Normalization-

Organizing the data in such a way that it minimize or remove the redundancy in the data

We can overcome

-insertion anomaly
-deletion anomaly
-updation anomaly

Order ID	**Cust Name**	**Cust zip code**	**Cust city**	**Product ID**	**Product Name**	**Qty**	**Order Date**	**Cust phone**	**Emp Id**	**Emp name**
1	Alice	123	CityA	101,104	Laptop, Ipad	1,1	2024-01-01	111-222-333	1	Gopal
2	Bob	234	CityB	102,107	Smartphone, Keypad	2,2	2024-01-02	121-222-333	1	Gopal
3	Alice	123	CityA	103,108	Tablet, Headphones	1,2	2024-01-03	112-222-333	2	Priya
4	Hary	789	CityC	101	Laptop	3	2024-01-04	111-122-333	3	preeth
5	Bob	234	CityB	104,106	Monitor, keyboard	1,1	2024-01-05	111-212-333	2	priya

1st Normal Form

-Each attribute should have a single value.
-Each row should be unique either through a single or multiple columns . Not mandatory to have a primary key.

Order ID	Cust Name	Cust zip code	Cust city	Product ID	Product Name	Qty	Order Date	Cust phone	Emp Id	Emp name
1	Alice	123	CityA	101	Laptop	1	2024-01-01	111-222-333	1	Gopal
1	Alice	123	CityA	104	Ipad	1	2024-01-01	111-222-333	1	Gopal
2	Bob	234	CityB	102	Smartphone	2	2024-01-02	121-222-333	1	Gopal
2	Bob	234	CityB	107	Keypad	2	2024-01-02	121-222-333	1	Gopal
3	Alice	123	CityA	103	Tablet	1	2024-01-03	112-222-333	2	Priya
3	Alice	123	CityA	108	Headphones	2	2024-01-03	112-222-333	2	Priya
4	Hary	789	CityC	101	Laptop	3	2024-01-04	111-122-333	3	preeth
5	Bob	234	CityB	104	Monitor	1	2024-01-05	111-212-333	2	priya
5	Bob	234	CityB	106	keyboard	1	2024-01-05	111-212-333	2	priya

Candidate key - Order Id,Product Id.

2nd Normal Form

-Should be in 1NF
-All non key attributes must be fully dependent on the candidate key.(No partial dependency should exist)
-Every table should have a primary key and relationships should be formed with the help of foreign keys.

Orders Table-

Id	Customer_Id	Employee_Id	Order_Date
1	1	1	2024-01-01
2	2	1	2024-01-02
3	1	2	2024-01-03
4	3	3	2024-01-04
5	2	3	2024-01-05

Customer Table-

ID	name	zipcode	city
1	Alice Smith	123	City A
2	Bob	789	City C
3	Charlie Lee	234	City b

Product Table-

Id	Name
101	Laptop
102	Smartphone
103	Tablet
104	Monitor
106	keyboard
107	keypad
108	Headphones

Order_Product table-

Order Id	**Product Id**	Qty
1	101	1
1	104	1
2	102	2
2	107	2
3	103	1
3	108	2
4	101	3
5	104	1
5	106	1

Employee Table-

Id	Name
1	Gopal
2	Priya
3	Preeth

3rd Normal Form

-It should be in 2NF
-NO TRANSITIVE DEPENDENCY (A->B,B->C i.e A->C)(one non primary key attribute should not depend on another non primary key attribute)

Customer Table

Id	Name	Zipcode
1	Alice Smith	123
2	Bob	789
3	Charlie Lee	234

CustomerZipcodeCity Table

zipcode	city
123	City A
789	City C
234	City B

BCNF

-Boyce codd normal form
-3NF
-for any dependency A->B
  A should be a super key

Orders-
Id->Order_Date (id)-super key

Customer-
Id->name (id)-super key
Id->zipcode (id)-super key
zipcode->city (zipcode)-super key

Products table-
id->name (id)-super key

orderProduct table-
(order_id,product_id)->qty -superkey

Employee
Id->name ->id-super key

4th Normal Form

-BCNF
-No multi valued dependency(If 2 non primary attributes depend on one primary key)

Example -{std_id,course,hobby}

Course depend on std_id
And
Hobby depend on std_id

Transformation
{std_id,course}->T1
{std_id,hobby}->T2

Orders Table-

Id	Customer_Id	Employee_Id	Order_Date
1	1	1	2024-01-01
2	2	1	2024-01-02
3	1	2	2024-01-03
4	3	3	2024-01-04
5	2	3	2024-01-05

Customer Table

Id	Name	Zipcode
1	Alice Smith	123
2	Bob	789
3	Charlie Lee	234

CustomerZipcodeCity Table

zipcode	city
123	City A
789	City C
234	City B

Product Table-

Id	Name
101	Laptop
102	Smartphone
103	Tablet
104	Monitor

106	keyboard
107	keypad
108	Headphones

Order_Product table-

Order Id	**Product Id**	Qty
1	101	1
1	104	1
2	102	2
2	107	2
3	103	1
3	108	2
4	101	3
5	104	1
5	106	1

Employee Table-

Id	Name
1	Gopal
2	Priya
3	Preeth

5th Normal Form(Project Normal form)

-4NF
-doesn't contain join dependency(no redundancy)

-On performance of join operation we are not getting any redundant rows so the table is said to be in 5NF

-Lossless join -
No extra tuples are generated when a natural join is performed.