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1. SHOPS

Relation	SHOPS(Name)
Primary Key	Name
Keys	Name
Functional Dependencies	-

Prove if relation is in 3NF:

- SHOPS only has one attribute and it is the primary key
- Thus, the relation SHOPS is in 3NF

2. PRODUCTS

Relation	PRODUCTS(Name, Maker, Category)
Primary Key	Name
Keys	Name
Functional Dependencies	(1) Name → Maker, Category

Prove if relation is in 3NF:

- FD (1) is ok, since Name is the primary key of PRODUCTS
- Thus, the relation PRODUCTS is in 3NF

3. PRODUCTS-IN-SHOPS

Relation	PRODUCTS-IN-SHOP(PRODUCTS.Name, SHOPS.Name, Price, Quantity)
Primary Key	{PRODUCTS.Name, SHOPS.Name}
Keys	{PRODUCTS.Name, SHOPS.Name}
Functional Dependencies	(1) {PRODUCTS.Name, SHOPS.Name} → Price, Quantity

Prove if relation is in 3NF:

- FD (1) is ok, since {PRODUCTS.Name, SHOPS.Name} is the primary key of PRODUCTS-in-SHOPS
- Thus, the relation PRODUCTS-IN-SHOPS is in 3NF

4. PRICE-HISTORY

Relation	PRICE-HISTORY(PRODUCTS.Name, Start-date, SHOPS.Name, End-date, Price)
Primary Key	{PRODUCTS.Name, SHOPS.Name, Start-date, End-date}, {Start-date, End-date}
Keys	{PRODUCTS.Name, SHOPS.Name, Start-date, End-date},
Functional Dependencies	(1) {PRODUCTS.Name, SHOPS.Name, Start-date, End-date} → Price (2) {Start-date, End-date} → Price

Assumptions: The attributes Start-date and End-date are candidate keys as they determine the price at the given date values. However, these 2 keys alone cannot determine the entire table as the dates cannot determine which product or shop the price is dependant on, thus they are combined with PRODUCTS.Name and SHOPS.Name to form our primary key {PRODUCTS.Name, SHOPS.Name, Start-date, End-date}.

Prove if relation is in 3NF:

- FD(1) is ok, since {PRODUCTS.Name, SHOPS.Name, Start-date, End-date} is a key of PRICE-HISTORY
- FD (2) is ok, since {Start-date, End-date} is a key of PRICE-HISTORY
- Thus, the relation PRICE-HISTORY is in 3NF

5. ORDERS

ID refers to ORDERS.ID

Relation	ORDERS(ID, USERS.ID, Shipping-address, Date-time)
Primary Key	ID
Keys	ID, {USERS.ID, Date-time}
Functional Dependencies	(1) ID → Shipping-address, USERS.ID, Date-Time (2) {USERS.ID, Date-time} → ID, Shipping-address

Assumptions:
We assume that Date-time is in 24 hour format(dd/mm/yy hh:mm:ss), with that, {USERS.ID, Date-time} is qualified to be a candidate key as it is unique in the table. However, ID is chosen as the primary key as it is unique in its column while there can be repetition of the same USERS.ID in {USERS.ID, Date-time} making it not as reliable as ID.

Prove if relation is in 3NF:

- FD(1) is ok, since ID is the Primary key of ORDERS
- FD(2) is ok, since {USERS.ID, Date-time} is a key of ORDERS
- Thus, the relation ORDERS is in 3NF

6. PRODUCT-IN-ORDERS

Relation	PRODUCT-IN-ORDERS(PRODUCTS.Name, ORDERS.ID, SHOPS.Name, Status, Delivery-date, Quantity, Price)
Primary key	{PRODUCTS.Name, ORDERS.ID, SHOPS.Name}
Keys	{PRODUCTS.Name, ORDERS.ID, SHOPS.Name}
Functional Dependencies	(1) {PRODUCTS.Name, Order.ID, SHOPS.Name} → Status, Delivery-date, Quantity, Price

Assumption:
We assume that the user has bought different products from different shops which is consolidated into 1 Order for a single unique Order ID. Hence we chose {PRODUCTS.Name, ORDERS.ID, SHOPS.Name} as the primary key.

