



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

DATABASE SYSTEMS

SCS1213

August 2024

This examination paper consists of 3 pages

Time Allowed: 3 hours
Total Marks: 100
Examiner's Name: Mrs. N. Marabada
External Examiner: Dr C Gombiro

INSTRUCTIONS

1. Answer any four (4) questions
2. Each question carries 25 marks

MARK ALLOCATION

QUESTION	MARKS
1.	25
2.	25
3.	25
4.	25
5.	25
TOTAL	100

QUESTION ONE

- a) Explain what cloud computing is? [5]
- b) With the aid of clearly labeled diagrams, differentiate between the following:
- i) Hierarchical and Network [5]
- ii) Distributed and Centralised [5]
- iii) Relational and Object Oriented [5]
- iv) Data and Information [5]

QUESTION TWO

a) Define each of the following relational database concepts using examples from the STUDENT relation given in the table below

- i. Tuple. [1]
- ii. Cardinality. [1]
- iii. Degree. [1]
- iv. Attribute. [1]
- v. Schema. [2]
- vi. Domain. [2]
- vii. Composite key. [2]

STUDENT

ROLL	NAME	CITY	PHONE	AGE
1	Mulambo	Harare	774370295	18
2	Ncube	Bulawayo	757567744	18
3	Samuriwo	Kwekwe	791562532	20
4	Moyo	Masvingo		34

b) Explain the importance of the ANSI-SPARC database architecture in supporting data independence in a Database Management System (DBMS) and supporting database design. [5]

c) Relational Algebra uses operators to manipulate a Relation. An operator can be either Unary or Binary. Consider the following Depositor and Borrower relations below:

Depositor

Borrower

ID	Name
1	a
2	b
3	c

ID	Name
2	b
3	a
5	d

i. Give examples of TWO Unary Relational Algebra (RA) operators that operate only on the Depositor or the Borrower relations. [4]

ii. Give examples of THREE Binary Relational Algebra operators that operate on both the Depositor and Borrower Relations given above. [6]

QUESTION THREE

Relational Databases are very efficient for specific tasks, but there are situations in which other approaches are more suitable. Consider the following case and answer the questions below.

You have a collection of classic comics, with just under 1000 comic books. You like to store information about your collection on your computer and you want to be able to query and maintain the data when you look for a specific comic or add to you collection.

You also want to store photos of the cover pages in jpeg format and link these to the relevant entries.

a) Compare a database approach and a spreadsheet-based approach for the above data management need considering the following:

i. Data representation (how are the needed types of data stored and viewed). [4]

ii. Data manipulation (how do you edit, search and update data). [4]

b) Why could a file-based approach be better for managing the data in this example? [4]

c) You are starting to trade in comics and need a system that stores customer information and sales transaction data. Why is a database better than a filebased system with regards to the following criteria:

i. Scalability; [3]

ii. Validation and data integrity; [3]

iii. Authentication. [3]

d) Using a DBMS provides physical and logical data independence. What benefit can a developer gain from these two types of data independence in the context of the above scenario and how is it achieved? [4]

QUESTION FOUR

a) Draw ER diagram for Hospital Management System

(Use DOCTOR,PATIENT, HOSPITAL and MEDICAL_RECORD Entity).

Identify Primary Key and Foreign Key. [6]

b) i. Provide the definitions for Boyce Codd Normal Form. [4]

ii. Explain the concept of 'update anomaly' that might occur in a database that is not normalised. Provide an example. [3]

iii. Normalize database

Employee(emp_id,emp_name,phone,skill,salary,deptno,dept_name,jobno,job_title)
upto 3NF [6]

c) Write SQL query for following consider table

EMP(empno , deptno, ename ,salary, Designation, joiningdate, DOB,city)

i) Display names of employees whose experience is more than 10 years

ii) Display age of employees

iii) Display average salary of all employee

iv) Display name of employee who earned highest salary [6]

QUESTION FIVE

a) Describe briefly the terms 'data integrity' and 'data recovery' in the context of maintaining consistency of data in a database system. [5]

b) What is domain integrity? How does a database enforce domain integrity? [5]

c) Explain the concept of checkpoints and describe, using a timeline diagram, how checkpoints are used to recover a database following failure of a transaction sequence. [6]

d) The weather can cause devastating events in which a business can suffer permanent loss of IT infrastructure, particularly if it destroys computers/servers holding a database.

To avoid becoming a victim of catastrophic data loss, you have been recruited to prepare a plan of action that the business must enact before such a disaster.

Write the plan as a series of actions that the business would apply to minimise data loss and preserve data integrity. [9]

END OF QUESTION PAPER