



THE UNIVERSITY OF DODOMA

COLLEGE OF INFORMATICS AND VIRTUAL EDUCATION

Department of Computer Science and Engineering

CP 224: Database Management Systems - Test One

Registration #. T..... Progr..... (eg. CS), Date: 18/05/2023

INSTRUCTION: Answer all Four Questions and time allocated is 50 min.

Question One – Relational Database Design

Answer the following questions: -

a. Let $R = (ABCDE)$ be a relation with set of functional dependencies $F = \{A \rightarrow BC, A \rightarrow D, CD \rightarrow E\}$ and $G = \{A \rightarrow BCE, A \rightarrow ABD, CD \rightarrow E\}$. Is $F = G$? (10 Marks)

b. Suppose you are given a relation $R = (ABCDE)$ with the following functional dependencies: $\{CE \rightarrow D, D \rightarrow B, C \rightarrow A\}$.

i. Find all candidate keys. (3 Marks)

ii. Identify the best normal form that R satisfies (*1NF*, *2NF*, *3NF*, or *BCNF*). (1 Mark)

iii. If the relation is not in *BCNF*, decompose it until it becomes *BCNF*. At each step, identify a new relation, decompose and re-compute the keys and the normal forms they satisfy. (6 Marks)

Question Two – OO Database Modeling and Relational Algebra

Answer the following questions: -

- a. Given the OO database design in Figure 1, identify superclass, subclass and relationship type between the classes. (10 Marks)

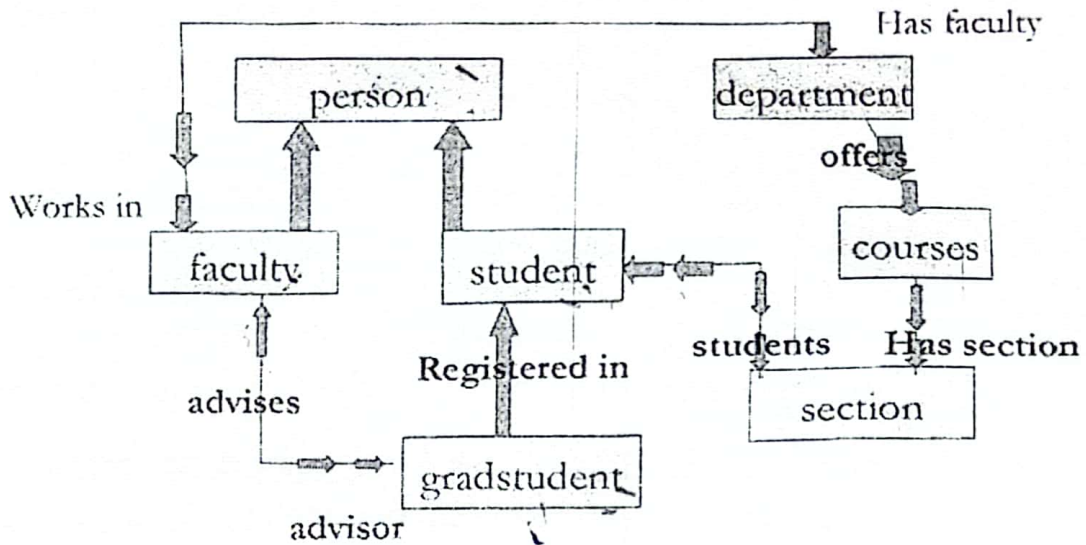


Figure 1: Object-Oriented database design

- b. Given Student and Department relations.

(10 Marks)

Student			
Registration#	Name	Programme	Dept_ID
T21-03-00224	Kenedy Peter	BSc. CS	01
T21-03-00001	Khamis Ally	BSc. IS	02
T21-04-00224	Angelina Bryson	BSc. CE	01
T21-03-01000	Paulina Zongo	B.Art. AC	03

Handwritten notes and diagrams below the table:

- A diagram showing a one-to-one relationship with the label `1:1`.
- A diagram showing a one-to-many relationship with the label `1:N`.
- A diagram showing a many-to-many relationship with the label `M:N`.

Department		
Dept_ID	Dept_Name	Budget
01	Computer Science	2,000,000,000
02	Information System Technology	1,500,000,000
04	Telecommunication Engineering	1,000,000,000
05	Economic Studies	1,000,000,000

- i. Write SQL statement to JOIN the two relations using FULL OUTER.
- ii. Write the resulting relation after executing the query in (i).

Question Three – Query

Answer each of the following questions briefly. The questions are based on the following relational schema: (4 Marks Each)

Emp(eid:integer, ename:string, age:integer, salary:real)

Works(eid:integer, did:integer, pcttime:integer)

Dept(did:integer, dname:string, budget:real, managerid:integer)

- a. Write the SQL statements required to create all relation, including appropriate versions of all constraints.
- b. Write the SQL statements that retrieve the names of employees who work in departments with a budget higher than the average budget across all departments.
- c. Write the SQL statements that display the names of employees who work in departments managed by employees with the highest salary.
- d. Write the SQL statements that retrieve the employee names and their respective department names for employees who work part-time (*pcttime less than 100*) and have a salary higher than the average salary across all employees.
- e. Write the SQL statements that find the department name and total salary expense for each department, ordered by the total salary expense in descending order.

Question Four – Transaction

Let T_1 transfer \$1500 from account A to account B, and T_2 transfer 30% of the balance from account A to account B. Initial balance for account A and B are 1000 and 2000 respectively.

- a. Write a serial schedule for transaction to transfer money from account A to account B. (6 Marks)
- b. Draw a transaction table of schedule in (a) by considering, Consistent @commit, Inconsistent @transit and Inconsistent @commit. (6 Marks)
- c. Prove that the database is consistent. (4 Marks)
- a. Explain active state, partially committed, committed, failed and aborted. In terms of CPU, RAM and hard disk by using transaction state diagram. (4 Marks)