

NVQ Level 05 Written Exam -December 2019 (Semester I)

National Diploma in Information and Communication Technology

Database system I

Answer four (04) questions.

1.

I. Define the computer Database

A database is an organized collection of data, generally stored and accessed electronically from a computer system. It can then be easily accessed, managed, modified, updated, controlled, and organized. A database is usually created and controlled by a database management system (DBMS).

II. Briefly explain the following terms and related to databases

(a) Flat file System

~~A flat file system is a system in which every file in an operating system is at the same directory level. These primitive file systems were mostly used in early computing systems prior to the development of the hierarchical file systems that are used today.~~

A flat file database is a database that stores data in a plain text file. Each line of the text file holds one record, with fields separated by delimiters, such as commas or tabs. While it uses a simple structure, a flat file database cannot contain multiple tables like a relational database can.

(b) Mini word

mini-world as a sample dataset of the real world. This mini-world can be a full or part of a business like a retail shop or a logistics operation or pharma system or a university system etc. Any changes to the mini-world should be updated in the corresponding database either in near real-time or on a scheduled duration basis

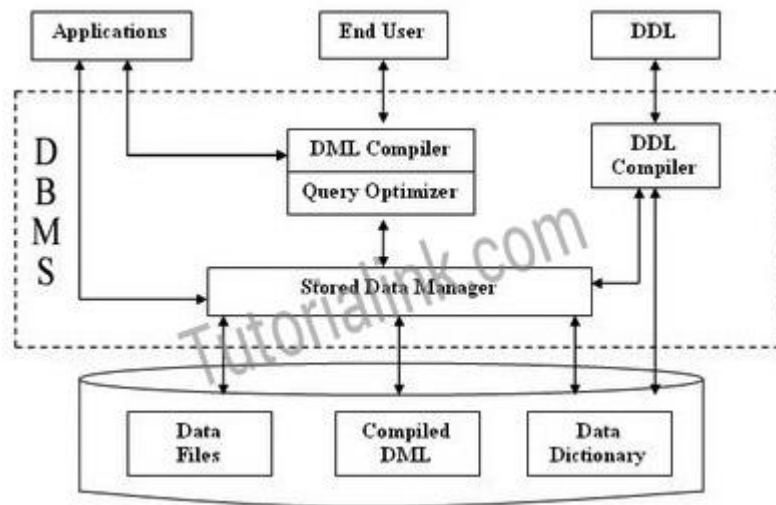
(c) Data Dictionary

A data dictionary is a collection of descriptions of the data objects or items in a data model for the benefit of programmers and others who need to refer to them.

- III. “DBMS Act as an interface between the user and the database” Explain this statement by giving the structural components of the DBMS with their related functions in interacting with the user

Structure of DBMS:

- DBMS (Database Management System) acts as an interface between the user and the database. The user requests the DBMS to perform various operations such as insert, delete, update and retrieval on the database.
- The components of DBMS perform these requested operations on the database and provide necessary data to the users.



- The various components of DBMS are described below:
- DDL Compiler:
 - Data Description Language compiler processes schema definitions specified in the DDL.
 - It includes metadata information such as the name of the files, data items, storage details of each file, mapping information and constraints etc.
- DML Compiler and Query optimizer:
 - The DML commands such as insert, update, delete, retrieve from the application program are sent to the DML compiler for compilation into object code for database access.
 - The object code is then optimized in the best way to execute a query by the query optimizer and then send to the data manager.
- Data Manager:
 - The Data Manager is the central software component of the DBMS also known as Database Control System.
 - The Main Functions Of Data Manager Are:
 - Convert operations in user's Queries coming from the application programs or combination of DML Compiler and Query optimizer

which is known as Query Processor from user's logical view to physical file system.

- Controls DBMS information access that is stored on disk.
- It also controls handling buffers in main memory.
- It also enforces constraints to maintain consistency and integrity of the data.
- It also synchronizes the simultaneous operations performed by the concurrent users.
- It also controls the backup and recovery operations.
- Data Dictionary:
 - Data Dictionary, which stores metadata about the database, in particular the schema of the database.
 - names of the tables, names of attributes of each table, length of attributes, and number of rows in each table.
 - Detailed information on physical database design such as storage structure, access paths, files and record sizes.
 - Usage statistics such as frequency of query and transactions.
 - Data dictionary is used to actually control the data integrity, database operation and accuracy. It may be used as a important part of the DBMS
- Data Files:
 - Which store the database itself.

