

Normalization:

1. Supplier

Supplier{Supplier_ID, Supplier_Name, Supplier_Type, Email_ID, Contact_no, Country, State, City}

Minimal FD set

$\text{Supplier_ID} \rightarrow \{ \text{Supplier_Name}, \text{Supplier_Type}, \text{Email_ID}, \text{Contact_no}, \text{Country}, \text{State}, \text{City} \}$

$\{\text{Supplier_ID}\}^+ = \text{Supplier}(\text{Supplier_ID}, \text{Supplier_Name}, \text{Supplier_Type}, \text{Email_ID}, \text{Contact_no}, \text{Country}, \text{State}, \text{City})$

Hence, Supplier_ID is the key.

BCNF

For every minimal FD that holds on relation Supplier, Supplier_ID is its key.

Therefore, Supplier is in BCNF.

2. Parts

Parts{Part_ID, Part_Name, Unit_price}

Minimal FD set

$\text{Part_ID} \rightarrow \{ \text{Part_Name}, \text{Unit_price} \}$

$\{\text{Part_ID}\}^+ = \text{Parts}(\text{Part_ID}, \text{Part_Name}, \text{Unit_price})$

Hence, Part_ID is the key.

BCNF

For every minimal FD that holds on relation Parts, Part_ID is its key.

Therefore, Parts is in BCNF.

3. Supplies_parts

Supplies_Parts{Supplier_ID, Part_ID, Quantity_Stock}

Minimal FD set

$\{\text{Supplier_ID}, \text{Part_ID}\} \rightarrow \{\text{Quantity_Stock}\}$

$\{\text{Supplier_ID}, \text{Part_ID}\}^+ = \text{Supplies_Parts}(\text{Supplier_ID}, \text{Part_ID}, \text{Quantity_Stock})$

Hence, $\{\text{Supplier_ID}, \text{Part_ID}\}$ is the key.

BCNF

For every minimal FD that holds on relation Parts, $\{\text{Supplier_ID}, \text{Part_ID}\}$ is its key.
Therefore, Supplies_Parts is in BCNF.

4. Orders_of_supplier

Orders_of_supplier{Ordering_supplier, Providing_supplier, Ordered_part_ID,
Supplier_order_no, Qty, Amount}

Minimal FD set

$\{\text{Ordering_supplier}, \text{Providing_supplier}, \text{Ordered_part_ID}, \text{Supplier_order_no}\} \rightarrow \{\text{Qty}, \text{Amount}\}$

$\{\text{Ordering_supplier}, \text{Providing_supplier}, \text{Ordered_part_ID}, \text{Supplier_order_no}\}^+ = \text{Orders_of_supplier}(\text{Ordering_supplier}, \text{Providing_supplier}, \text{Ordered_part_ID}, \text{Supplier_order_no}, \text{Qty}, \text{Amount})$

Hence, $\{\text{Ordering_supplier}, \text{Providing_supplier}, \text{Ordered_part_ID}, \text{Supplier_order_no}\}$ is the key.

BCNF

For every minimal FD that holds on relation Orders_of_supplier, $\{\text{Ordering_supplier}, \text{Providing_supplier}, \text{Ordered_part_ID}, \text{Supplier_order_no}\}$ is its key.
Therefore, Orders_of_supplier is in BCNF.

5. Manufacturer

Manufacturer{M_ID, M_Name, Email_ID, Contact_no, Country, State, City}

Minimal FD set

$M_ID \rightarrow \{M_Name, Email_ID, Contact_no, Country, State, City\}$

$\{M_ID\}^+ = \text{Manufacturer}(M_ID, M_Name, Email_ID, Contact_no, Country, State, City)$

Hence, M_ID is the key.

BCNF

For every minimal FD that holds on relation Manufacturer, M_ID is its key.

Therefore, Manufacturer is in BCNF.

6. Order_of_manufacturer

Order_of_manufacturer{Order_no, M_ID , Placing_Date, Receiving_Date}

Minimal FD set

$Order_no \rightarrow \{M_ID, Placing_Date, Receiving_Date\}$

$\{Order_no\}^+ = \text{Order_of_manufacturer}(Order_no, M_ID, Placing_Date, Receiving_Date)$

Hence, $Order_no$ is the key.

BCNF

For every minimal FD that holds on relation Order_of_Manufacturer, $Order_no$ is its key.

Therefore, Order_of_manufacturer is in BCNF.

7. Order_for_parts

Order_for_parts{Part_ID, Order_no, Quantity}

Minimal FD set

$\{Part_ID, Order_no\} \rightarrow \{Quantity\}$

$\{Part_ID, Order_no\}^+ = \text{Order_for_parts}(Part_ID, Order_no, Quantity)$

Hence, {Part_ID, Order_no} is the key.

