UNIVERSITY OF MPUMALANGA

Creating Opportunities

ACAD21

EXAMINATION	:	**SPECIAL EXAM – JULY 2024**
MODULE DESCRIPTION	:	**INFORMATION SYSTEMS 321**
MODULE CODE	:	**DICT321**
FACULTY	:	**FACULTY OF AGRICULTURE AND NATURAL SCIENCES**
QUALIFICATION	:	**DIPLOMA IN ICT IN APPLICATION DEVELOPMENT**
DURATION (IN MINUTES)	:	**180**
TOTAL MARKS	:	**100**
PAGES	:	**9 (Including the cover page)**
ADDENDUMS	:	**NONE**
EXAMINER/S	:	**PROF. BM KALEMA**
MODERATOR/S	:	**DR. S GITANJALI**

INSTRUCTIONS:

THIS QUESTION PAPER CONSISTS OF FIVE **(5) QUESTIONS.**

- **READ THE QUESTIONS AND ANSWER STRICTLY AS INDICATED.**
- **NUMBER ALL QUESTIONS CLEARLY AND CORRECTLY.**
- **INCORRECT NUMBERING AND ILLEGIBLE WRITING WILL NOT BE CONSIDERED FOR MARKING.**
- **WRITE NEATLY AND CLEARLY.**
- **WRITE YOUR NAME AND STUDENT NUMBER CLEARLY ON ALL ANSWERING PAPERS**
- **THIS IS A CLOSED BOOK ASSESSMENT.**
- **THE GENERAL UNIVERSITY OF MPUMALANGA POLICIES, PROCEDURES AND RULES PERTAINING TO WRITTEN ASSESSMENTS APPLY TO THIS ASSESSMENT.**

DO NOT TURN THE PAGE BEFORE TOLD TO DO SO

QUESTION 1 (20 MARKS):

1. The database initial study phase of the DBLC involves ____.
   A. Defining Objectives C. Testing the Database
   B. Introducing Changes D. Installing the DBMS
2. ____ allow(s) physical access to areas by authorised personnel only.
   A. Physical security C. Access rights
   B. Password security D. Data encryption
3. Once the data has been loaded into the database, the ____ tests and fine-tunes the database for performance, integrity, concurrent access, and security constraints.
   A. Programmer C. Database Administrator
   B. Manager D. Systems Administrator
4. The ____ design is the process of selecting the data storage and data access characteristics of the database.
   A. Time C. Logical
   B. Network D. Physical
5. Analysing the company situation is part of the ____ phase of the DBLC.
   A. Database Initial Study
   B. Database Design
   C. Implementation and Loading, Testing, and Evaluation
   D. Operation
6. If you wish to create an inner join, but the two tables do not have a commonly named attribute, you can use a(n) ____ clause.
   A. OF C. HAS
   B. USING D. JOIN ON
7. A(n) ____ join returns not only the rows matching the join condition (that is, rows with matching values in the common columns) but also the rows with unmatched values.
   A. Outer C. Equi-
   B. Inner D. Cross
8. A ____ is a query (SELECT statement) inside a query.
   A. Subquery C. Join
   B. Range Query D. Set Query
9. The ____ statement in SQL combines rows from two queries and returns only the rows that appear in the first set but not in the second.
   A. UNION C. INTERSECT
   B. UNION ALL D. MINUS
10. The ____ operator could be used in place of MINUS if the RDBMS does not support it.
    A. IN C. AND
    B. NOT IN D. UNION
11. An example of a command you would use when making changes to a PRODUCT table is ____.
    A.
    ```
    CHANGE PRODUCT
    SET P_INDATE = '18-JAN-2020'
        WHERE P_CODE = '13-Q2/P2';
    ```

