

(DATA INTEGRITY AND NORMALIZATION)

LECTURE NO.1

TIME: 30 MIN.

<p>REVIEW OF TODAY'S TOPICS</p> <p>A. Data integrity</p> <p>B. Normalization, Problems in Normalization process</p>	<p>Name: _____</p> <p>Roll No: _____</p> <p>Date: _____</p>
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DATA INTEGRITY

EXTENSIVE QUESTION

Q.1 What is data integrity? Explain its different types. (DGK 2021)

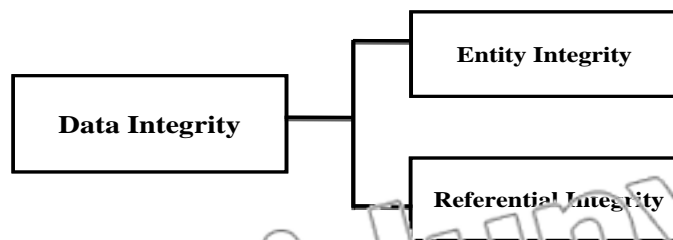
SHORT QUESTIONS

- (i) Differentiate entity integrity and referential integrity. (SWL 2022)(U.B)
- (ii) What is data integrity? (BWP 2018) (RWP 2017) (K.B)
- (iii) What is entity integrity? (FSD 2022) (K.B)
- (iv) Define Referential integrity. (LHR 2022)(MTN 2022)(DGK2022)(BWP 2022)(SGD 2017) (K.B)

DATA INTEGRITY

Definition:

Database integrity refers to the correctness and consistency of data.



- (i) It is another form of database protection.
- (ii) It is related to security and precision; it has some broader implications as well.
- (iii) Security involves protecting the data from unauthorized operations, while integrity is concerned with the quality of data itself.
- (iv) Integrity is usually expressed in terms of certain constraints which are the consistency rules that the database is not permitted to violate.

TYPES OF DATA INTEGRITY:

There are two types of data integrity:

- (i) **Entity Integrity:** Is a constraint on primary values that states that no attribute of a primary key should contain nulls.
- (ii) **Referential Integrity:** is a constraint on foreign key values that states that if a foreign key exists in a relation. Then either the foreign key value must match the primary key value of some tuple in its home relation or the foreign key value must be completely null.

MULTIPLE CHOICE QUESTIONS

- 1) How many type of data integrity are there?
(a) 2 (b) 3
(c) 4 (d) 5
- 2) Data integrity is expressed in term of:
(a) Constraints (b) Consistency Rules
(c) Redundancy rules (d) Both (a) & (b)
- 3) Which Constraint states that in a relation no primary key value can have a null value?
(a) Referential Integrity (b) Entity Integrity
(c) Data Integrity (d) All of these

SHORTS QUESTIONS

Q.1 What is Data Integrity? (BWP 2018) (RWP 2017) (K.B)

Ans: Data integrity refers to the correctness and consistency of data. Integrity is usually expressed in terms of certain constraints. These are the consistency rules that can be applied to database so that the correct data can be entered into database.

Q.2 What is Entity Integrity? (FSD 2022) (K.B)

Ans: The entity integrity is a constraint on primary key value. It states that any attribute of a primary key cannot contain null value. If primary key contains null value, it is not possible to uniquely identify a record in a relation.

Q.3 Define Referential Integrity? (LHR 2022)(MTN 2022)(DGK2022)(BWP 2022)(SGD 2017)(K.B)

Ans: The referential integrity is a constraint on foreign key value. It states that if a foreign key exist in a relation, the foreign key value must match the primary key value of some tuple in its parent relation. Otherwise the foreign key value must be completely null.

NORMALIZATION, PROBLEMS IN NORMALIZATION PROCESS

EXTENSIVE QUESTION

Q.1 Example the following terms: (DGK 2021)

- Synonym
- Homonym
- Redundancy
- Mutual exclusiveness of data

SHORT QUESTIONS

- (i) Define Synonym problem in database. (BWP 2019) (MTN 2018) (K.B)
- (ii) Define Homonym. (FSD 2022) (RWP 2022) (K.B)
- (iii) What is redundant information? (RWP 2022) (K.B)
- (iv) What is meant normalized form? (GRW 2022)(RWP 2017, 2018)(U.B)
- (v) What is meant redundancy? (LHR 2022) (U.B)
- (vi) What is Mutually Exclusive Data? (SWL 2022) (SGD 2018) (K.B)

NORMALIZATION, PROBLEMS IN NORMALIZATION PROCESS

Definition 1:

Normalization is the process of converting complex data structures into simple and stable data structures.