BCNF

For every minimal FD that holds on relation Order_for_parts, {Part_ID, Order_no} is its key.

Therefore, Order_for_parts is in BCNF.

8. Order_transactions

Order_transactions {Transaction_ID, Order_no, Ordered_amount, Tax_name, Tax_in_percentage, Total_amount}

Minimal FD set

Transaction_ID \rightarrow {Order_no, Ordered_amount, Tax_name, Tax_in_percentage, Total_amount}

{Transaction_ID}⁺ = Order_transactions(Transaction_ID, Order_no, Ordered_amount, Tax_name, Tax_in_percentage, Total_amount)

Hence, Transaction_ID is the key.

BCNF

For every minimal FD that holds on relation Order_transactions, Transaction_ID is its key.

Therefore, Order_transactions is in BCNF.

9. Car_model

Car_model {Car_model_ID, Model_Name, Mileage_in_kmpl, Color, Base_price, Warranty_duration_in_months}

Minimal FD set

Car_model_ID \rightarrow {Model_Name, Mileage_in_kmpl, Color, Base_price, Warranty_duration_in_months}

{Car_model_ID}⁺ = Car_model(Car_model_ID, Model_Name, Mileage_in_kmpl, Color, Base_price, Warranty_duration_in_months)

Hence, Car_model_ID is the key.

BCNF

For every minimal FD that holds on relation Car_model, Car_model_ID is its key.

Therefore, Car_model is in BCNF.

10. Orders_based_on

Orders_based_on{Order_no, Car_Model_ID}

Minimal FD set

No minimal FDs.

11. Assembly_plant

Assembly_plant{Plant_no, M_ID, Country, State, City}

Minimal FD set

$\text{Plant_no} \rightarrow \{\text{M_ID}, \text{Country}, \text{State}, \text{City}\}$

$\{\text{Plant_no}\}^+ = \text{Assembly_plant}(\text{Plant_no}, \text{M_ID}, \text{Country}, \text{State}, \text{City})$

Hence, Plant_no is the key.

BCNF

For every minimal FD that holds on relation Assembly_plant, Plant_no is its key.

Therefore, Assembly_plant is in BCNF.

12. Plant_head

Plant_head{Phead_ID, H_Name, Plant_no, Contact_no}

Minimal FD set

$\text{Phead_ID} \rightarrow \{\text{H_Name}, \text{Plant_no}, \text{Contact_no}\}$

$\{\text{Phead_ID}\}^+ = \text{Plant_head}(\text{Phead_ID}, \text{H_Name}, \text{Plant_no}, \text{Contact_no})$

Hence, Phead_ID is the key.

BCNF

For every minimal FD that holds on relation Plant_head, Phead_ID is its key.

Therefore, Plant_head is in BCNF.

13. Manufactured_parts_by_own

Manufactured_parts_by_own{Component_ID, Component_Name, Car_model_ID, M_ID, Unit_price, Quality_factors}

Minimal FD set

$\text{Component_ID} \rightarrow \{\text{Component_Name}, \text{Car_model_ID}, \text{M_ID}, \text{Unit_price}, \text{Quality_factors}\}$

$\{\text{Component_ID}\}^+ = \text{Manufactured_parts_by_own}\{\text{Component_ID}, \text{Component_Name}, \text{Car_model_ID}, \text{M_ID}, \text{Unit_price}, \text{Quality_factors}\}$

Hence, Component_ID is the key.

BCNF

For every minimal FD that holds on relation Manufactured_parts_by_own, Component_ID is its key.

Therefore, Manufactured_parts_by_own is in BCNF.

14. Plant_produces

Plant_produces{Plant_no, Car_model_ID, Start_date, End_date}

Minimal FD set

$\{\text{Plant_no}, \text{Car_model_ID}\} \rightarrow \{\text{Start_date}, \text{End_date}\}$

$\{\text{Plant_no}, \text{Car_model_ID}\}^+ = \text{Plant_produces}\{\text{Plant_no}, \text{Car_model_ID}, \text{Start_date}, \text{End_date}\}$

Hence, {Plant_no, Car_model_ID} is the key.

BCNF

For every minimal FD that holds on relation Plant_produces, {Plant_no, Car_model_ID} is its key.

Therefore, Plant_produces is in BCNF.