B. ROLLBACK PRODUCT
SET P_INDATE = '18-JAN-2020'
WHERE P_CODE = '13-Q2/P2';

C. EDIT PRODUCT
SET P_INDATE = '18-JAN-2020'
WHERE P_CODE = '13-Q2/P2';

D. UPDATE PRODUCT
SET P_INDATE = '18-JAN-2020'
WHERE P_CODE = '13-Q2/P2';

12. ____ attributes can have many values.
A. Composite
B. Simple
C. Single-valued
D. Multivalued

13. A ____ should be a derived attribute.
A. Person's Name
B. Person's Age
C. Person's Social Security Number
D. Person's Phone Number

14. Another word for existence-independent is ____.
A. Weak
B. Alone
C. Unary
D. Strong

15. The existence of a(n) ____ relationship indicates that the minimum cardinality is at least 1 for the mandatory entity.
A. Mandatory
B. Optional
C. Multivalued
D. Single-Valued

16. When you define a table's primary key, the DBMS automatically creates a(n) ____ index on the primary key column(s) you declared.
A. Key
B. Incomplete
C. Unique
D. Primary

17. Consider a relational table R that is in 3NF, but not in BCNF, which of the following statements about R is true
A. R has a nontrivial functional dependency X=➔A, where X is not a superkey and A is a prime attribute
B. R has a nontrivial functional dependency X=➔A, where X is not a superkey and A is non-prime attribute and X is not a proper subset of any key
C. R has a nontrivial functional dependency X=➔A, where X is not a superkey and A is non-prime attribute and X is a proper subset of some key
D. A cell in E holds a set instead of an atomic value

18. If every none-key attribute is functionally dependent on a primary key, then the relation will be in
A. First normal form
B. Second normal form
C. Third normal form
D. Fourth normal form

19. Consider a relation R(A, B, C, D, E, F, G, H) where each attribute is atomic, and the following dependencies exist.
CH=➔G
A=➔ BC
B==➔CFH
E==➔ A

F==➔ EG
The relation R is

A. In 1NF but not in 2NF
B. In 2NF but not in 3NF
C. In 3NF but not in BCNF
D. In BCNF

20. A relation in which every non-key attribute is fully functionally dependent on a primary key, and which has no transitive dependencies is said to be in----------

A.1NF
B. 2NF
C. 3NF
D. BCNF

QUESTION 2: (20 MARKS)

2.1) It is paramount that before database development, a systems analyst must carry out a systematic systems analysis. Briefly explain what is meant by systems analysis — 2 Marks

Systems Analysis is the process that establishes the need for, and the extent of, an information system.

2.2) Describe the planning phase within the SDLC. And clearly explain how this phase answers the questions; Should the existing system be continued? Should the existing system be replaced? — 6 Marks

The SDLC planning phase yields a general overview of the company and its objectives. An initial assessment of the information-flow-and-extent requirements must be made during this discovery portion of the SDLC. Such an assessment should answer some important questions:

Should the existing system be continued? If the information generator does its job well, there is no point in modifying or replacing it. To quote an old saying, 'If it ain't broke, don't fix it.' Should the existing system be modified? If the initial assessment indicates deficiencies in the extent and flow of the information, minor (or even major) modifications may be in order. When considering modifications, the participants in the initial assessment must keep in mind the distinction between wants and needs.

Should the existing system be replaced? The initial assessment might indicate that the current system's flaws are beyond fixing. Given the effort required to create a new system, a careful distinction between wants and needs is perhaps even more important in this case than it is in modifying the system

2.3) What is the impact of threats on database security? Explain the three likely consequences of database security. — 8 Marks

Threats are any set of circumstances that have the potential to cause loss, misuse or harm to the system and/or its data. Threats can cause:

- The loss of the integrity of data through unauthorised modification. For example a person gaining unauthorised access to a bank account and removing some money from the account.
- The loss of availability of the data. For example some adversary causes the database system from being

operational which stops authorised users of the data from accessing it.

- The loss of confidentiality of the data (also referred to as the privacy of data). This could be caused by a person gaining access to private information such as a password or a bank account balance.

