

## Minimal Functional Dependency Set

1. User
  - $\text{UserID} \rightarrow \text{Name, Email, Password, PhoneNumber, Address, UserType}$  (*Primary Key Dependency*)
  - $\text{Email} \rightarrow \text{UserID}$  (*Unique Email ID constraint*)
2. Customer
  - $\text{CustomerID} \rightarrow \text{UserID, RewardCoins, PaymentPreferences}$  (*Primary Key Dependency*)
  - $\text{UserID} \rightarrow \text{CustomerID}$  (*1-1 Mapping*)
3. RestaurantOwner
  - $\text{RestaurantOwnerID} \rightarrow \text{UserID, LicenseNumber}$  (*Primary Key Dependency*)
  - $\text{UserID} \rightarrow \text{RestaurantOwnerID}$  (*1-1 Mapping*)
4. Restaurant
  - $\text{RestaurantID} \rightarrow \text{Name, Address, ContactInfo, CuisineType, AverageRating, LicenseNumber, RestaurantOwnerID}$  (*Primary Key Dependency*)
  - $\text{RestaurantOwnerID} \rightarrow \text{RestaurantID}$  (*Assuming 1 owner owns 1 restaurant*)
5. DeliveryAgent
  - $\text{DeliveryAgentID} \rightarrow \text{UserID, Earnings}$  (*Primary Key Dependency*)
  - $\text{UserID} \rightarrow \text{DeliveryAgentID}$  (*1-1 Mapping*)
6. Menu
  - $\text{MenuID} \rightarrow \text{RestaurantID, ItemName, Price, Availability}$  (*Primary Key Dependency*)
7. Order
  - $\text{OrderID} \rightarrow \text{CustomerID, RestaurantID, DeliveryAgentID, OrderDate, DeliveryAddress, Status, TotalAmount, RewardCoinsEarned}$  (*Primary Key Dependency*)
8. OrderDetails
  - $\text{OrderDetailsID} \rightarrow \text{OrderID, MenuID, Quantity, Price}$  (*Primary Key Dependency*)
9. Payment
  - $\text{TransactionID} \rightarrow \text{OrderID, PaymentMethod, TotalAmount, RewardCoinsUsed, AmountPaid,}$

PlatformCommission, RestaurantEarnings,  
PaymentStatus, PaymentDate (*Primary Key  
Dependency*)

10. RewardCoinUsage

- RewardCoinUsageID → TransactionID, CustomerID,  
CoinsUsed, CoinsValue (*Primary Key Dependency*)

11. PayoutHistory

- PayoutID → DeliveryAgentID, OrderID, BaseFee,  
DistanceFee, TotalPayout, PaymentStatus,  
PayoutDate (*Primary Key Dependency*)

12. FinancialReport

- ReportID → RestaurantID, DeliveryAgentID,  
CommissionEarned, PayoutAmount, ReportDate  
(*Primary Key Dependency*)

13. Review

- ReviewID → RestaurantID, Rating, Comment  
(*Primary Key Dependency*)

**Proofs for BCNF for Each Relation**

1. User

- **FDs:**
  - UserID → {Name, Email, Password,  
PhoneNumber, Address, UserType}
    - UserID is the primary key → *superkey*.
  - Email → UserID
    - Email is a candidate key → *superkey*.
- **Conclusion:** All FDs have superkeys → BCNF.

2. Customer

- **FDs:**
  - CustomerID → {UserID,  
RewardCoins,  
PaymentPreferences}
    - CustomerID is the primary key → *superkey*.
  - UserID → CustomerID
    - UserID is a candidate key → *superkey*.
- **Conclusion:** BCNF.

### 3. RestaurantOwner

- **FDs:**
  - $\text{RestaurantOwnerID} \rightarrow \{\text{UserID}, \text{LicenseNumber}\}$ 
    - RestaurantOwnerID is the primary key  $\rightarrow$  *superkey*.
  - $\text{UserID} \rightarrow \text{RestaurantOwnerID}$ 
    - UserID is a candidate key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

### 4. Restaurant

- **FDs:**
  - $\text{RestaurantID} \rightarrow \{\text{Name}, \text{Address}, \dots, \text{RestaurantOwnerID}\}$ 
    - RestaurantID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** Single FD with *superkey*  $\rightarrow$  BCNF.

### 5. DeliveryAgent

- **FDs:**
  - $\text{DeliveryAgentID} \rightarrow \{\text{UserID}, \text{Earnings}\}$ 
    - DeliveryAgentID is the primary key  $\rightarrow$  *superkey*.
  - $\text{UserID} \rightarrow \text{DeliveryAgentID}$ 
    - UserID is a candidate key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

### 6. Menu

- **FDs:**
  - $\text{MenuID} \rightarrow \{\text{RestaurantID}, \text{ItemName}, \text{Price}, \text{Availability}\}$ 
    - MenuID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

### 7. Order

- **FDs:**
  - $\text{OrderID} \rightarrow \{\text{CustomerID}, \text{RestaurantID}, \dots, \text{RewardCoinsEarned}\}$ 
    - OrderID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

## 8. OrderDetails

- **FDs:**
  - $\text{OrderDetailsID} \rightarrow \{\text{OrderID}, \text{MenuID}, \text{Quantity}, \text{Price}\}$ 
    - OrderDetailsID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

## 9. Payment

- **FDs:**
  - $\text{TransactionID} \rightarrow \{\text{OrderID}, \text{PaymentMethod}, \dots, \text{PaymentDate}\}$ 
    - TransactionID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

## 10. RewardCoinUsage

- **FDs:**
  - $\text{RewardCoinUsageID} \rightarrow \{\text{TransactionID}, \text{CustomerID}, \text{CoinsUsed}, \text{CoinsValue}\}$ 
    - RewardCoinUsageID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

## 11. PayoutHistory

- **FDs:**
  - $\text{PayoutID} \rightarrow \{\text{DeliveryAgentID}, \text{OrderID}, \dots, \text{PayoutDate}\}$ 
    - PayoutID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

## 12. FinancialReport

- **FDs:**
  - $\text{ReportID} \rightarrow \{\text{RestaurantID}, \text{DeliveryAgentID}, \dots, \text{ReportDate}\}$ 
    - ReportID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.

## 13. Review

- **FDs:**
  - $\text{ReviewID} \rightarrow \{\text{RestaurantID}, \text{Rating}, \text{Comment}\}$ 
    - ReviewID is the primary key  $\rightarrow$  *superkey*.
- **Conclusion:** BCNF.