15. Dealer

Dealer{Dealer_ID, Dealer_Name, Deals_with_M_ID, Email_ID, Contact_no, Country, State, City}

Minimal FD set

Dealer_ID \rightarrow {Dealer_Name, Deals_with_M_ID, Email_ID, Contact_no, Country, State, City}

{Dealer_ID}⁺ = Dealer{Dealer_ID, Dealer_Name, Deals_with_M_ID, Email_ID, Contact_no, Country, State, City}

Hence, Dealer_ID is the key.

BCNF

For every minimal FD that holds on relation Dealer, Dealer_ID is its key.

Therefore, Dealer is in BCNF.

16. Dealer_order_for

Dealer_order_for{Dealer_ID, Car_model_ID, Ordering_date, Receiving_date, Tax_name, Tax_in_Percentage, Total_Amount}

Minimal FD set

{Dealer_ID, Car_model_ID} \rightarrow {Ordering_date, Receiving_date, Tax_name, Tax_in_Percentage, Total_Amount}

{Dealer_ID, Car_model_ID}⁺ = Dealer_order_for{Dealer_ID, Car_model_ID, Ordering_date, Receiving_date, Tax_name, Tax_in_Percentage, Total_Amount}

Hence, {Dealer_ID, Car_model_ID} is the key.

BCNF

For every minimal FD that holds on relation Dealer_order_for, {Dealer_ID, Car_model_ID} is its key.
Therefore, Dealer_order_for is in BCNF.

17. Test

Test{Test_name}

Minimal FD set

No minimal FDs.

18. Car_test

Car_test{Test_name, Car_model_ID, Result}

Minimal FD set

{Test_name, Car_model_ID} \rightarrow {Result}

{Test_name, Car_model_ID}⁺ = Car_test{Test_name, Car_model_ID, Result}

Hence, {Test_name, Car_model_ID} is the key.

BCNF

For every minimal FD that holds on relation Car_test, {Test_name, Car_model_ID} is its key.

Therefore, Car_test is in BCNF.

19. Customer

Customer{Customer_ID, Customer_Name, Email_ID, Contact_no, Country, State, City}

Minimal FD set

Customer_ID \rightarrow {Customer_Name, Email_ID, Contact_no, Country, State, City}

{Customer_ID}⁺ = Customer{Customer_ID, Customer_Name, Email_ID, Contact_no, Country, State, City}

Hence, Customer_ID is the key.

BCNF

For every minimal FD that holds on relation Customer, Customer_ID is its key.

Therefore, Customer is in BCNF.

20. RTO

RTO{Registration_no, Engine_no, Registration_date, VIN, Total_reg_amount, Road_tax_amount}

Minimal FD set

Registration_no \rightarrow {Engine_no, Registration_date, VIN, Total_reg_amount, Road_tax_amount}

{Registration_no}⁺ = RTO{Registration_no, Engine_no, Registration_date, VIN, Total_reg_amount, Road_tax_amount}

Hence, Registration_no is the key.

BCNF

For every minimal FD that holds on relation RTO, Registration_no is its key.

Therefore, RTO is in BCNF.

21. Sells_to

Sells_to{Dealer_ID, Customer_ID, Car_model_ID, Registration_no, Selling_date, Car_amount, Tax_name, Tax_in_percentage, Discount_amount}

Minimal FD set

{Dealer_ID, Customer_ID, Car_model_ID} \rightarrow {Registration_no, Selling_date, Car_amount, Tax_name, Tax_in_percentage, Discount_amount}

{Dealer_ID, Customer_ID, Car_model_ID}⁺ = Sells_to{Dealer_ID, Customer_ID, Car_model_ID, Registration_no, Selling_date, Car_amount, Tax_name, Tax_in_percentage, Discount_amount}

Hence, {Dealer_ID, Customer_ID, Car_model_ID} is the key.

BCNF

For every minimal FD that holds on relation Sells_to, {Dealer_ID, Customer_ID, Car_model_ID} is its key.

Therefore, Sells_to is in BCNF.

22. Insurance

Insurance{In_policy_no, Company_name, Dealer_ID, Customer_ID, Car_model_ID, Start_date, End_date, Coverage_amount, Insurance_amount}

Minimal FD set

In_policy_no \rightarrow {Company_name, Dealer_ID, Customer_ID, Car_model_ID, Start_date, End_date, Coverage_amount, Insurance_amount}

{In_policy_no}⁺ = Insurance{In_policy_no, Company_name, Dealer_ID, Customer_ID, Car_model_ID, Start_date, End_date, Coverage_amount, Insurance_amount}

Hence, In_policy_no is the key.

BCNF

For every minimal FD that holds on relation Insurance, In_policy_no is its key.

Therefore, Insurance is in BCNF.