



MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

**BACHELOR OF SCIENCE (CLOUD COMPUTING AND INFORMATION
SECURITY)**

SCC 150: DATA STORAGE

DATE: 12/4/2023

TIME: 8:30 – 10:30 AM

INSTRUCTIONS

- i) Answer question ONE and other TWO questions**
- ii) Write on both sides of the answer sheet**

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define
 - i) DBMS (2 marks)
 - ii) Data Dictionary (2 marks)
 - iii) Entity Relationship Model (ER Model) (2 marks)
- b) Distinguish between the following:
 - i) Data and information (2 marks)
 - ii) File and database (2 marks)
 - iii) Entities and attributes (2 marks)
- c) Explain the Advantages of DBMS (3 marks)
- d) List the contents of Data dictionary (4 marks)
- e) Briefly describe 3 Database languages. (5 marks)
- f) List THREE significant differences between a File-Processing System and a DBMS (6 marks)

QUESTION TWO (20 MARKS)

- a) What are five main functions of a database administrator (7 marks)
- b) Convert the following Entity Set to a Relational Database (5 marks)

STUDENT(rollno (primary key),name, address)

FACULTY(id(primary key),name ,address, salary)

COURSE(course-id,(primary key),course_name,duration)

DEPARTMENT(dno(primary key),dname)

- c) Given relation R (A, B, C, D, E, F, G) and the set of functional dependencies F= {BCD $\rightarrow$ A, BC $\rightarrow$ E, A $\rightarrow$ F, F $\rightarrow$ G, C $\rightarrow$ D, A $\rightarrow$ G}, decompose R into 3NF. Show your steps. Is this decomposition also BCNF? Why or why not? (8 marks)

QUESTION THREE (20 MARKS)

- a) Use examples/diagrams to explain the following terms (5 marks)
- Generalization,
 - Aggregation and
 - specialization
- b) You are designing a database for KW Humane Society. The result is the following set of relations where the type of each relations attribute is given following the attribute (e.g., ID: integer):
- Animals (ID: integer, Name: string, PrevOwner: string, DateAdmitted: date, Type: string)*
- Adopter (SIN: integer, Name: string, Address: string, OtherAnimals: integer)*
- Adoption (AnimalID: integer, SIN: integer, AdoptDate: date, chipNo: integer)*

where

- The primary keys are underlined.
- *Animals* stores information about the animals currently at the Humane Society. Each is given an ID, and their names together with the SIN of their previous owners (attribute PrevOwner), and their date of admission is recorded. Type refers to the type of animal (dog, cat, etc).
- *Adopter* is the relation that holds information about animal adopters. The attributes are self-descriptive, except OtherAnimals which records the number of other animals that the adopter currently has at home.
- *AnimalID* in *Adoption* refers to the ID of *Animals*. Similarly, *SIN* in *Adoption* refers to the SIN of *Adopter*. Attribute chipNo stores the number on the microchip that is implanted on the animal for tracking. Owner in *Animals* refers to the SIN of *Adopter* (in this case the previous adopter).

Formulate the following queries in SQL

- i) Retrieve the total number of dogs that were brought to the Humane Society on 18 April 2000. (3 marks)
- ii) List the name of the adopter who has adopted every type of animal. (3 marks)
- iii)) For each animal type, list the animal type and total number of adoptions on 14 June 1999. (3 marks)
- iv) List the types of animals who have not had any adoptions (3 marks)
- v) For each adopter who has made at least two adoptions, list their names and addresses (3 marks)

QUESTION FOUR (20 MARKS)

- a) Briefly describe the following file organization methods/techniques
 - i) Sequential file organization (3 marks)
 - ii) Indexed file organization (3 marks)
 - iii) Hashed file organization (4 marks)
- b) Machakos University registrar's office maintains data about the following entities:
 - *Course, includeing number,title,credits,syllabus and prerequisites*
 - *course offering,including course number,year,semester,section number,instructor timings, and class room*
 - *Students including student-id,name and program*
 - *Instructors, including identification number,name,department and title further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriate modeled.*Construct an E-R diagram for the registrar's office (10 marks)

QUESTION FIVE (20 MARKS)

- a) What is a relational schema? (2 marks)
- b) Create a relational schema of degree 5 (3 marks)
- c) Given Relation schema created in (b) above, construct its Relation instance (3 marks)
- d) Explain domain Constraint for the relational schema above (3 marks)
- e) Consider the following BOOK Table

Acc-No	Title	Author
100	"DBMS"	"Silbershatz"
200	"DBMS"	"Ramanuj"
300	"COMPILER"	"Silbershatz"
400	"COMPILER"	"Ullman"
500	"OS"	"Sudarshan"
600	"DBMS"	"Silbershatz"

- i) Write the result of execution of the following relational algebra
- ii) $\sigma_{\text{Acc-no} > 300}(\text{BOOK})$ (3 marks)
- iii) $\sigma_{\text{Title} = \text{"DBMS"}}(\text{BOOK})$ (3 marks)
- iv) $\pi_{\text{Acc-no}}(\sigma_{\text{Title} = \text{"DBMS"}}(\text{BOOK}))$ (3 marks)