Definition 2:

Normalization is a technique for reviewing the entity/ attribute lists to ensure that attributes are stored.

Definition 3:

It is the process of analyzing the dependencies of attributes within entities.

FUNCTIONAL DEPENDENCY

Definition:

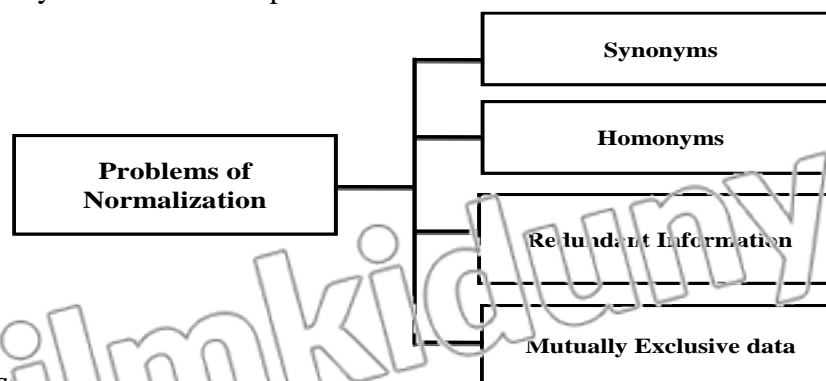
“A functional dependency is a particular relationship between two attributes”.

- (i) For any relation R, attribute B is functionally dependent on attribute A if, for every valid instance of A, that value of A uniquely determines the value of B”
- (ii) The functional dependence of B on A is represented by an arrow.
- (iii) As example $A \rightarrow B$ an attribute may be functionally dependent on two or more attributes rather than a single attribute.
- (iv) For example, consider the relation:
COURSE (STUDID, CRSNO, CRSDATE)
- (v) The functional dependency in the relation is represented as follows:

STUDID, CRSNO \rightarrow CRSDATE

PROBLEMS IN NORMALIZATION

There may be some hidden problems as:



- **Synonyms.**

- (i) A synonym is created when two different names are used for the same information (attribute).
- (ii) If an attribute resides in more than one entity, make sure that all entities use the same attribute name.
- (iii) For Example

ITEM

Stock_No

Item_Color

Supplier_Code

SUPPLIER

Supplier_ID

Supplier Name

(error)

• **Homonyms:**

- (i) A Homonym is created when same name is used for two different attributes.
- (ii) Consider the following example:

CUSTOMER

Company Name

SUPPLIER

Company Name

(error)

We should use Supplier_Name instead of Company_Name in SUPPLIER.

• **Redundant Information:**

- (i) Storing the same information in two different ways of forms.
- (ii) Consider the following example:

Employee

Employee_Age

(error)

D_O_Birth

- (iii) Only one attribute can serve the purpose (The programmer can manipulate the age by using **D_O_Brith** as basis).

• **Mutually Exclusive Data:**

Definition:

Mutually exclusive data exists when attributes occur whose values can be expressed as “yes/no” indicators, cannot all be true for any single entity.

- (i) For example, consider the proposed attributes of “MARRIED” and “SINGLE” in a Employee entity. Quite often, errors of this type represent values of a larger category.
- (ii) Whenever possible, resolve the error by creating the larger categorical attribute.
- (iii) In this case, these two elements should be combined into a single attribute of “MARITAL_STATUS” which would have a value of either M (married) or S (single).

Employee

MARITAL_STATUS (An indicator of the employee’s marital status)

MULTIPLE CHOICE QUESTIONS

Q.No.1

- (i) Storing the same information in two different ways. (SWL 2022) (BWP 2022) (MTN 2021) (DGK 2022, 2021)
- (a) Homonyms (b) Redundant Information
(c) Mutually Exclusive Data (d) None of these
- (i) A constraint between two attributes is called a(n): (BWP 2018)
- (a) Functional relation (b) Attribute dependency
(c) Functional dependency (d) Functional relation constraint
- (ii) A process of converting complex data structures into simple data structures is called.
- (a) Normalization (b) Facts
(c) D Filter (d) Correctness
- (iii) Which of the following is created when two different names are used for the same information?
- (a) Mutually Exclusive (b) Data Security
(c) Synonyms (d) Anomaly
- (iv) Storing the same information in two different ways.
- (a) Homonyms (b) Redundant Information
(c) Mutually Exclusive Data (d) None of these
- (v) When any data value of attribute can be expressed as “yes / no” is called:
- (a) Mutually Exclusive (b) Redundant Information
(c) Homonyms (d) None of these

SHORT QUESTIONS

Q.No.2

Q1: Explain Normalization or what is meant by normal form? (RWP 2018) (GRW 2022)

Ans: The process of producing a simpler and more reliable database structure is called normalization. It is used to create a suitable set of relations for storing data. It identifies and corrects the problems and complexities of database. It produces a new set of relations. The new design is as free of processing problems as possible.

