



Foundation University
Rawalpindi Campus

Introduction to Database Systems – CSC - 221

A Presentation by

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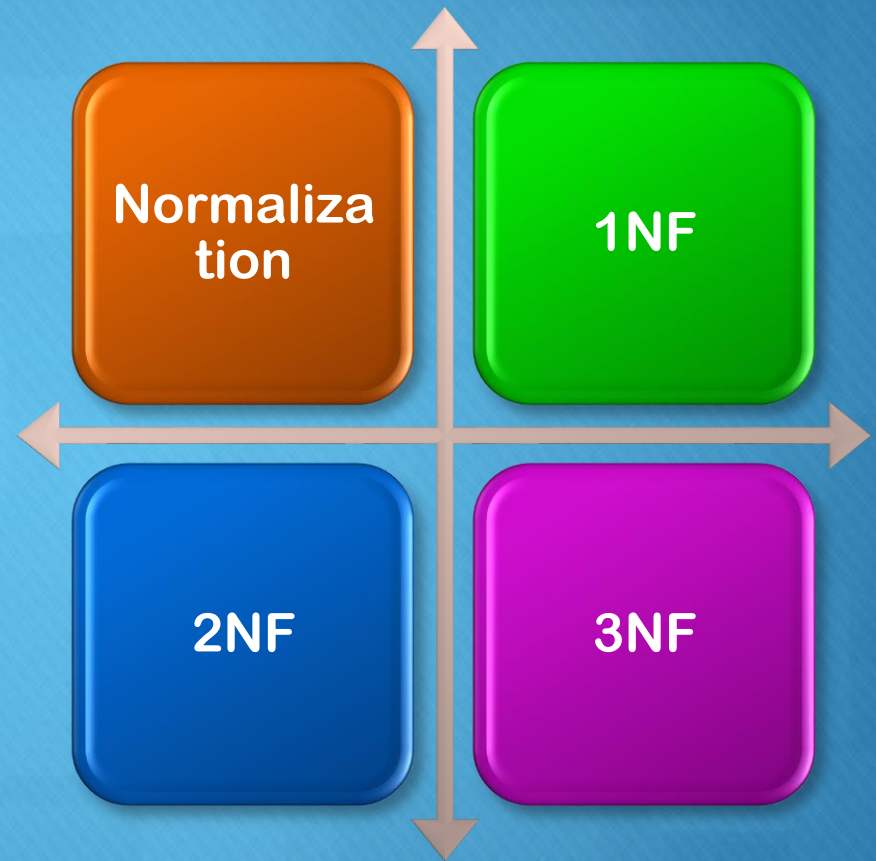


RECAP

o MY NAME IS.....

o I REMEMBER.....

Objective of Today's Lecture





Normalization

- A step by step process to produce more efficient and accurate database design.
- Purpose is to produce an anomaly free design that is smaller and well-structured.

Anomalies

❑ An inconsistent, incomplete or incorrect state of database.

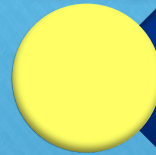
❑ Four types of anomalies are of concern here.



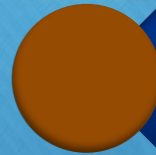
Redundancy



Insertion



Deletion



Updation

Goals of Normalization

- Eliminate redundant data (for example, storing the same data in more than one table).
- Ensure data dependencies make sense (only storing related data in a table).
- Both of these are worthy goals as they reduce the amount of space a database consumes, and ensure that data is logically stored.



Normal Forms

First Normal Form

Second Normal Form

Third Normal Form

Boyce - Codd Normal Form

Higher Forms

Normalization Practice

Item	Colors	Price	Tax
T-shirt	Red, Blue	12.00	0.60
Polo	Red, Yellow	12.00	0.60
T-shirt	Red, Blue	12.00	0.60
Sweatshirt	Blue, Black	25.00	1.25

Table is not in first normal form because:

- Multiple items in color field
- Duplicate records / no primary key

*Price and Tax measure in \$

First Normal Form

- A relation is in first normal (1st NF) form if and only if
- Every attribute is single valued for each tuple.
- This means that each attribute in each row , or each cell of the table, contains only one value.
- No repeating fields or groups are allowed.

