



MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)

University Examinations for 2013/2014

DEPARTMENT OF COMPUTING AND APPLIED SCIENCE

End of Term Examination for Diploma in Information Communication Technology

Data Management Systems

Date:

Time: 2 Hours

Instructions

*Answer question **One** and any Other Two Questions.*

All questions carry the equal marks

Section A: Attempt all questions in this section

Question One

(a) Using an illustrative example explain how the following are mapped in an Entity Relationship

Diagram:

- i. Derived attribute
- ii. Multivalued attribute
- iii. Total participation (6 marks)

(b) Consider the following CUSTOMER relation schema with the fields as shown:

Customer(CustID, CustName, CustAddress, CustCity, CustAge)

- i. Write a relational algebra that returns all customers who are aged below 30 and come from Nairobi. (2 marks)
- ii. Write a relational algebra that would return only the names of customers who come from Mombasa. (2 marks)

(c) Explain any **five** ways in which the database approach overcomes limitations associated with the early conventional file processing systems. (10 marks)

Section B: Attempt any **two** questions.

Question Two

(a) Consider the following tables that 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)

By first populating the Hotel and Room tables appropriately with five instances, show the manipulations and describe the relations that would be produced by the following relational algebraic operations:

i. $\Pi_{\text{hotelNo}}(\sigma_{\text{price}>50})^{(\text{Room})}$ (5 marks)

ii. $\sigma_{\text{Hotel.hotelNo}=\text{Room.hotelNo}}^{(\text{Hotel X Room})}$ (5 marks)

iii. $\Pi_{\text{hotelName}}^{(\text{Hotel})} \bowtie \sigma_{\text{Hotel.hotelNo}=\text{Room.hotelNo}}(\sigma_{\text{price}<50})^{(\text{Room})}$ (5 marks)

(b) Using a suitable diagram, describe the 3-schema database architecture (5 Marks)

Question Three

(a) A banking database maintains data for the following entities:

i. The branch entity set, with attributes: branch_name, branch_city and assets

ii. The customer entity set, with attribute: Customer_ID, Customer_Name, Customer_Address (which includes Customer_street and Customer_city)

iii. Employee entity set, with attributes: Employee_ID, Employee_Name, Telephone_Number, Salary.

Additional descriptive attributes are a multivalued attribute; dependant_Name and a derived attribute; employee_length.

{ Assuming each customer belongs to a certain branch which has its own employees }

Develop an E-R representing the above information. (10 marks)

(b) Outline the importance of relationships in database systems (2 marks)

(c) Describe **three** types of relationships in relation to databases (3 marks)

(d) Outline the main responsibilities of a database administrator. (5 marks)

Question Four

(a) Consider the relational database below and answer the following queries using relational algebraic expressions:

Employee (e-name, street, city)

Works (e-name, company-name, salary)

Company (company-name, city)

Manages (employee-name, manager-name)

Write an expression that will display:

- i) The names of all employees who work for First Bank Corporation (2 marks)
- ii) The names and cities of residence of all employees who work for First Bank Corporation. (2 marks)
- iii) The names, street address and cities of residence of all employees who work for First Bank Corporation and earn more than \$10,000 p.a. (2 marks)
- iv) The names of all employees in this database who live in the same city and on the same street as their manager. (2 marks)
- v) The names of all employees in this database who live in the same city as the company which they work. (2 marks)
- vi) The names of all employees who do not work for First Bank Corporation. (2 marks)

(b) Briefly describe the following terms used in databases:

- i) Data mining
- ii) Data warehousing
- iii) Meta data. (6 marks)

(c) Define the term Database Management System. (2 marks)

Question Five

(a) Briefly describe the following terms as used in databases:

- i) Primary key
- ii) Candidate key
- iii) Weak entity (6 marks)

(b) Explain any **three** disadvantages of using a database system (6 marks)

- (c) A student takes one or more units from their program of study. Each unit is taught by a lecturer, who belongs to a department. A unit can be taken by more than one student and a lecturer can teach more than one unit. Represent this situation using an Entity Relationship Diagram. Give at least one attribute per entity. (8 marks)

Question Six

- (a) The following data structure is in its First Normal Form (1NF). Normalize it to the Third Normal Form (3NF). (8 marks)

studentID	Name	Advisor	Dept	deptName	courseName	Grade
123	Jones	Brooks	CS	CompSci	CS451	A
123	Jones	Brooks	CS	CompSci	CS450	B
123	Jones	Brooks	CS	CompSci	CS551	B
321	Smith	Hansen	CS	CompSci	CS451	C
321	Smith	Hansen	CS	CompSci	CS450	B
999	Abel	Thomas	EE	ElectEng	EE450	B

- (b) Proposed database for a book order processing system will have four relations: *customers*, *customer orders*, *order details*, *books*.
- i) Suggest the fields these tables might contain. (6 marks)
 - ii) Draw an entity relationship model for the books order processing system. (6 marks)

Question Seven

- (a) Differentiate between a database and a database management system. (4 marks)
- (b) A local microfinance company keeps information about all customer and savings accounts in permanent system physical files at the bank. Highlight any **four** disadvantages of using this method. (4 marks)
- (c) Explain the role of each of the following in relations to database systems: (6 marks)
 - i) Database administrator
 - ii) Database designer
 - iii) Application programmers
- (d) Define each of the following terms as used in database: (6 marks)
 - i) Entity set;
 - ii) Attributes;
 - iii) Schema.