Q2: Differentiate between Synonyms and Homonyms? (FSD 2022) (RWP 2022)

Ans: Following are the difference between Synonyms and Homonyms:

SYNONYMS (BWP 2019) (MTN 2018)	HOMONYMS (FSD 2022) (RWP 2022)
<ul style="list-style-type: none"> When two different attribute names are used for the same information, it is called synonym. 	<ul style="list-style-type: none"> When same attribute name is used for two different attributes, it is called homonym.
<ul style="list-style-type: none"> In the following example, Roll No is primary key in student table. It is used as foreign key in subject table, but with different name that is Roll_Number. We should use Roll no instead of Roll-Number. 	<ul style="list-style-type: none"> For example, in customer table, C_Name field is used for customer name and in Supplier table, again C_Name is used for company name. So same name is used for two different attributes.
<ul style="list-style-type: none"> Student (Roll No, Name, Address, Class) Subject (Roll_Number, Subject_Name, Marks) 	<ul style="list-style-type: none"> Customer (Customer ID, C_Name, Address) Supplier (Supplier ID, C_Name, Address)

Q3: What is meant by Redundancy? (LHR 2022)

Ans: This error occurs in relation when same information is stored in two or more different ways. In the following example, two different attributes like Age and Date-of-Birth are used for storing same information.

Employee (Emp_ID, Name, Address, Age, Date-of-Birth)

Q4: What is Mutually Exclusive Data? (SWL 2022) (SGD 2018)

Ans:

Mutually exclusive data exists when attributes occur whose values can be expressed as “yes/no” indicators, cannot all be true for any single entity.

For example, consider the proposed attributes of “**MARRIED**” and “**SINGLE**” in an Employee entity: Quite often, errors of this type represent values of a larger category.

Whenever possible, resolve the error by creating the larger categorical attribute.

In this case, these two elements should be combined into a single attribute of “**MARITAL_STATUS**” which would have a value of either M (married) or S (single).

Employee

MARITAL STATUS (An indicator of the employee’s marital status)

**REVISION LECTURE NOTES
CHAPTER NO.4
(DATA INTEGRITY AND NORMALIZATION)**

LECTURE NO.2

TIME: 30 MIN.

PREVIEW OF TODAY'S TOPICS

- C. Normalization steps process
- D. Database Anomalies, Types of Anomalies

NORMALIZATION STEPS PROCESS

EXTENSIVE QUESTION

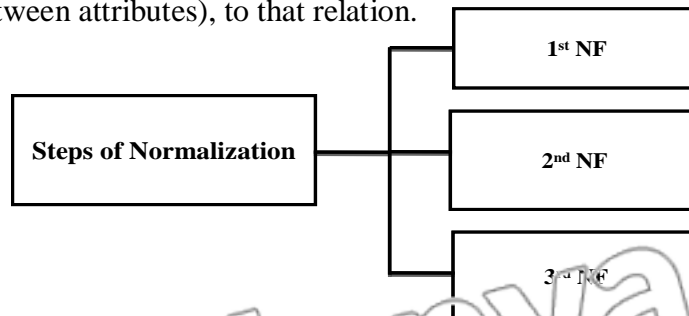
Q.1 What is normalization? How it can be used to bring the database in a consistent state? (DGK 2021)

SHORT QUESTIONS

- (i) Define full functional dependency. (MTN 2018) (K.B)
- (ii) What is transitive dependency? (MTN 2018) (K.B)
- (iii) What is repeating group? (K.B)
- (iv) Define second normal form. (K.B)

NORMALIZATION STEPS PROCESS

- (i) Normalization is often accomplished in steps, each of which corresponds to a normal form. It can be graphically expressed as follows:
- (ii) A normal form is a state of a relation that can be determined by applying simple rules, regarding dependencies (or relationship between attributes), to that relation.



Normalization is often achieved in steps, each of which corresponds to a normal form. These normal forms are: **1NF, 2NF, 3NF** etc. A Normal Form is a state of a relation that can be determined by applying simple rules, or conditions.

If a relation satisfies conditions of a specific normal form (i.e. **1NF, 2NF, 3NF** etc.), then the relation is said to be in that normal form. A brief description of the major normal forms are as follows.

- 1) **First Normal Form (1NF):**
Any repeating _group from the table is removed. After applying this rule, each cell of the table has a single value.
- 2) **Second Normal Form (2NF):**
Any partial functional dependency of the relation is removed.
- 3) **Third Normal Form (3NF):**
Any transitive dependency is removed.