1NF

Item	Colors	Price	Tax
T-shirt	Red	12.00	0.60
T-shirt	Blue	12.00	0.60
Polo	Red	12.00	0.60
Polo	Yellow	12.00	0.60
Sweatshirt	Blue	25.00	1.25
Sweatshirt	Black	25.00	1.25

Table is now in first normal form

Second Normal Form

- A relation is in second normal form (2NF) if and only if
- It is in first normal form (1st NF) and All the nonkey attributes are fully functionally dependent on the key.
- The only time, we have to be concerned about 2NF, when the key is composite.
- **Removing the partial dependency**

2NF – Conversion

Item	Colors	Price	Tax
T-shirt	Red	12.00	0.60
T-shirt	Blue	12.00	0.60
Polo	Red	12.00	0.60
Polo	Yellow	12.00	0.60
Sweatshirt	Blue	25.00	1.25
Sweatshirt	Black	25.00	1.25

Table is not in second normal form because:
Price and tax depend on item, but not color

2NF

Item	Colors
T-shirt	Red
T-shirt	Blue
Polo	Red
Polo	Yellow
Sweatshirt	Blue
Sweatshirt	Black

Item	Price	Tax
T-shirt	12.00	0.60
Polo	12.00	0.60
Sweatshirt	25.00	1.25

Table is now in 2NF

Third Normal Form

- A relation is in Third Normal Form (3rd NF) if and only if
- It is in First (1st NF) and Second Normal Form (2nd NF) and in which no non-primary-key attribute is dependent on another non-key attribute.
- All non-key attributes are functionally dependent only on primary key.
- **Remove transitive dependency**

3NF – Conversion

Item	Colors
T-shirt	Red
T-shirt	Blue
Polo	Red
Polo	Yellow
Sweatshirt	Blue
Sweatshirt	Black

Item	Price	Tax
T-shirt	12.00	0.60
Polo	12.00	0.60
Sweatshirt	25.00	1.25

Tables are not in third normal form because:

- tax depends on **price**, not **item**

3NF

Item	Colors
T-shirt	Red
T-shirt	Blue
Polo	Red
Polo	Yellow
Sweatshirt	Blue
Sweatshirt	Black

Item	Price
T-shirt	12.00
Polo	12.00
Sweatshirt	25.00

Price	Tax
12.00	0.60
25.00	1.25

Table is now in 3NF



Another Example

Normalization Practice

Student ID	Student Name	Society ID	Society Name	SupervisorID	Supervisor	Position
111	Zofeen	001 003	EMS EC	123 124	ABC XYZ	President Member
112	Rohaaf	001	EMS	123	ABC	Member
113	Noshail	002 005 008	SS AS NMS	123 125 126	ABC PQR LMK	Member President President

First Normal Form

- A relation is in first normal (1st NF) form if and only if
- Every attribute is single valued for each tuple.
- This means that each attribute in each row , or each cell of the table, contains only one value.
- No repeating fields or groups are allowed.

Converting into 1NF

Student ID	Student Name
111	Zofeen
112	Rohaaf
113	Noshail

Student ID	Society ID	Society Name	Supervisor ID	Supervisor	Position
111	001	EMS	123	ABC	President
111	003	EC	124	XYZ	Member
112	001	EMS	123	ABC	Member
113	002	SS	123	ABC	President
113	005	AS	125	PQR	President
113	008	NMS	126	LMK	President

Second Normal Form

- A relation is in second normal form (2NF) if and only if
- It is in first normal form (1st NF) and All the nonkey attributes are fully functionally dependent on the key.
- The only time, we have to be concerned about 2NF, when the key is composite.
- **Removing the partial dependency**

Converting into 2NF

Student ID	Student Name
111	Zofeen
112	Rohaaf
113	Noshail

StudentID	SocietyID	Position
111	001	President
111	003	Member
112	001	Member
113	002	President
113	005	President
113	008	President

Society ID	Society Name	SupervisorID	Supervisor
001	EMS	123	ABC
003	EC	124	XYZ
001	EMS	123	ABC
002	SS	123	ABC
005	AS	125	PQR
008	NMS	126	LMK

Third Normal Form

- A relation is in Third Normal Form (3rd NF) if and only if
- It is in First (1st NF) and Second Normal Form (2nd NF) and in which no non-primary-key attribute is dependent on another non-key attribute.
- All non-key attributes are functionally dependent only on primary key.
- **Remove transitive dependency**

Converting into 3NF

Student ID	Student Name
111	Zofeen
112	Rohaaf
113	Noshail

SupervisorID	Supervisor
123	ABC
124	XYZ
125	PQR
126	LMK

Society ID	Society Name	SupervisorID
001	EMS	123
003	EC	124
001	EMS	123
002	SS	123
005	AS	125
008	NMS	126

StudentID	SocietyID	Position
111	001	President
111	003	Member
112	001	Member
113	002	President
113	005	President
113	008	President



Normalization Practice

- More Normalization Practice
- Students Home Normalization Practice at least 5 examples
- Individual or group of students



CHHUTTI

**AND THAT IS
FAREWELL TO
DAY 18-20 😊**