2.

- I. Write down any three responsibilities of a data base administrator

A database administrator's responsibilities can include the following tasks:

- Installing and upgrading the ~~Oracle~~ Database server and application tools
- Allocating system storage and planning future storage requirements for the database system
- Creating primary database storage structures (tablespaces) after application developers have designed an application
- Creating primary objects (tables, views, indexes) once application developers have designed an application
- Modifying the database structure, as necessary, from information given by application developers
- Enrolling users and maintaining system security
- Ensuring compliance with Oracle license agreements
- Controlling and monitoring user access to the database
- Monitoring and optimizing the performance of the database
- Planning for backup and recovery of database information
- Maintaining archived data on tape
- Backing up and restoring the database

- II. State the difference between security and integrity.

The key difference between Security and Integrity is that Data security is the protection of data from unauthorized users. Data integrity means that the data contained in the database is both correct and consistent. For this purpose, the data stored in the database must satisfy certain types of constraints.

Security	Integrity
Data security defines the prevention of data corruption through the use of controlled access mechanisms.	Data integrity defines the quality of data, which guarantees the data is complete and has a whole structure.
Data security deals with the protection of data	Data integrity deals with the validity of data
Data security is making sure only the people who should have access to the data are the only ones who can access the data.	Data integrity is making sure the data is correct and not corrupt.
Data security refers to making sure that data is accessed by its intended users, thus ensuring the privacy and protection of data.	Data integrity refers to the structure of the data and how it matches the schema of the database.
Authentication/authorization, encryptions, and masking are some of the popular means of data security.	Backing up, designing a suitable user interface and error detection/correction in data a
It can be implemented through : <ul style="list-style-type: none"> • user accounts (passwords) • authentication schemes 	It can be implemented by following rule : <ul style="list-style-type: none"> • Primary Key • Foreign Key Relationship

III. Explain the following constraint used in relational data model giving examples

- Domain constraint

Domain constraint: A domain is a unique set of values permitted for an attribute in a table/relation. Domain constraint defines the domain or set of values for an attribute

Example CustomerName varchar(50)

- Key constraint

Key constraint specify that all tuples in a relation must be distinct. No two tuples can have the same combination of values for all their attributes.

An attribute or set of attribute that uniquely identify each row in relation is called a key of the table/relation.

- Referential integrity constraint

A row in one table that refers to another table must refer to an existing row in that table. It is used to maintain consistency among tuples in two relations and specified between two relations / tables based on foreign key

3.

I. Explain the two levels of data independence in brief

Data independence can be explained using the three-schema architecture. Data independence refers to characteristic of being able to modify the schema at one level without affecting the other levels of the database system

There are two types of data independence;

Logical Data Independence

- It refers characteristic of being able to change the conceptual schema without having to change the external schema
- It is used to separate the external level from the conceptual level
- Logical Data independence occurs at user interface level