MULTIPLE CHOICE QUESTIONS

Q.No.1

- (i) **The goal of normalization is to:** (RWP 2018)
(a) Get stable data structure (b) Increase number of relation
(c) Functional dependency (d) Functional relation constraint
- (ii) **In 2NF, which form of dependency is removed?** (RWP 2022, 2021, 2019) (SWL 2022, 2021)
(A) Transitive (B) Associative
(C) Partial (D) Functional
- (iii) **Which of the following dependency is removed from 3NF?** (LHR 2015) (RWP 2019)
(A) Transitive (B) Associative
(C) Partial (D) Functional

SHORT QUESTIONS

Q.No.2

Q1: Why normalization is used? (BWP 2022)

Ans: Normalization is a systematic approach of decomposing tables to eliminate data redundancy (repetition) and undesirable characteristics like Insertion, Update and Deletion Anomalies. It is a multi-step process that puts data into tabular form, removing duplicated data from the relation tables.

Q2: Define the second normal form.

Ans: A relation that is in first normal form and every non-primary key attribute is fully functionally dependent on the primary key.

Q3: Define a full functional dependency. (MTN 2018)

Ans: Fully functional dependency indicates that if A and B are attributes of a relation, B is fully functionally dependent on A if B is functional dependent on A, but not on the proper subset of A.

Q4: What is Transitive dependency? (MTN 2018)

Ans: A relation is in third normal form (3NF) if it is in 2NF and no transitive dependencies exist:

Example

A condition where A, B and C are attributes of a relation such that if $A \rightarrow B$ and $B \rightarrow C$, then C is transitively dependent on A via B (Provided that A is not functionally dependent on B or C).

Q5: What is Repeating Group?

Ans: A repeating group is a set of one or more data items that may occur a variable number of items in a tuple. Each cell in a relation should contain only one value.

DATABASE ANOMALIES, TYPES OF ANOMALIES

EXTENSIVE QUESTION

Q.1 What are the database Anomalies? Briefly discuss insertion, deletion and modification anomalies.

SHORT QUESTIONS

- (i) **What is database anomalies?** (BWP 2019) (TGK 2018) (SGD 2017) (K.B)
- (ii) **When does an insertion anomaly occur?** (SWL 2019) (A.B)
- (iii) **Define deletion anomaly.** (K.B)
- (iv) **What is update anomaly?** (K.B)

DATABASE ANOMALIES

Database anomalies/ errors create problem in relations. These problems occur due to the data redundancy in relations. These problems are also referred to as update anomalies. The update anomalies create problems when insertion, Deletion and modification operations are performed on database. Some important data may be lost if a relation is updated that contains anomalies.

TYPES OF ANOMALIES

- **Insertion Anomaly:**
To insert a row for the table, we must provide the values for both STUD-ID and CRSNO.
- **Deletion Anomaly:**
If we delete a row for one student, we lose the information that the student completed a course on a particular date.
- **Modification Anomaly:**
If a student's monthly fee changes, we must record the change in multiple rows.

MULTIPLE CHOICE QUESTIONS

- (i) Which of the following anomalies result from a transitive dependency?
(A) Insertion (B) Modification
(C) Deletion (D) All of these
- (ii) When we add a new record in a relation it may cause:
(A) Critical anomaly (B) Transitive anomaly
(C) Security anomaly (D) Insertion anomaly
- (iii) Which of the following is update anomaly?
(a) Insertion (b) Deletion
(c) Modification (d) All of these
- (iv) Which of the following are anomalies that can be caused by redundancy in tables?
(a) Insertion (b) Deletion
(c) Modification (d) All of these
- (v) Which of the following anomalies result from a transitive dependency?
(a) Insertion (b) Modification
(c) Deletion (d) All of these

SHORT QUESTIONS

Q.No.2

Q.1 What is Database Anomalies?

(BWP 2019) (DGK 2018) (SGD 2017)

Ans: Database anomalies or error create problem in relations. These problems occur due to the data redundancy in relations. These problems are also referred to as update anomalies. The update anomalies create problems when insertion, deletion and modification operations are performed on database. Some important data may be lost if a relation is updated that contains anomalies.

Q.2 Define Insertion Anomaly or When does an insertion anomaly occur? (SVL 2019)

Ans: The insertion anomaly occurs when new record is inserted in the relation. In this anomaly, the user cannot store a fact about an entity until he has stored an additional fact about another entity.

Q.3 Define Deletion Anomaly?

Ans: The deletion anomaly occurs when a record is deleted from the relation. In this anomaly, the deletion of facts about entity automatically deletes the fact of another entity.

Q.4 Define updated Anomaly?