Prove if relation is in 3NF:

- FD(1) is Ok, since {PRODUCTS.Name, ORDERS.ID, SHOPSName} is the primary key of PRODUCTS-IN-ORDERS
- Thus, the relation PRODUCTS-IN-ORDERS is in 3NF

7. USERS

ID refers to USERS.ID

Relation	USERS(ID, Name)
Primary Key	ID
Keys	ID
Functional Dependencies	(1) ID → Name

Prove if relation is in 3NF:

- USERS only has two attributes, hence it is already in 3NF

8. FEEDBACK

Relation	FEEDBACK(USERS.ID, PRODUCTS.Name, SHOPS.Name, ORDERS.ID, Rating, Date-time,Comment)
Primary Key	{USERS.ID, Date-time}
Keys	(SHOPS.Name, PRODUCTS.Name, USERS.ID, ORDERS.ID}, {USERS.ID, Date-time}
Functional Dependencies	(1) {USERS.ID, Date-Time} → Rating, Comment, PRODUCTS.Name, SHOPS.Name, ORDERS.ID (2) {SHOPS.Name, PRODUCTS.Name, USERS.ID, ORDERS.ID} →Rating, Date-time, Comment

Assumptions: We assume that Date-time is in 24 hour format(dd/mm/yy hh:mm:ss). Date-time is qualified to be a candidate key as it is able to determine the values in the table when it is combined with USERS.ID to form {USERS.ID, Date-time}. We chose {USERS.ID, Date-time} as the primary key based on the fact that they are unique in our table compared to the other key in the table.

Prove if relation is in 3NF:

- FD (1) is OK, since {USERS.ID, Date-Time} is a key in FEEDBACK
- FD (2) is OK, since {SHOPS.Name, PRODUCTS.Name, USERS.ID, ORDERS.ID} is a key in FEEDBACK
- Thus, the relation FEEDBACK is in 3NF

9. COMPLAINTS

ID refers to COMPLAINTS.ID

Relation	COMPLAINTS(ID,Text, Status, Filed-date-time, USERS.ID)
Primary Key	ID
Keys	ID, {USERS.ID, Filed-date-time}
Functional Dependencies	(1) ID → USERS.ID, Status, Text, Filed-date-time (2) {USERS.ID, Filed-date-time} → ID, Text, Status

Assumptions: We assume that Filed-date-time is in 24 hour format(dd/mm/yy hh:mm:ss), with that, {USERS.ID, Filed-date-time} is qualified to be a candidate key as it is unique in the table. ID is chosen as the primary key as it is unique whereas there may be repetitions of either USERS.ID or Filed-date-time for {USERS.ID,Filed-date-time}.

Prove if relation is in 3NF:

- FD (1) is OK, since ID is the primary key of COMPLAINTS
- FD (2) is OK, since {USERS.ID, Filed-date-time} is a key of COMPLAINTS
- Thus, the relation COMPLAINTS is in 3NF

10. COMPLAINTS-ON-ORDERS

Relation	COMPLAINTS-ON-ORDERS(COMPLAINTS.ID, ORDERS.ID)
Primary Key	COMPLAINTS.ID
Keys	COMPLAINTS.ID
Functional Dependencies	(1) COMPLAINTS.ID → ORDERS.ID

Prove if relation is in 3NF:

- COMPLAINTS-ON-ORDERS only has two attributes, hence it is already in 3NF

11.COMPLAINTS-ON-SHOPS

Relation	COMPLAINTS-ON-SHOPS(COMPLAINTS.ID, SHOPS.Name)
Primary Key	COMPLAINTS.ID
Keys	COMPLAINTS.ID
Functional Dependencies	(1) COMPLAINTS.ID → SHOPS.Name

Prove if relation is in 3NF:

- COMPLAINTS-ON-SHOPS only has two attributes, hence it is already in 3NF

12. EMPLOYEES

ID refers to EMPLOYEES.ID

Relation	EMPLOYEES(ID, Name, Salary)
Primary Key	ID
Keys	ID
Functional Dependencies	(1) ID → Name, Salary

Prove if relation is in 3NF:

- FD(1) is OK since ID is the Primary key of Employee
- Thus, the relation Employee is in 3NF

13. HANDLED

Relation	HANDLED(COMPLAINTS.ID, Employees.ID, Handled-date-time)
Primary Key	COMPLAINTS.ID
Keys	COMPLAINTS.ID
Functional Dependencies	(1) COMPLAINTS.ID → Handled-date-time, Employees.ID

Prove if relation is in 3NF:

- FD(1) is OK since COMPLAINTS.ID is the primary key in the table
- Thus, the relation Handled is in 3NF