

# Database Management System Project

Group Id:- T612    Lab Group No:- 6

Topic Name:- e-Bay

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## ❖ Functional Dependencies and Proof that Relations are in Boyce-Codd Normal Form(BCNF) :-

### (1) User\_Profile

**Attributes:-** { Email , Password , first\_name , last\_name }

Email → Password

Email → first\_name

Email → last\_name

### ➤ Let's take the closure of Email:-

$\text{Email}^+ = \{ \text{Email} , \text{Password} , \text{first\_name} , \text{last\_name} \}$

**Candidate-Key:- Email**

**Primary-Key:- Email**

- Since in this Minimal Set of FDs, the left side in all of the FDs is **Email** which is **Candidate-Key** of this relation  
Therefore, “User\_Profile” is in BCNF

## **(2) User**

**Attributes:- { User\_id , Email }**

$\text{User\_id} \rightarrow \text{Email}$

- Let's take the closure of User\_id:-

$\text{User\_id}^+ = \{ \text{User\_id} , \text{Email} \}$

**Candidate-Key:- User\_id**

**Primary-Key:- User\_id**

- Since in this Minimal Set of FDs, the left side in all of the FDs is **User\_id** which is **Candidate-Key** of this relation  
Therefore, “User” is in BCNF

## **(3) Seller**

**Attributes:- { User\_id , item\_sold, Avg\_Rating , A/C\_Number }**

$\text{User\_id} \rightarrow \text{item\_sold}$

$\text{User\_id} \rightarrow \text{Avg\_Rating}$

$\text{User\_id} \rightarrow \text{A/C\_Number}$

- Let's take the closure of User\_id:-

$\text{User\_id}^+ = \{ \text{User\_id}, \text{item\_sold}, \text{Avg\_Rating}, \text{A/C\_Number} \}$

**Candidate-Key:- User\_id**

**Primary-Key:- User\_id**

- Since in this Minimal Set of FDs, the left side in all of the FDs is **User\_id** which is **Candidate-Key** of this relation  
Therefore, "Seller" is in BCNF

#### (4) Bank\_Details

**Attributes:-** { A/C\_Number , Balance }

$\text{A/C\_Number} \rightarrow \text{Balance}$

- Let's take the closure of A/C\_Number:-

$\text{A/C\_Number}^+ = \{ \text{A/C\_Number}, \text{Balance} \}$

**Candidate-Key:- A/C\_Number**

**Primary-Key:- A/C\_Number**

- Since in this Minimal Set of FDs, the left side in all of the FDs is **A/C\_Number** which is **Candidate-Key** of this relation. Therefore, "Bank\_Details" is in BCNF

#### (5) Product

**Attributes:-** { Product\_id , Product\_Name ,  
Watching\_Number , Available\_Units , Price , Description ,  
Avg\_Rating , Product\_Seller\_id }

Product\_id  $\rightarrow$  Product\_Name  
Product\_id  $\rightarrow$  Watching\_Number  
Product\_id  $\rightarrow$  Available\_Units  
Product\_id  $\rightarrow$  Price  
Product\_id  $\rightarrow$  Description  
Product\_id  $\rightarrow$  Avg\_Rating  
Product\_id  $\rightarrow$  Product\_Seller\_id

- Let's take the closure of Product\_id:-

$\text{Product\_id}^+ = \{ \text{Product\_id}, \text{Product\_Name}, \text{Watching\_Number}, \text{Available\_Units}, \text{Price}, \text{Description}, \text{Avg\_Rating}, \text{Product\_Seller\_id} \}$

**Candidate-Key:- Product\_id**

**Primary-Key:- Product\_id**

- Since in this Minimal Set of FDs, the left side in all of the FDs is **Product\_id** which is **Candidate-Key** of this relation.  
Therefore, "Product" is in BCNF

## (6) Product\_Review

**Attributes:-** { Product\_id , User\_id , Rating , Comment }

{Product\_id , User\_id }  $\rightarrow$  Rating

{Product\_id , User\_id }  $\rightarrow$  Comments

- Let's take the closure of { Product\_id, User\_id }:-

$\{ \text{Product\_id}, \text{User\_id} \}^+ = \{ \text{Product\_id}, \text{User\_id}, \text{Rating}, \text{Comment} \}$

**Candidate-Key:- { Product\_id, User\_id }**

**Primary-Key:- { Product\_id , User\_id }**

- Since in this Minimal Set of FDs, the left side in all of the FDs is { **Product\_id, User\_id** } which is **Candidate-Key** of this relation. Therefore, “**Product\_Review**” is in BCNF