2.4) Briefly explain the two classical approaches to database design 4 Marks

There are two classical approaches to database design:

- Top-down design starts by identifying the data sets and then defines the data elements for each of those sets. This process involves the identification of different entity types and the definition of each entity's attributes.
- Bottom-up design first identifies the data elements (items) and then groups them together in data sets. In other words, it first defines attributes, and then groups them to form entities.

QUESTION 3: (20 MARKS)

3.1) What is normalization? 1 Mark

Normalization is the process of analysing relation schemas to achieve minimal redundancy and insertion or update anomalies.

Normalization is the process for assigning attributes to entities. Properly executed, the normalization process eliminates uncontrolled data redundancies, thus eliminating the data anomalies and the data integrity problems that are produced by such redundancies. Normalization does not eliminate data redundancy; instead, it produces the carefully controlled redundancy that lets us properly link database tables.

3.2) Describe the characteristics of a table that violates first normal form (1NF) and then describe how such a table is converted to 1NF. 4 Mark

- The rule for first normal form (1NF) is a table in which the intersection of every column and record contains only one value. In other words a table that contains more than one atomic value in the intersection of one or more column for one or more records is not in 1NF.
- The non 1NF table can be converted to 1NF by restructuring original table by removing the column with the multi-values along with a copy of the primary key to create a new table. The advantage of this approach is that the resultant tables may be in normal forms later that 1NF.

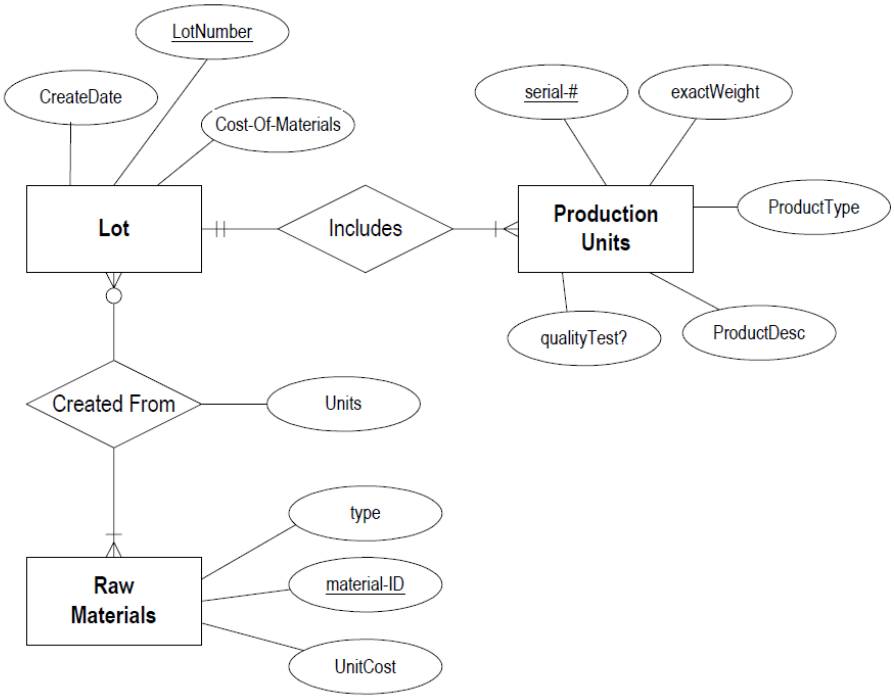
3.3) By using an example of a combined table of attributes of student and professor within a university, describe an approach you will use to convert a first normal form (1NF) table to second normal form (2NF) table(s). 5 Mark

Second normal form applies only to tables with composite primary keys, that is, tables with a primary key composed of two or more columns. E.g. studentNo and professorNo

A 1NF table with a single column primary key is automatically in at least 2NF.
A second normal form (2NF) is a table that is already in 1NF and in which the values in each non-primary-key column can be worked out from the values in all the columns that makes up the primary key.

