LAIKIPIA UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST SEMESTER 2025/2026 ACADEMIC YEAR

THIRD YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COMP 316: ADVANCED DATABASE SYSTEMS

STREAM: R ***TIME: 2 HRS***

DAY: WEDNESDAY [8.30 – 10.30 A.M ***DATE: 28/01/2026***

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

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INSTRUCTIONS: Answer Question ONE and ANY other TWO Questions in Section B

SECTION A

QUESTION ONE: [30 MARKS] – COMPULSORY

(a) Express your understanding of the following terminologies;

(i) Structured query language (SQL) **[1 Mark]**

(ii) Data manipulation language (DML) **[1 Mark]**

(iii)Data definition language (DDL) **[1 Mark]**

(b) (i) Express your understanding of the term DBMS? **[2 Marks]**

(ii) Describe the **FIVE** components of the DBMS environment and discuss how they relate to each other. **[5 Marks]**

(c) Explain any **FIVE** typical functions and services a DBMS should provide. **[5 Marks]**

(d) What **FOUR** main types of actions involve databases? Briefly discuss each. **[4 Marks]**

(e) Explain what a transaction is in the context of a database. **[2 Marks]**

(f) Why should database systems maintain integrity constraints? **[3 Marks]**

(g) Write an SQL statement that can be used to copy an entire table into another. **[3 Marks]**

(h) What is the main difference between the DML command DELETE and the DDL command DROP? **[1 Mark]**

(i) Write an SQL statement that will identify all employees who are due for retirement in the year 2017 and copy their details into a new table called **dueForRetirement**. Assume that their details are currently stored in a table called **empDetails**, the retirement age is 60 years and the employee date of Birth is stored in the format **dd/mm/yy**. **[2 Marks]**

QUESTION TWO [20 MARKS]

(a) Explain the purpose and scope of database Security. **[2 Marks]**

(b) Outline the main types of threat that could affect a database system, and for each describe the controls that you would use to counteract each of them. **[5 Marks]**

(c) Explain the following in terms of providing security for a database:

(i) Authorization **[1 Mark]**

(ii) Access controls **[1 Mark]**

(iii) Backup and recovery; **[1 Mark]**

(iv) Views **[1 Mark]**

(v) Encryption; **[1 Mark]**

(vi) RAID technology. **[1 Mark]**

(vii) Integrity; **[1 Mark]**

(d) Distinguish between *Discretionary* and *Mandatory security mechanisms*. **[4 Marks]**

(e) What is an SQL injection attack and how is it executed? **[2 Marks]**

QUESTION THREE [20 MARKS]

Consider the following tables that store an Employee Tracking Database where an organization mandates that each employee complete a specified number of hours of training each year. The employee's attendance at training session is also to be kept. There are various training sessions.

EMPLOYEE TABLE

STAFFNO	NAME	DEPARTMENT	HIRE DATE	TRAINING
1234	J. JONES	SALES	18/6/1992	24
2345	S. KORIR	PRODUCTION	12/2/1998	40
3456	A. MWANGI	SALES	18/11/1998	60
4567	B. BETTY	ADVERTISING	10/3/1985	16
6789	C. WANJIRU	SHIPPING	18/5/1991	32
7890	E. OMOLO	SALES	15/12/1998	80
8901	F. NGUGI	ADVERTISING	17/10/1990	24
9012	G. GATHONI	ADVERTISING	15/31999	48
5678	D. DAVIS	PRODUCTION	26/7/1999	56

TRAINING TABLE

STAFFNO	SESSIONID	HOURS
2345	PERSMGT	12
3456	COMPSKILLS1	8
3456	COMPSKILLS2	24
3456	PERSELL1	24
4567	COMPSKILLS1	8
5678	PERSMGT	12
5678	PROJMGT1	12
7890	PERSMGT	12
7890	PERSELL	24
8901	PERSMGT	12
9012	PROJMGT	16

(a) Provide SQL statements to create structures for the two tables to store required data.

[@1.5 MARKS= [3 MARKS]

(b) Give SQL statements to insert the given data into the EMPLOYEE table. **[3 MARKS]**

(c) Write a query that will be used to retrieve a listing of SESSIONID and HOURS for all the training sessions for employee B.BETTY. **[3 MARKS]**

(d) Write a query that will retrieve a listing of employees who attended PERSMGT along with the number attended. **[4 MARKS]**

(e) Write a query that will retrieve employees who did not attend COMPSKILLS2 and PROJMGT1

[4 MARKS]

(f) From your knowledge of the referential integrity rule, what would happen to the database if employee 4567 left employment? **[3 MARKS]**

QUESTION FOUR [20 MARKS]

(a) The objective of the three-level architecture is to separate each user's view of the database from the way the database is physically represented. Give **FIVE** reasons why this separation is desirable.

[5 Marks]

(b) Distinguish between *Unary* operation and *Binary* operations as it pertains to relational algebra.

[2 Marks]

(c) Study the relational schema below then answer the questions that follow.

STUDENT

RegNo	**FName**	**LName**	**Hostel**
S13/28101/16	Samuel	Kamau	Hollywood
S18/26933/16	Jane	Gwako	Tatton
S13/27508/16	Stephen	Kimwaro	Hollywood
S18/22458/16	Peter	Wito	Maringo

TAKES

RegNo	**CourseCode**
S13/28101/16	AICM 713
S18/26933/16	COMP 391
S13/27508/16	COMP 391
S18/2458/16	MATH 342

ENROL

RegNo	**Programme**
S18/26933/16	101
S13/28101/16	113
S13/27508/16	101
S18/22458/16	101

COURSE

NUM	**NAME**	**DEPARTMENT**
AICM 713	Database Design and Management	Computer
COMP 391	Research Methods	Computer
COMP 401	Database Systems	Computer
MATH 342	Quality Control Methods	Math

PROGRAMME

NUM	NAME	DEPARTMENT
113	GDip	Computer
101	PhD	Computer

Write relational algebra expressions to do the following;

(i) Choose STUDENT tuples where Hostel is 'Hollywood'? **[2 Marks]**

(ii) Find the first and last names of all students in the institution. **[2 Marks]**

(iii) List the first and last names of all students who live in Hollywood. **[3 Marks]**

(iv) Show IDs of students doing both courses AICM 713 and COMP 391. **[3 Marks]**

(v) Finds the student IDs who are not taking any subjects. **[3 Marks]**

QUESTION FIVE [20 MARKS]

For each of the following, draw an ER diagram showing entities, attributes, relationships, cardinality, and participation. Where necessary state any assumptions.

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(a) Customers identified by a name and with an address purchase items. Items are identified by a number and have a colour. The quantity bought of each item is recorded. **[5 Marks]**

(b) Departments are identified by an ID and have a budget. Within each department there are several projects. Projects have a name and a start date. **[5 Marks]**

(c) An order with a unique number and date can be made for any quantity of parts, each with an item identifier and colour. Each order is made by one supplier with a name and address. **[5 Marks]**

(d) A worksite at a particular address has several named workers with payroll numbers and tasks. Building materials of certain types and quantities are delivered by named trucking companies on a date to a supervisor at the worksite; there are several manufacturers of each kind of material, each with their own business name and address. **[5 Marks]**