



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI-ABUJA**  
**FACULTY OF SCIENCE**  
**DEPARTMENT OF COMPUTER SCIENCE**  
**2021\_2 EXAMINATION**

**COURSE CODE:** CIT 843  
**COURSE TITLE:** INTRODUCTION TO DATABASE MANAGEMENT SYSTEM  
**CREDIT UNIT:** 2  
**TIME ALLOWED:** 2 HRS  
**INSTRUCTION:** ANSWER QUESTION ONE AND ANY OTHER THREE

**Question 1**

- a. i. What is a Primary Key? State the rules for defining primary ke: **(3.5marks)**  
ii. What is Candidate Key? Differentiate between a Candidate and Alternative Key and state the properties for each.

**(6 marks)**

- iii. From the Table below, identify the primary key, Candidate Key and the Alternate key

StudID	Roll No	First Name	LastName	Email
1	11	Tom	Price	<a href="mailto:abc@gmail.com">abc@gmail.com</a>
2	12	Nick	Wright	<a href="mailto:xyz@gmail.com">xyz@gmail.com</a>
3	13	Dana	Natan	<a href="mailto:mno@yahoo.com">mno@yahoo.com</a>

**(3 marks)**

- b. i. When do we need to store derivable data in the table and what are the advantages and disadvantages of storing derivable data in a table? **(4marks)**  
ii. Apart from containing sequences of SQL code in a script, describe other ways that SQL code can be stored, contained, encapsulated and run as a sequence of executable statements **(2.5 marks)**  
iii. Describe four possible benefits of “Views” in databases. **(2 marks)**  
c. Define the basic characteristics of a NoSQL database, with examples of where is used **(2 marks)**  
d. Explain how the entity relationship (ER) model helped produce a more structured relational database design environment **(2 marks)**

### Question 2

a. The following table stores details of employees and the projects they work on and for how long. The Primary Key is (EmpID, ProjID).

<u>EmpID</u>	EmpName	<u>ProjID</u>	ProjName	HoursPerWeek
E01	Smith	P02	Database	10
E01	Smith	P01	Web Portal	5
E02	Robinson	P02	Database	20

Explain why the above table is not in 2<sup>nd</sup> Normal Form.

Transform the table into 2<sup>nd</sup> Normal Form tables. **(6 marks)**

b. Using your own specific examples, illustrate the following SQL querying techniques:

- Row-level filtering.
- Aggregate functions.
- Grouping and group-level filtering.
- Joining.
- Sub-Queries.

**(5marks)**

c. A football club uses the table below to record details of players and the positions in which they can play. Each player can play in up to a maximum of three positions:

<u>playerID</u>	playerName	positions
P1	Lionel Messi	Forward, Centre Midfield
P2	Cristiano Ronaldo	Forward, Left Midfield, Right Midfield
P3	Philippa Lahm	Right Back, Defensive Midfield

i. Explain why this table is not in “First Normal Form” (1NF). **(1 mark)**

ii. Show how this table can be transformed into 1NF tables. Give 2 possible solutions.

**(3 marks)**

### Question 3

- With reference to the table below explain the concept of a Domain.
  - List 2 examples from the above tables of columns that could be defined as a domain.
  - Suppose you were required to implement (create and populate) in the tables using an SQL script containing a set of CREATE TABLE and INSERT operations. List the logical sequence the tables should be populated to ensure referential integrity is preserved.
  - TotalQtySold is a column that contains derived data. Write a SQL SELECT statement that computes a value for this column for a specific product.
  - When do we need to store derivable data in the table and what are the advantages

and disadvantages of storing derivable data in a table?

- vi. Write an SQL UPDATE statement that updates the column TotalQtySold given a specific product.

Customer

Column Name	Type	Length	Nulls	Key
CustID	Integer	4	No	PK
CustName	Varchar	25	No	
Custaddress	Varchar	25	No	
CustPostCode	Char	8	No	

Products

Column Name	Type	Length	Nulls	Key
ProductID	Integer	4	No	PK
Description	Varchar	25	No	
StorageAddress	VarChar	25		
StoragePostCode	VarChar	12		
Reorderquantity	Integer	4	No	
QuantityInStock	Integer	4	No	
Unitprice	Decimal	8,2	No	
Total_quantitySold	Integer	4	Yes	

Orders

Column Name	Type	Length	Nulls	Key
OrderID	Integer	4	No	PK
CustID	Integer	4	No	FK
OrderDate	Date		No	
PromiseDate	Date		No	

LineItems

Column Name	Type	Length	Nulls	Key
ProductID	Integer	4	No	PK,FK
OrderNo	Integer	4	No	PK,FK
QuantityOrdered	Integer	4	No	

- i. With reference to the table explain the concept of a Domain. (2marks)  
 ii. List 2 examples from the tables of columns that could be defined as a domain. (2marks)  
 iii. Suppose you were required to implement (create and populate) in the tables using an SQL script containing a set of CREATE TABLE and INSERT operations.  
 List the logical sequence the tables should be populated to ensure referential integrity is preserved. (2marks)

- iv. TotalQtySold is a column that contains derived data. Write a SQL SELECT statement that computes a value for this column for a specific product.