Ans: The update anomaly occurs when a record is updated in the relation. In this anomaly to update the value of specific attribute requires to update all records in which that value occurs.

PREVIEW OF TODAY'S TOPICS

E. 1st Normal Form, 2nd Normal Form

1ST NORMAL FORM, 2ND NORMAL FORM

EXTENSIVE QUESTION

- Q.1 What is first normal form? Explain it in detail. (FSD 2021) (SWL 2021)
- Q.2 What is normalization? Explain second normal with an example. (BWP 2021)
- Q.3 Define functional dependency? How partial dependency defect are relation?

SHORT QUESTIONS

- (i) When is a relation in first normal form? (MTN 2022) (U.B)
- (ii) Write down conditions for a table to be in second normal form. (GRW 2022) (U.B)
- (iii) What is partial dependency? (K.B)

UN-NORMALIZED FORM (UNF): A table that contains one or more repeating groups

FIRST NORMAL FORM (1NF)

A relation in which the intersection of each row and column contains one and only one value.

Un-Normalized Form (UNF): Client Rental

Client No.	C Name	Property No.	P Address	rent Start	Rent Finish	Ren t	Owner No.	O Name
CR76	John Kay	PG4	6 Lawrence St, Glasgow	1-Jul-03	31-Aug-04	350	CO40	Tina Murphy
		PG16	5 Novar Dr. Glasgow	1-Sep-04	1-Sep-04	450	CO93	Tony Shaw
CR56	Aline Stewart	PG4	6 Lawrence St, Glasgow	1-Sep-02	10-Jun-03	350	CO40	Tina Murphy
		PG36	2 Manor Rd, Glasgow	10-Oct-03	1-Dec-04	375	CO93	Tony Shaw
		PG16	5 Novar Dr, Glasgow	1-Nov-05	10-Aug-06	450	CO93	Tony Shaw

First Normal Form (1NF): Client Rental

Client No.	C Name	Property No.	P Address	Rent Start	Rent Finish	Rent	Owner No.	O Name
CR76	John Kay	PG4	6 Lawrence St, Glasgow	1-Jul-03	31-Aug-04	350	CO40	Tina Murphy
CR76	John Kay	PG16	5 Novar Dr. Glasgow	1-Sep-04	1-Sep-04	450	CO93	Tony Shaw
CR56	Aline Stewart	PG4	6 Lawrence St, Glasgow	1-Sep-02	10-June-03	350	CO40	Tina Murphy
CR56	Aline Stewart	PG36	2 Manor Rd, Glasgow	10-Oct-03	1-Dec-04	375	CO93	Tony Shaw
CR56	Aline Stewart	PG16	5 Novar Dr. Glasgow	1-Nov-05	10-Aug-06	450	CO93	Tony Shaw

Alternative (1NF) Client and Property Rental Owner

Client

To bring it to first normal form, we eliminate the repeating groups from a table.

Client No.	C Name
CR76	John Kay
CR76	Aline Stewart

Alternative (1NF) Property Rental Owner

Client No.	Property No.	P Address	Rent Start	Rent Finish	Rent	Owner No.	O Name
CR76	PG4	6 Lawrence St, Glasgow	1-Jul-03	31-Aug-04	350	CO40	Tina Murphy
CR76	PG16	5 Novar Dr. Glasgow	1-Sep-04	1-Sep-05	450	CO93	Tony Shaw
CR56	PG4	6 Lawrence St, Glasgow	1-Sep-02	10-June-03	350	CO40	Tina Murphy
CR56	PG36	2 Manor Rd, Glasgow	10-Oct-03	1-Dec-04	375	CO93	Tony Shaw
CR56	PG16	5 Novar Dr. Glasgow	1-Nov-05	10-Aug-06	450	CO93	Tony Shaw

SECOND NORMAL FORM (2NF)

A relation that is in 1NF and every non-primary-key attribute is fully functionally dependent on the primary key.

Client

Client No.	C Name
CR76	John Kay
CR56	Aline Stewart

Rental

Client No.	Property No.	Rent Start	Rent Finish
CR76	PG4	1-Jul-03	31-Aug-04
CR76	PG16	1-Sep-04	01-Sep-04
CR56	PG4	1-Sep-02	10-Jun-03
CR56	PG36	1-Oct-03	01-Dec-04
CR56	PG16	1-Nov-05	01-Aug-06

Property Owner

Property No.	P Address	Rent	Owner No.	O Name
PG4	6Lawrence St, Glasgow	350	CO40	Tina Murphy
PG16	5 Novar Dr. Glasgow	450	CO93	Tony Shaw
PG36	2 Manor Rd, Glasgow	375	CO93	Tony Shaw