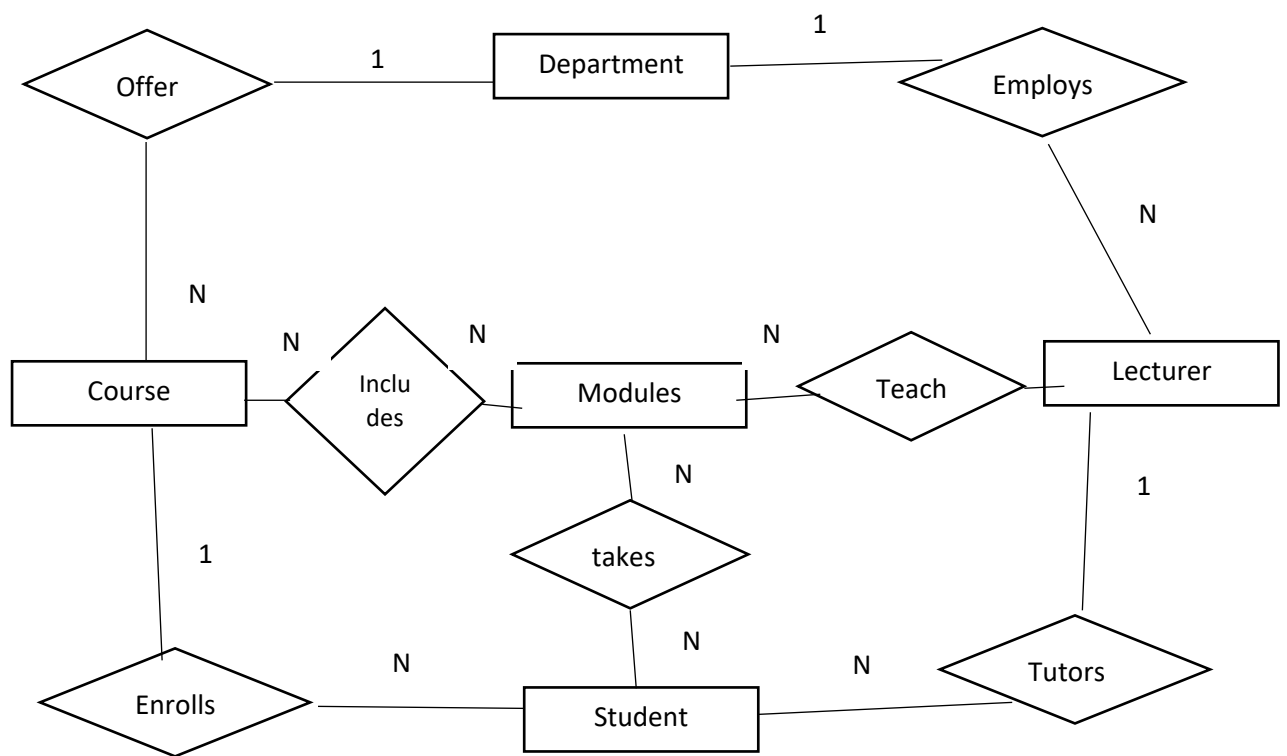
Physical Data Independence

- The capacity to change the internal schema without having to change the conceptual schema
- It is used to separate the conceptual level from the internal level
- Physical Data independence occurs at logical interface level

- II. A vocational university consists of a number of departments. System keeps the details of department like Department No, Department name and start date. Each department offers several technical courses. A number of modules make up each technical course.

Students enroll in a particular course and take modules towards the completion of that course. Each module is taught by a lecturer from the appropriate department and each lecturer tutors a group of students. Unique Student id, Student Name, Gender, date of birth, details are stored in the system.

- (a) Draw an Entity Relationship diagram by identifying entities, relationships, and attributes for the above case study



4.

I. Briefly explain the following terms

(a) Cardinality ratio

The **Cardinality Ratio** for a binary relationship specifies “the max number of relationship instances that an entity can participate in”

The possible **Cardinality Ratio** for binary relationships are

One-to-One (1:1) Relationships

One-to-Many (1:N) Relationships

Many-to-Many (M:N) Relationships

(b) Candidate key

Candidate key is an attribute or set of attributes that uniquely identifies any given row in a table. There may be more than one candidate key. When one of the candidate key is selected as the key of the relation, It may call **Primary key**

II. Consider the following table called “projects” and Normalized up to 3NF showing all necessary steps:

Projects

Dept_No	DepName	EmployeeID	Ename	Address	Projects	Dead_Line
D1	Math	E001	Amali	Galle	Y	09/03/2019
		E002	Kamal	Maradana	X	08/03/2019
		E010	Pubudu	Badulla	X	08/03/2019
D2	Zoology	E002	Kamal	Maradana	P	10/02/2019
		E003	Chaturika	Kandy	Q	08/03/2019

III. In what normal form is this Project Table? Zero normal form

IV. Normalize Project Table into 1NF,2NF,3NF relations

First Normal Form

- Remove the repeating groups and define a primary key (Dept No, EmployeeID)