(4marks)

- vi. Write an SQL UPDATE statement that updates the column TotalQtySold given a specific product. ( 5marks)

#### Question 4

Assume the following SQL script is to be executed:

CREATE TABLE Students (StudentID CHAR(6)

```
,StudentFname VARCHAR(20) NOT NULL
,StudentLname VARCHAR(20) NOT NULL
,Date_of_Birth DATE
,CourseCode CHAR(6) ,
CONSTRAINT student_pk PRIMARY KEY (Studentid));

CREATE TABLE Courses(CourseCode CHAR(6) PRIMARY KEY
,CourseLevel INT
,Fee NUMBER(5,2));

INSERT INTO Students VALUES
('234349','Bill','Nomas', NULL,NULL);

INSERT INTO Students VALUES
('234350','Ramesh', 'Haslam', 22,'SET');

INSERT INTO Students VALUES
('234351','John','Norman', 24, 'GHR');

INSERT INTO Students VALUES
('234347','John','Sagatara', NULL, NULL);

INSERT INTO Students VALUES
('234350','Ramesh','Bartok', 22, NULL);

INSERT INTO Students VALUES
('234341','John','Norman', 24, NULL);

INSERT INTO Students VALUES
('234348', 'David', 'Bulmar', NULL, NULL);

INSERT INTO Students VALUES
('234345', NULL, 'Desai', NULL, NULL);

INSERT INTO Courses VALUES
('GHR',1,249 );
```

- a. Classify TWO types of data integrity checks that have been specified to prevent invalid data being entered. Give examples of each of these types of data integrity checks. **(2marks)**
- ii. What is the result of running the above script (assuming it is syntactically correct) in terms of table creation and insertion of data? **(2.5 marks)**
- iii. Change the script to enforce an additional constraint that would be applied to restrict the data of birth of all students to be later than 01-jan-1998. **(2marks)**
- iv. Change the script to enforce an additional constraint that would ensure data integrity

between data referenced in both the Students and Courses Tables. Assume that a student can only attend one course at a time and a course may have many students **(3marks)**

- vi. Why is it necessary to constrain updates performed on referenced data in tables such as Courses and Students? Explain the measures available in SQL to constrain these updates. **(2marks)**
- vii. Describe with the aid of example SQL code how data may be inserted into a table by selecting and copying data from one or more existing tables, hence avoiding the use of many INSERT statements **(3.5 marks)**

### Question 5

Consider the following relations:

Doctor(SSN, FirstName, LastName, Specialty, YearsOfExperience, PhoneNum)

Patient(SSN, FirstName, LastName, Address, DOB, PrimaryDoctor\_SSN)

Medicine(TradeName, UnitPrice, GenericFlag)

Prescription(Id, Date, Doctor\_SSN, Patient\_SSN)

Prescription\_Medicine(Prescription Id, TradeName, NumOfUnits)

The Doctor relation has attributes Social Security Number (SSN), first and last names, specialty, the number of experience years, and the phone number.

The Patient relation has attributes SSN, first and last names, address, date of birth (DOB), and the SSN of the patient's primary doctor.

The Medicine relation has attributes trade name, unit price, and whether or not the medicine is generic (True or False).

The Prescription relation has attributed the prescription id, the date in which the prescription is written, the SSN of the doctor who wrote the prescription, and the SSN of the patient to whom the prescription is written.

The Prescription Medicine relation stores the medicines written in each prescription along with their quantities (number of units).

### Write the relational algebra expressions for the following queries

- a. i. List the trade name of generic medicine with unit price less than \$50 **(1 marks)**
- ii. List the first and last name of patients whose primary doctor named 'John Smith' **(2 marks)**
- iii. List the first and last name of doctors who are not primary doctors to any patient **(2 marks)**
- iv.. For medicines written in more than 20 prescriptions, report the trade name and the total number of units prescribed **(2 marks)**
- v. List the SSN of patients who have 'Aspirin' and 'Vitamin' trade names in one prescription **(3 marks)**
- vi. List the SNN of distinct patients who have 'Aspirin' prescribed to them by doctor named 'John Smith' **(3 marks)**
- vii. List the first and last name of patients who have no prescriptions written by doctors other than their primary doctors. **(3 marks)**