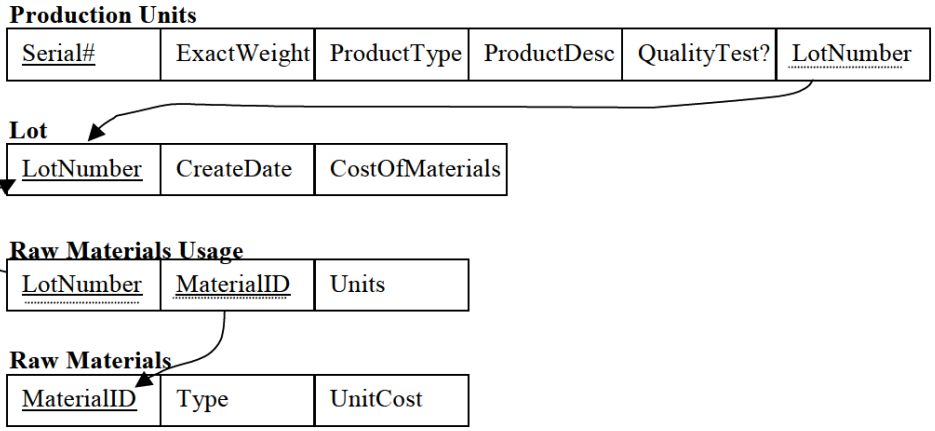
A table in 1NF can be converted into 2NF by removing the columns that can be worked out from only part of the primary key. These columns are placed in a new table along with a copy of the part of the primary key that they can be worked out from. E.g. Separate tables are derived one with studentNo, another with professorNo. A third table with PK studentNo and professorNo. could created if there are attributes that are independent of the first two

3.4) Production tracking is important in many manufacturing environments. The following ER diagram captures important information in the tracking of production. Specifically, the ER diagram captures relationships between production lots (or batches), individual production units, and raw materials. Base on the ER to answer the following questions



a) Convert the ER diagram into a relational database schema. Be certain to indicate primary keys and referential integrity constraints.

6 Marks



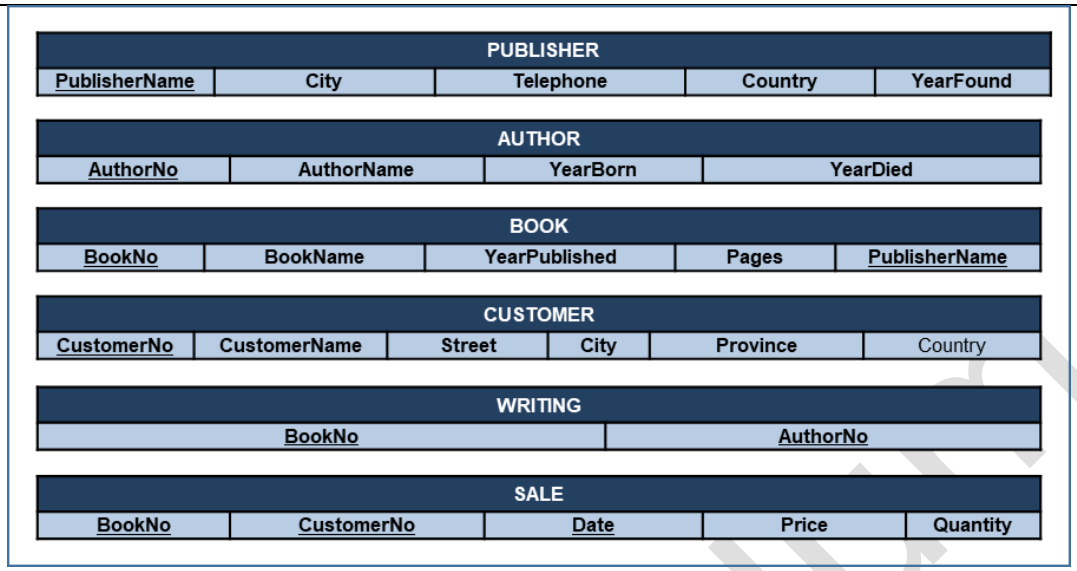
b) Identify an attribute in the ER diagram that could represent a derived attribute and explain why/how it might represent a derived attribute

4 Marks

Cost-of-Materials (associated with the Lot entity) most likely represents a derived attribute. The cost of materials could be computed based on the materials unit cost (from the raw materials entity) and the number of units required for a lot (on the relationship).