Step 1

<u>Dept No</u>	DepName	<u>EmployeeID</u>	Ename	Address	Projects	Dead_Line
D1	Math	E001	Amali	Galle	Y	09/03/2019
D1	Math	E002	Kamal	Maradana	X	08/03/2019
D1	Math	E010	Pubudu	Badulla	X	08/03/2019
D2	Zoology	E002	Kamal	Maradana	P	10/02/2019
D2	Zoology	E003	Chaturika	Kandy	Q	08/03/2019

Step 2

Department

<u>Dept No</u>	DepName
D1	Math
D2	Zoology

Projects

<u>Dept No</u>	<u>EmployeeID</u>	Ename	Address	Projects	Dead_Line
D1	E001	Amali	Galle	Y	09/03/2019
D1	E002	Kamal	Maradana	X	08/03/2019
D1	E010	Pubudu	Badulla	X	08/03/2019
D2	E002	Kamal	Maradana	P	10/02/2019
D2	E003	Chaturika	Kandy	Q	08/03/2019

Second Normal Forms

- Remove partial dependencies on primary key

<u>Dept_No</u>	DepName
D1	Math
D2	Zoology

<u>EmployeeID</u>	Ename	Address
E001	Amali	Galle
E002	Kamal	Maradana
E010	Pubudu	Badulla
E002	Kamal	Maradana
E003	Chaturika	Kandy

<u>Dept_No</u>	<u>EmployeeID</u>	Projects	Dead_Line
D1	E001	Y	09/03/2019
D1	E002	X	08/03/2019
D1	E010	X	08/03/2019
D2	E002	P	10/03/2019
D2	E003	Q	08/03/2019

Third Normal Forms

Department

<u>Dept_No</u>	DepName
D1	Math
D2	Zoology

Projects

<u>Projects</u>	Dead_Line
Y	09/03/2019
X	08/03/2019
P	10/02/2019
Q	08/03/2019

Employee

<u>EmployeeID</u>	Ename	Address
E001	Amali	Galle
E002	Kamal	Maradana
E010	Pubudu	Badulla
E003	Chaturika	Kandy

<u>Dept_No</u>	<u>EmployeeID</u>	<u>Projects</u>
D1	E001	Y
D1	E002	X
D1	E010	X
D2	E002	P
D2	E003	Q

5.

I. What is DML ? Explain in brief by giving two DML statements used in SQL

The SQL Commands that deals with the manipulation of data present in the database belongs to DML or data Manipulation Language. This includes most of the SQL statements

Examples of DML:

INSERT – used to insert data into table

UPDATE – used to update existing data within a table

DELETE – used to delete records from a database table

II. Write SQL Statement for the following table structures for Item and Sales

Item (Item_code, Description, Price)

Sales (Invoice_No, Item_code, Qty_sold

(a) Write SQL statement to create the above Item and Sales table with their relationship using suitable data_types.

```
CREATE TABLE Item (  
  Item_code varchar(5) Primary Key,  
  Description varchar(30),  
  Price money  
  
);  
  
CREATE TABLE Salse(  
  Invoice_no varchar(6) Primary Key,  
  Item_code varchar(5) Foreign Key REFERENCES Item(Item_code)  
  ,  
  Qty_sold int  
  
);
```

(b) Add new field as “Date_Sold”,into existing sales table

```
ALTER TABLE Salse  
ADD Date_sold Datetime;
```

(c) Add new item into Item table with the following details ‘Item_code; T001,Description: Table fan, Price:4500

```
INSERT INTO Item VALUES ('T001','Table fan',4500)
```

(d) List all items with price between Rs. 2000 and Rs.5000

```
SELECT * FROM Item WHERE Price >= 2000 AND Price <=5000;  
SELECT * FROM Item WHERE Price BETWEEN 2000 AND 5000;
```

(e) Increase the price of all items by 5%

```
UPDATE Item  
SET Price =Price * 1.05;
```

(f) Delete all records in Item table starting the item_code with character 'F'

```
DELETE FROM Item  
WHERE Item-code LIKE 'F%';
```