MULTIPLE CHOICE QUESTIONS:

- (i) In 2NF, which form of dependency is removed? (RWP 2022)(SWL 2021, 2019) (BWP 2021, 2019)
- (a) Functional (b) Partial
(c) Associative (d) Transitive
- (ii) A relation is in 2NF if it is in 1NF and all its non-key attribute are:
- (a) Dependent on part of the primary key (b) Dependent on the entire primary key
(c) Independent of the primary key (d) Independent of any other relation
- (iii) In which of the following normal forms, any repeating group from the table is removed?
- (a) 1NF (b) 2NF
(c) 3NF (d) None

SHORT QUESTIONS

Q.1 When is a Relation in First Normal Form?

(MTN 2022) (U.B)

Ans: A table is in First Normal Form if it has no repeating group. Every field of the table is single valued. A repeating group is an attribute that has more than one value in single records. Each cell in a relation should have only one value.

Q.2 Write down conditions for a table to be in second normal form. (GRV 2022) (1B)

Ans: A table will be in 2NF normal form if any of the following conditions apply:

- The primary key consists of only one attribute.
- No non-key attributes exist in the relation.
- Every non-key attribute is functionally dependent on the full set of primary key attributes.

Q.3 Define Functional Dependency?

Ans: A functional dependency is a relationship between attributes of a relation. The value of one attribute can be used to find value of another attribute in a relation. An attribute B is functionally dependent on an attribute A if each value of attribute A determines one value of attribute B in a relation. The functional dependency of B on A is represented as: $A \rightarrow B$.

Q.4 What is removed when a relation is converted from 1 NF to 2NF?

Ans: All primary dependent attribute are placed in another relation when a relation is converted from 1 NF to 2NF.

Q.5 Write a note on partial dependency.

Ans: A type of dependency in which one or more non-key attribute are functionally dependent on a part of primary key is called partial dependency.

**REVISION LECTURE NOTES
CHAPTER NO.4
(DATA INTEGRITY AND NORMALIZATION)**

LECTURE NO.4

TIME: 30 MIN.

PREVIEW OF TODAY'S TOPICS

F. Transitive Dependency/ Third Normal Form (3NF)

TRANSITIVE DEPENDENCY/ THIRD NORMAL FORM (3NF)

EXTENSIVE QUESTION

Q.1 Define transitive dependency. How it can be removed? Explain with the context of normalization.

Q.2 What is normalization? Explain third form of normalization. (MTN 2021)

SHORT QUESTIONS

- (i) What is third normal form? (SWL 2019) (K.B)
- (ii) What is transitive dependency? (DGK 2022) (U.B)
- (iii) What is removed when a relation is converted from 2NF to 3NF? (U.B)
- (iv) What type of anomalies are occur due to transitive dependency? (U.B)

TRANSITIVE DEPENDENCY/ THIRD NORMAL FORM (3NF):

It is a functional dependency in a relation between two (or more) non-key attributes. A more precise definition for 3 NF is: "A non-key attribute must not depend on any other non-key attribute" or if a non-key attribute's value can be obtained simple by knowing the value of another non-key attribute, the relation is not in 3 NF.

Consider a relation as follows:

SALES (CUSTNO, NAME, SALESMAN, REGION)

Where CUSTNO is the primary key.

The following functional dependencies exist in the relation.

(a) CUSTNO → NAME, SALESMAN

(b) SALESMAN → Region (since each salesman is assigned a unique region)

Notice that SALES is in 2 NF, because the primary key consists of a single attribute (CUSTNO). However, there is a transitive dependency, because REGION is functionally dependent on SALESMAN which in turn is functionally dependent on CUSTNO. As a result, there are update anomalies in relation sales.

CUSTNO	NAME	SALESMAN	REGION
8023	AAAA	Ahmad	South
9157	BBBB	Bashir	West
7924	CCCC	Ahmad	South
6837	DDDD	Khalid	East
9596	EEEE	Bashir	West
7018	FFFF	Munir	North

A relation with transitive dependency

The Anomalies

(i) **Insertion Anomaly:**

A new salesman (Abid), assigned to the North region cannot be entered until a customer has been assigned to that salesman (since a value of the CUSTNO must be provided to insert a row in the label relation).

(ii) **Deletion Anomaly:**

If customer number 6837 is deleted from the relation, we lose the information that salesman Khalid is assigned to the east region.

(iii) **Modification Anomaly:**

If salesman Ahmad is re-assigned to the east region, several rows must be changed to reflect the fact (two rows in this case).

These anomalies arise as a result of the transitive dependency. This problem (the transitive dependency) can be removed by de-composing the relation SALES into two relations as shown below.

