

## Assignment Week 4

Name: Son Cao (570135)

Group 10

Class ETI2VI-A2

Exercise 6: Retail Sales

### Step 1: First Normal Form (1NF)

Rule (1NF)

- All attributes must be atomic (single value).
- No repeating groups or multi-valued attributes.

Issue

- The table has repeating products per order (e.g., order 3462 with 3 products).
- Fields like Total\_sale, Sales\_tax, Total\_amount are derived (calculated values).
- Customer address is not atomic (street and number in same column).

Solution

- Split orders and products into Order and OrderLine (order details).
- Keep one row per product per order.
- Break customer address into separate fields if needed (Street, HouseNo).
- Remove calculated attributes (can be computed later).

Tables after 1NF

- CUSTOMER(Customer\_ID, Name, Street, HouseNo, Phone)
- ORDER(Order\_ID, Date, Customer\_ID)
- ORDER\_LINE(Order\_ID, Product\_ID, Quantity, UnitPrice)
- PRODUCT(Product\_ID, Description, Dept\_ID)
- DEPARTMENT(Dept\_ID, DeptName, City)

Before (Unnormalized (raw SALES table):

SALES	
Order_Number	
Date	
Customer_Name	
Customer_Address	
Customer_Phone	
Product_Number	
Product_Description	
Product_Quantity	
Product_UnitPrice	
Product_Source_Department	
Product_Source_City	
Total_Sale	
Sales_Tax	
Total_Amount	

AFTER (1NF) (Tables)

CUSTOMER				
Customer_ID	Name	Street	HouseNo	Phone
1	Antony Duncan	Main Street	125	813-5834466
2	Ray Curtis	North Blvd	223	813-5468888

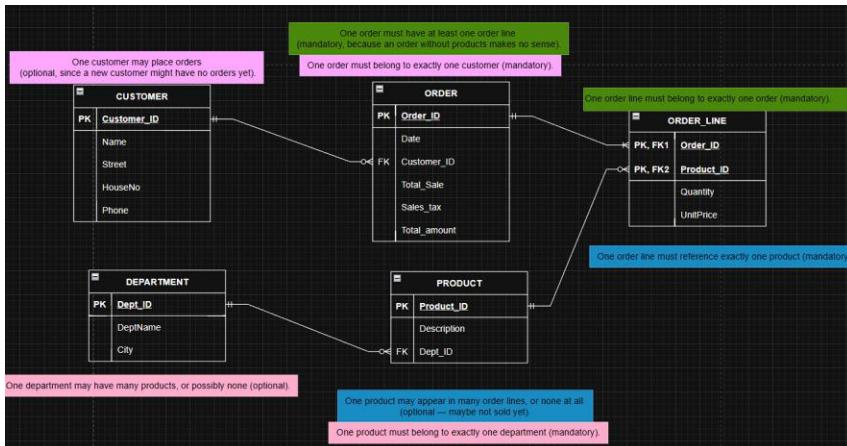
PRODUCT		
Product_ID	Description	Dept_ID
203322	Crockpot	10
215099	Multicooker	10
220510	Rice cooker	10
445566	Washing Mach.	20
456789	Iron	20
324532	Refrigerator	20

ORDER					
Order_ID	Date	Customer_ID	TotalSale	Tax	TotalAmount
3462	12/09/2015	1	605.00	97.00	702.00
3597	15/09/2015	2	2190.00	350.00	2540.00

DEPARTMENT		
Dept_ID	DeptName	City
10	Kitchen	Utrecht
20	Home Appliances	Amsterdam

ORDER_LINE				
Order_ID	Product_ID	Quantity	UnitPrice	
3462	203322	3	85.00	
3462	215099	2	100.00	
3462	220510	5	30.00	
3597	445566	2	550.00	
3597	456789	3	70.00	
3597	324532	1	880.00	

(Draw.io)



Step 2: Second Normal Form (2NF)

Rule (2NF)

- Table must be in 1NF.
- All non-key attributes must depend on the whole primary key (no partial dependency). That means: In a table with a composite key, every non-key attribute must depend on the **whole** key, not just part of it.

Issue

- In **ORDER\_LINE**, UnitPrice depends only on Product\_ID, not on the full key {Order\_ID, Product\_ID}.

- Keeping UnitPrice in ORDER\_LINE causes redundancy.

