

06130T4CSC

COMPUTER SCIENCE LEVEL 6

ICT/OS/CS/CR/05/6

Demonstrate Database Management Skills

November/December 2025



**TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION
COUNCIL (TVET CDACC)**

WRITTEN ASSESSMENT

Time: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. The paper consists of **TWO** sections
2. Answer **ALL** questions in section A and any **THREE (3)** questions in section B.
3. Marks for each question are indicated in the brackets.
4. Candidates are provided with a separate answer booklet
5. Do not write on this question paper.

This paper consists of FIVE printed pages

**Candidate should check the question paper to ascertain that all
pages are printed as indicated and no questions are missing.**

SECTION A (40 MARKS)

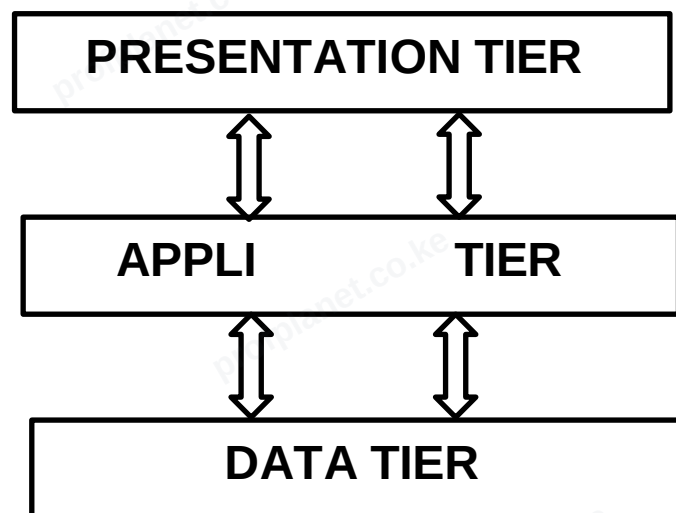
Answer ALL Questions in This Section

1. Consider a student management system in a college. Explain how the following database objects would be used in this context: (2 marks)
 - a. Forms
 - b. Queries
2. While setting up a student portal, the IT team implemented both authentication and authorization. Using this scenario, explain the difference between the TWO concepts. (4 marks)
3. Outline TWO real-life situations where understanding a data model would be essential in database design. (4 marks)
4. A company is considering implementing a hierarchical database. Explain ONE major limitation they might face if they choose this model. (2 marks)
5. During the database design life cycle of a Hospital System, explain how the logical phase differs from the physical phase. (4 marks)
6. A new software firm is evaluating options for a database system. The firm considered using PostgreSQL and Mong DB tools. Explain the purposes of each of these tools considered. (4 marks)
7. Using an example of a relational database for a business, explain TWO key components that ensure data is organized and accessible. (4 marks)
8. In designing a database for employee records, the team needs to choose a primary key. Outline TWO essential characteristics this key must have. (2 marks)
9. As part of onboarding, a junior database administrator is learning about Database Management Skills (DBMS). Outline TWO key components they should understand. (2 marks)
10. A banking application must maintain data integrity during transactions. Explain what ACID means in this context. (2 marks)
11. A software developer is optimizing database performance. Differentiate between passive and active data dictionaries in this context. (2 marks)
12. A company has Employees and Managers. Explain how you would use inheritance to model this in an object-oriented database. (4 marks)
13. A shopping system needs to store information about Products and Customers. List TWO possible classes and ONE attribute for each. (4 marks)

SECTION B: (60 marks)

Answer Any *THREE* Questions in This Section

14. a. In a certain institution a student is identified by admission number, names which consist of the first and the second name, date of birth and age which is derived from the date of birth, their phone numbers which include that of the guardian. Each student belongs to a class which is identified by a class name. Students are free to register in one or more clubs. Each club is identified by a club name and club identification code. Represent the information using an entity relationship diagram. (8 marks)
- b. With the aid of a well labeled diagram describe the database life cycle. (6 marks)
- c. Figure below shows database tier architecture. Use it to answer the questions that follow:



- i. Explain the database architecture above (2 marks)
- ii. Explain Two benefits of this type of tier architecture (4 marks)
- 15 a) An online ticket booking system must handle millions of customer queries by CustomerID.
- i. Design a hashing scheme for CustomerID using modulo division (assume 10 buckets). (2 marks)
- ii. Demonstrate how collisions would be handled if both CustomerID = 105 and CustomerID = 115 map to the same bucket. (2 marks)
- iii. Explain how dynamic hashing would improve performance if the number of customers doubles. (2 marks)

iv. Given a student database where records are frequently retrieved by Admission Number, demonstrate with an example how one type of hashing can be applied generate the storage address. (2 marks)

b) A database stores student records with attributes: StudentID, Name, Course, and Year of Study. The database is frequently queried using StudentID.

i. Explain how you would apply dense index and sparse index on the StudentID attribute in this database. (4 marks)

ii. Illustrate with a small example of 6 students (use StudentID numbers like 101, 102, 104, 107, 110, 115). (2 marks)

iii. A school library system is being designed. The system should store details about Books (title, author, ISBN) and Students (name, admission number, class). Students can borrow multiple books, and each borrowed book must record the date borrowed and due date. Using object-oriented concepts, explain how you would represent this system in an object-oriented database. (6 marks)

16 A hospital database is being design patients, doctors, and appointments.
Each patient can book many appoi each doctor can attend to many patients.

a.) Using UML notation, draw an entity model for the system, showing entities, attributes, and relationships (with cardinalities). (6 marks)

b.) You are given the following unnormalised data for appointments: Appointment (ApptID, PatientName, PatientPhone, DoctorName, DoctorSpecialty, ApptDate, ApptTime, RoomNo) Normalise this relation step by step up to 3rd Normal Form (3NF). Show all intermediate tables. (6 marks)

c) Construct a CRUD matrix for the following transactions: (8 marks)

- i. Register a new patient
- ii. Assign a doctor to an appointment
- iii. Update appointment time
- iv. Delete a patient's appointment.

- 17 a. Table 1 shows employee records stored in a database. Use it to answer the questions that follow.

Employee No	First name	Last name	Date employed	Salary	Grade
1010	Gabriel	Williams	11/11/2009	10000.09	Lower
1011	Jane	Antony	09/11/2007	20000.56	Higher
1012	Nicholas	Kings	06/06/2008	25000.67	Higher
1013	Mary	Anne	05/10/2008	15000.45	Middle
1014	Johnstone	Able	12/12/2009	11000.99	Lower

Write SQL statements that would:

- Extract the first names and last names in uppercase; (2 marks)
 - Extract the first three characters of the *Grade* and store them in a field named *grade 1*; (2 marks)
 - Determine the number of characters in the *last name* and store them in the field named *last na* (2 marks)
 - Round off the value field to 0 decimal places and store them in the field named s (2 marks)
- b.) Database abstraction is the _____ding the complexity of the database system from the users. Explain THREE levels of data abstraction. (6 marks)
- c.) A database is being designed with the entities Student, Course, and Lecturer. Draw ERD fragments to show how each of the following cardinalities would be represented in this case: (6 marks)
- One-to-One
 - One-to-Many
 - Many-to-Many