SALE-1

CUSTNO	NAME	SALESMAN
8023	AAAA	Ahmad
9167	BBBB	Bashir
7924	CCCC	Ahmad
6837	DDDD	Khalid
9596	EEEE	Bashir
7018	FFFF	Munir

SMAN

SALESMAN	REGION
Ahmad	South
Bashir	West
Khalid	East
Munir	North

SALE-1 (CUSTNO, NAME, SALESMAN)

SMAN (SALESMAN, REGION)

Now both the relations (SALE1 & SMAN) are in 3 NF, since no transitive dependency exists. We can verify that the anomalies that exist transitive dependency exist. We can verify that the anomalies that exist in SALES are not present in SALE1 and SMAN.

The SALESMAN which is the determinant in the transitive dependency in SALES, became the primary key in SMAN. SALESMAN is also foreign key in SALE1.

MULTIPLE CHOICE QUESTIONS

Q.No.1

- (i) In 3NF, which form of dependency is removed? (FSD 2021) (RWP 2019) (MTN 2018) (DGK 2018)
- (a) Functional (b) Associative
(c) Transitive (d) Non-functional
- (ii) In 3NF, a non-key attributes must not depend on a: (GRW 2022) (FSD 2022) (SGD 2019) (GDK 2018) (FSD 2019)
- (a) Non-key attributes (b) Key attributes
(c) Composites attributes (d) Sort key
- (iii) Which of the following ensures that duplicate records are not stored in a table?
- (a) Primary key (b) data type of fields
(c) Description (d) record
- (iv) Which of the following anomalies result from a transitive dependency?
- (a) Insertion (b) Modification
(c) Deletion (d) All of above

SHORT QUESTIONS

Q.No.2

Q1: Define the third normal form. (SWL 2019) (K.B)

Ans: A relation that is in first and second normal form and in which non-primary key attribute must not depend one any other non-key attribute.

Q2: What is transitive dependency? (DGK 2022) (SGD 2017) (U.B)

Ans: A relation is in third normal form (3NF) if it is in 2NF a no transitive dependencies exist:

Example

A condition where A, B and C are attributes of a relation such that if $A \rightarrow B$ and $B \rightarrow C$, then C is transitively dependent on A via B (Provided that A is not functionally depend on B or C).

Q3: What is removed when a relation is converted from 2NF to 3NF? (U.B)

Ans: Any transitive dependencies, non-key attributes dependent on other non-key attribute, are removed when a relation is converted from 2NF to 3NF

Q4: What type of anomalies are occur due to transitive dependency? (U.B)

Ans: There are three types of anomalies a raised due to transitive dependency.

1. Insertion Anomaly
2. Deletion Anomaly
3. Modification Anomaly

STUDENTS LEARNING OBJECTIVES (SLOs)

MULTIPLE CHOICE QUESTIONS

Knowledge Based Questions

- (i) When all the non key attributes are fully dependent on primary key then the state is known as:
(A) Entity Integrity (B) Fourth Normal Form
(C) Second Normal Form (D) Functional Dependency
- (ii) A relation is in 2NF if it is in 1NF and all its non-key attribute are:
(a) Dependent on part of the primary key (b) **Dependent on the entire primary key**
(c) Independent of the primary key (d) Independent of any other relation
- (iii) When any data value of attribute can be expressed as “yes / no” is called:
(a) **Mutually Exclusive** (b) Redundant Information
(c) Homonyms (d) None of these
- (iv) Which constraint states that in a relation no primary key value can have a null value?
(a) Referential Integrity (b) **Entity Integrity**
(c) Data Integrity (d) All of above
- (v) In 2NF, which form of dependency is removed? (RWP 2022) (SWL 2019, 2021) (BWP 2019, 2021)
(a) Functional dependency (b) **Partial dependency**
(c) Associative dependency (d) Transitive dependency

Understanding Based Questions

- (ii) The attribute on the left hand side of the arrow in a functional dependency is:
(a) Candidate key (b) **Determinate**
(c) Foreign key (d) Primary key
- (iii) A relation that contains minimal redundancy and allows easy use is called:
(a) Clean (b) Simple
(c) Complex (d) **Well-structured**
- (iv) Which rule states that each foreign key value must match a primary key value in the other relation is called:
(a) **Referential integrity** (b) Key match rule
(c) Entity key group rule (d) Foreign / Primary match
- (v) How many type of data integrity are there?
(a) **2** (b) 3
(c) 4 (d) 5rule