#### Solution

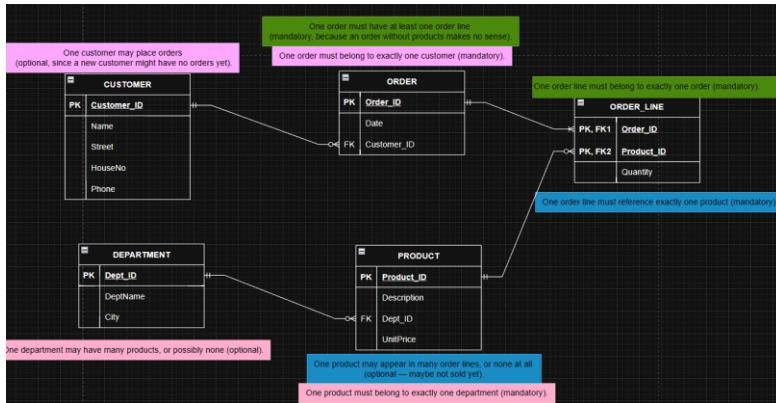
- Move UnitPrice to the PRODUCT table.
- Keep only {Order\_ID, Product\_ID, Quantity} in ORDER\_LINE.

(Tables) (remove partial dependency → move UnitPrice into PRODUCT)

ORDER_LINE		
Order_ID	Product_ID	Quantity
3462	203322	3
3462	215099	2
3462	220510	5
3597	445566	2
3597	456789	3
3597	324532	1

PRODUCT			
Product_ID	Description	UnitPrice	Dept_ID
203322	Crockpot	85.00	10
215099	Multicooker	100.00	10
220510	Rice cooker	30.00	10
445566	Washing Mach.	550.00	20
456789	Iron	70.00	20
324532	Refrigerator	880.00	20

(Draw.io)



#### Step 3: Third Normal Form (3NF)

##### Rule (3NF)

- Table must be in **2NF**.
- **No transitive dependencies:** non-key attributes cannot depend on other non-key attributes.

##### Issue

- In DEPARTMENT, City depends on Dept\_ID, but if multiple departments share a city, we'll repeat city names.
- If the City depends on DeptName (because each department name always corresponds to one city), then City is dependent on another non-key attribute, not directly on the PK (Dept\_ID) => no transitive dependencies

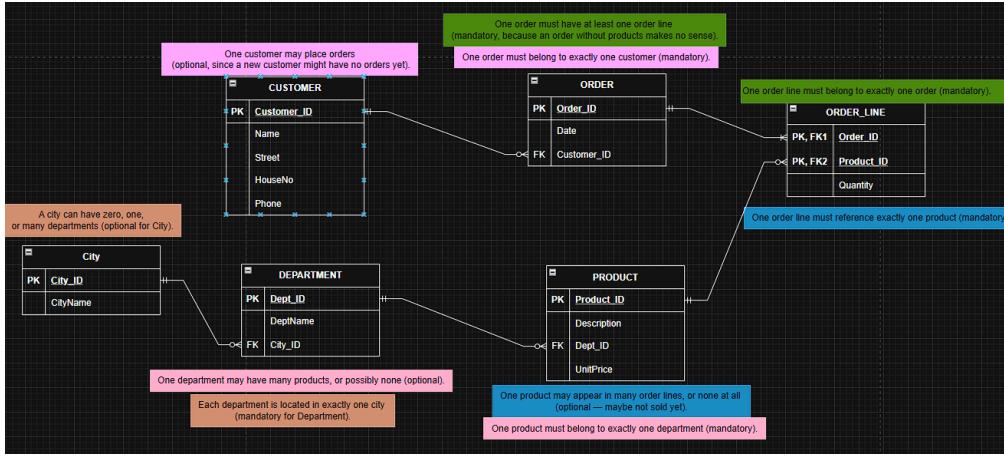
#### Solution

- Create a CITY table.
- Let DEPARTMENT reference it by City\_ID.

#### Final Tables (3NF)

1. CUSTOMER(Customer\_ID, Name, Street, HouseNo, Phone)

2. ORDER(Order\_ID, Date, Customer\_ID)
3. ORDER\_LINE(Order\_ID, Product\_ID, Quantity)
4. PRODUCT(Product\_ID, Description, UnitPrice, Dept\_ID)
5. DEPARTMENT(Dept\_ID, DeptName, City\_ID)
6. CITY(City\_ID, CityName)



(Tables) (remove transitive dependency → City into separate table)

DEPARTMENT		
Dept_ID	DeptName	City_ID
10	Kitchen	1
20	Home Appliances	2

CITY	
City_ID	CityName
1	Utrecht
2	Amsterdam