each branch is the branch address made up of street, city, state, and zip code, and the telephone number. Each branch is given a branch number, which is unique throughout the company. Each branch is allocated staff, which includes a Manager. The Manager is responsible for the day-to-day running of a given branch. The data held on a member of staff is his or her name, position, and salary. Each member of staff is given a staff number, which is unique throughout the company. Each branch has a stock of videos. The data held on a video is the catalog number, video number, title, category, daily rental, cost, status, and the names of the main actors and the director. The catalog number uniquely identifies each video. However, in most cases, there are several copies of each video at a branch, and the individual copies are identified using the video number. A video is given a category such as Action, Adult, Children, Drama, Horror, or Sci-Fi. The status indicates whether a specific copy of a video is available for rent. Before hiring a video from the company, a customer must first register as a member of a local branch. The data held on a member is the first and last name, address, and the date that the member registered at a branch. Each member is given a member number, which is unique throughout all branches of the company. Once registered, a member is free to rent videos, up to a maximum of ten at any one time. The data held on each video rented is the rental number, the full name and number of the member, the video number, title, and daily rental, and the dates the video is rented out and returned. The rental number is unique throughout the company.

Required:

- a) From the requirements narrative above, identify **ALL** the entities as well as attributes for each of the entities **(5 Marks)**
- b) Using the entities and attributes identified in (i) above, draw a ER- Diagram to clearly capture the requirements in the narrative above. Write down your assumptions and indicate all entity relationship cardinality. (Use Crow's foot notation). **(10 Marks)**

Question FOUR (15 Marks)

a) There are three transaction anomalies, namely the lost update problem, the dirty read/ reading uncommitted data problem and the inconsistent analysis problem. With relevant examples, describe each of these. **(6 Marks)**

Consider the following case and use it to answer the questions that follow:

Mwambao, a client of Bank Account no. 200816 in Utamaduni Bank PLC is transferring Ksh. 12,500 from his account to Account no. 201384 run by one of his business associates. The business associate (owner of account 201384) is also trying to settle a debt of goods supplied by one of his suppliers and has thus issued an electronic transfer request for Ksh. 28,000 in favour of his supplier. This e-transfer is to be effected immediately as there are anticipated funds that should reach the account as soon.

Consider the following transaction schedule, assuming the bank has a rule that minimum balances cannot go below zero.

| Time (t) | Transaction P | Transaction Q | Bal Account No. 200816 | Bal Account No. 201384 |
|----------------|------------------------------------|----------------------------------|------------------------|------------------------|
| t ₁ | Begin transaction | | 68,000 | 27,500 |
| t ₂ | Read Bal Acc 200816 | | 68,000 | 27,500 |
| t ₃ | Bal 200816 = Bal 200816 – 12,500 | | 68,000 | 27,500 |
| t ₄ | Bal 201384 = Bal 201384 + 12,500 | Begin Transaction | 68,000 | 27,500 |
| t ₅ | Write Bal 200816, write Bal 201384 | Read Bal 201384 | 55,500 | 40,000 |
| t ₆ | - | Bal 201384 = Bal 201384 – 28,000 | 55,500 | 40,000 |
| t ₇ | - | Write Bal 201384 | 55,500 | 12,000 |
| t ₈ | - | Commit | 55,500 | 12,000 |
| t ₉ | Roll back | | 68,000 | - |

b) From the above case, answer the following questions;

- i) What property or properties have been contravened in the above schedule? **(2 Marks)**
- ii) What anomaly might have occurred? **(3 Marks)**
- iii) Rewrite the schedule correctly. **(4 Marks)**

Question FIVE (15 Marks)

An agency called Instant Cover supplies part-time/temporary staff to hotels within Kenya. The table shown below displays sample data, which lists the time spent by agency staff working at various hotels. The National Insurance Number (NHIF_NO) is unique for every member of staff.

| NHIF_NO | Contract_No | HrsPerWeek | Employee_Name | Hotel_No | HotelLocation |
|----------|-------------|------------|---------------|----------|---------------|
| N113567D | CH6788 | 16 | James Meno | H225 | Westlands |
| N189848A | CH6788 | 24 | Triza Atieno | H225 | Westlands |
| N749598D | CH6789 | 28 | Leah Chebet | H44 | Upper Hill |
| N113567D | CH6789 | 16 | James Meno | H44 | Upper Hill |

Figure 1: Employees of Instant Cover and their contracts to work at hotels

a) The relation above (Figure 1) is susceptible to update anomalies. Using the table, provide examples of insertion, deletion, and modification anomalies. **(6 Marks)**

b) Normalize the relation (Figure 1) above, showing how you progress from 1NF through 2NF to a set of 3NF named relations. At each stage show the primary key and any foreign keys of each relation and state assumptions that you make about any of the relationships between the columns of data. Give your relations meaningful names. **(9 Marks)**