Application Based Questions

- (i) A relation is in third normal form if it is in second normal form and:
(a) Dependent on part of the key (b) Dependent on all of the key
(c) Independent of the key (d) **Has no transitive dependencies**
- (ii) Data integrity is expressed in term of:
(a) Constraints (b) Consistency Rules
(c) View index (d) **Both (a) & (b)**
- (iii) Which of the following are anomalies that can be caused by redundancy in tables?
(a) Insertion (b) Deletion
(c) Modification (d) **All of above**
- (iv) In which every non-key attribute must depend on the key and all parts of the key?
(a) 1NF (b) **2NF**
(c) 3NF (d) 4NF

SHORT QUESTIONS

Knowledge Based Questions

Q.1 What is Entity Integrity? (FSD 2022) (K.B)

Ans: The entity integrity is a constraint on primary key value. It states that any attribute of a primary key cannot contain null value. If primary key contain null value, it is not possible to uniquely identify a record in a relation.

Q.2 What is Synonym? (BWP 2019) (MTN 2018) (K.B)

Ans: This error is occurred when two different names are used for the same attribute in different tables. The name attribute must be same if it exists in two or more tables. In the following example, Roll No is primary key in student table. It is used as foreign key in subject table, but with different name that is Roll_Number. We should use Roll no instead of Roll-Number.

- **Student (Roll No, Name, Address, Class)**
- **Subject (Roll_Number, Subject_Name, Marks)**

Q.3 What is meant by Redundancy?

Ans: This error occurs in relation when same information is stored in two or more different ways. In the following example, two different attributes like Age and Date-of-Birth are used for storing same information.

- **Employee (Emp_ID, Name, Address, Age, Date-of-Birth)**

Q.4 What is Third Normal Form? (SWL 2019) (DGK 2018)

Ans: A relation is in third normal form if it is in second normal form and no transitive dependency exists. The transitive dependency is an important factor in normalization. A relation is not in third normal form if the value of a non-key attribute can be obtained by knowing the value of another non-key attribute.

Q.5 What is Database Anomalies? (BWP 2019) (DGK 2018)

Ans: Database anomalies/errors create problem in relations. These problems occur due to the data redundancy in relations. These problems are also referred to as update anomalies. The update anomalies create problems when insertion, deletion and modification operations are performed on database. Some important data may be lost if a relation is updated that contains anomalies.

Understanding Based Questions

Q.1 When is a Relation in First Normal Form? (MTN 2022)

Ans: A table is in First Normal Form if it has no repeating group. Every field of the table is single valued. A repeating group is an attribute that has more than one value in single records. Each cell in a relation should have only one value.

Q.2 How is Entity Integrity attained? (SGD 2018)

Ans: The entity integrity can be attained by specifying primary key in a relation. When a primary key constrain is specified on a relation, the DBMS automatically applies the entity integrity on the attribute that is used as primary key.

Q.3 How is referential integrity achieved? (RWP 2018)

Ans: The referential integrity can be achieved by connecting two relations by specifying relationships between them. When two relations are connected, one relation is called parent relation and the other is called child (dependent) relation.

Q.4 Which types of errors can be occurred due to dependency? (LHR 2022)

Ans: Database anomalies/errors create problem in relations. These problems occur due to the data redundancy in relations. These problems are also referred to as update anomalies. The update anomalies create problems when insertion, deletion and modification operations are performed on database. Some important data may be lost if a relation is updated that contains anomalies.

- (i) Insertion Anomaly
- (ii) Deletion Anomaly
- (iii) updated Anomaly

Application Based Questions

Q.1 In order to bring to the database in a complete, consistent state, without errors. Which techniques will be used by DBA?

Ans: In order to bring to the database in a complete, consistent form we use normalization is a systematic approach of decomposing tables to eliminate data redundancy (repetition) and undesirable characteristics like Insertion, Update and Deletion Anomalies. It is a multi-step process that puts data into tabular form, removing duplicated data from the relation tables.

Q.2 What is removed when a relation is converted from 2NF to 3NF?

Ans: Any transitive dependencies, non-key attributes dependent on other non-key attribute, are removed when a relation is converted from 2NF to 3NF.

Q.3 What kind of problem created by Mutual Exclusiveness of data?

Ans: The data that does not have overlapping information is known as mutually exclusive data. The mutual exclusiveness of data creates problem in some cases. It creates problem for the attributes whose values can be specified as “Yes / No” form.

Q.4 Shortly explain error of Homonym.

Ans: This error is occurred in a relation when same name is used for two different attributes.

Example:

Consider the following relations.

- Customer (Customer ID, C_Name, Address)
- Supplier (Supplier ID, C_Name, Address)

Q.5 How updated Anomaly occur in a relation?

Ans: The update anomaly occurs when a record is updated in the relation. In this anomaly update the value of specific attribute requires to update all records in which that value occurs.