QUESTION 4: (20 MARKS)

4.1)	*The table represent a SIYAKHA READING BOOK STORE database system that is represented by five tables: PUBLISHER, AUTHOR, BOOK, SUSTOMER, WRITING, and SALE. The assumption is that all the tables are populated with data.*	

		
	a) Write an SQL query that finds the book number, book name, and number of pages of all the books published by London Publishing Ltd. List the results in order by book name.'' SELECT BookNo, BookName, Pages FROM BOOK WHERE PublisherName = 'London Publishing Ltd.' ORDER BY BookName;	8 Marks
	b) Examine the SQL query below and determine the purpose of this query SELECT COUNT (*) FROM PUBLISHER, BOOK WHERE PUBLISHER.PublisherName=BOOK.PublisherName AND CITY= 'Mbombela' AND COUNTRY= 'South Africa' AND PAGES>=400; The query will return the number of books that that has 400 pages or more in the Siyakha Reading Bookstore that were published by publishers based in Mbombela, South Africa	6 Marks
4.2)	What is the difference between an INSERT and an UPDATE command? The INSERT command is used to add a new row to a table, which implies that the number of rows will increase when using it. The UPDATE command changes the values in attributes of an existing row, resulting to the number of the rows being constant.	6 Marks

QUESTION 5: (20 MARKS)

5.1) By use of an example explain the concept of single-valued attributes. With the use of an example, explain why a single-valued attribute may not necessarily be taken as always simple. 5 Marks

Answer

A single-valued attribute is an attribute that can have only a single value. For example, a person can have only one Social Security number, and a manufactured part can have only one serial number. Keep in mind that a single-valued attribute is not necessarily a simple attribute. For instance, a part's serial number, such as SE-08-02-189935, is single-valued, but it is a composite attribute because it can be subdivided into the region in which the part was produced (SE), the plant within that region (08), the shift within the plant (02), and the part number (189935).

5.2) What is the difference between optional and mandatory participation in a relationship? 5 Marks

Answer

a) Optional participation means that one entity occurrence does not require a corresponding entity occurrence in a particular relationship.

b) Mandatory participation means that one entity occurrence requires a corresponding entity occurrence in a particular relationship. If no optionality symbol is depicted with the entity, the entity exists in a mandatory relationship with the related entity. The existence of a mandatory relationship indicates that the minimum cardinality is 1 for the mandatory entity.

Remember that the burden of establishing the relationship is always placed on the entity that contains the foreign key. In most cases, that will be the entity on the many side of the relationship.

5.3) With the use of a relevant example briefly explain what is meant by a key and why is it important in the relational model? 5 Marks

[Students will give varied examples but each example given should be relevant to the question]

In the relational model, keys are important because they are used to ensure that each row in a table is uniquely identifiable. They are also used to establish relationships among tables and to ensure the integrity of the data. A key consists of one or more attributes that determine

other attributes. For example, an invoice number identifies all of the invoice attributes, such as the invoice date and the customer name.

5.4) What is the data dictionary and why is it important in relational databases?

The data dictionary provides a detailed accounting of all tables found within the user/designer-created database. Thus, the data dictionary contains at least all of the attribute names and characteristics for each table in the system. In short, the data dictionary contains metadata—data about data. The data dictionary is sometimes described as 'the database designer's database' because it records the design decisions about tables and their structures.