## (7) Order

**Attributes:-** { Order\_id , Order\_Date , Shipping\_Cost , Buyer\_User\_id , Transaction\_id ,Shipping\_Address\_User\_id, Total\_order\_cost }

Order\_id → Order\_Date

Order\_id → Shipping\_Cost

Order\_id → Buyer\_User\_id

Order\_id → Transaction\_id

Order\_id → Shipping\_User\_id

Order\_id → Total\_order\_cost

Transaction\_id → Order\_id

Transaction\_id → Order\_Date

Transaction\_id → Shipping\_Cost

Transaction\_id → Buyer\_id

Transaction\_id → Shipping\_User\_id

Transaction\_id → Total\_order\_cost

- Let's take the closure of Order\_id and Transaction\_id:-

$\text{Order\_id}^+ = \{ \text{Order\_id} , \text{Order\_Date} , \text{Shipping\_Cost} , \text{Buyer\_User\_id} , \text{Transaction\_id} , \text{Shipping\_Address\_User\_id} , \text{Total\_order\_cost} \}$

$\text{Transaction\_id}^+ = \{ \text{Order\_id} , \text{Order\_Date} , \text{Shipping\_Cost} , \text{Buyer\_User\_id} , \text{Transaction\_id} , \text{Shipping\_Address\_User\_id} , \text{Total\_order\_cost} \}$

**Candidate-Keys:-** Order\_id , Transaction\_id

**Primary-Key:-** Order\_id

- Since in this Minimal Set of FDs, the left side in all of the FDs is Either Order\_id or Transaction\_id which are **Candidate-Keys** of this relation. Therefore, “Order” is in BCNF

### (8) Shipping\_Status

**Attributes:-** { tracking\_id , Est\_Delivery\_Date ,  
Delivered\_Date , Delivery\_Status , Order\_id }

tracking\_id → Est\_Delivery\_Date

tracking\_id → Delivered\_Date

tracking\_id → Delivery\_Status

tracking\_id → Order\_id

Order\_id → Est\_Delivery\_Date

Order\_id → Delivered\_Date

Order\_id → Delivery\_Status

Order\_id → tracking\_id

- Let's take the closure of Order\_id and tracking\_id:-

$\text{Order\_id}^+ = \{ \text{tracking\_id} , \text{Est\_Delivery\_Date} , \text{Delivered\_Date} ,$   
 $\text{Delivery\_Status} , \text{Order\_id} \}$

$\text{tracking\_id}^+ = \{ \text{tracking\_id} , \text{Est\_Delivery\_Date} ,$   
 $\text{Delivered\_Date} , \text{Delivery\_Status} , \text{Order\_id} \}$

**Candidate-Keys:-** Order\_id , tracking\_id

**Primary-Key:-** tracking\_id

- Since in this Minimal Set of FDs, the left side in all of the FDs is Either Order\_id or tracking\_id which are **Candidate-Keys** of this relation. Therefore, “Shipping\_Status” is in BCNF

## (9) Shipper

**Attributes:-** { Shipper\_id , Inv\_House\_Name , Shipper\_Name }

Shipper\_id  $\rightarrow$  Inv\_House\_Name

Shipper\_id  $\rightarrow$  Shipper\_Name

- Let's take the closure of Shipper\_id:-

$\text{Shipper\_id}^+ = \{ \text{Shipper\_id} , \text{Inv\_House\_Name} , \text{Shipper\_Name} \}$

**Candidate-Key:-** Shipper\_id

**Primary-Key:-** Shipper\_id

- Since in this Minimal Set of FDs, the left side in all of the FDs is **Shipper\_id** which is **Candidate-Key** of this relation.  
Therefore, "Shipper" is in BCNF

## (10) Shipper\_Phone\_No

**Attributes:-** { Shipper\_id , Phone\_No }

Phone\_No  $\rightarrow$  Shipper\_id

- Let's take the closure of Phone\_No:-

$\text{Phone\_No}^+ = \{ \text{Shipper\_id} , \text{Phone\_No} \}$

**Candidate-Key:-** Phone\_No

**Primary-Key:-** {Shipper\_id , Phone\_No}

- Since in this Minimal Set of FDs, the left side in all of the FDs is **Phone\_No** which is **Candidate-Key** of this relation.  
Therefore, "Shipper\_Phone" is in BCNF

**(11) Inv\_Phone\_No**

**Attributes:-** { Inv\_House\_Name, Inv\_Phone\_No }

Inv\_Phone\_No  $\rightarrow$  Inv\_House\_Name

- Let's take the closure of Inv\_Phone\_No:-

$\text{Inv\_Phone\_No}^+ = \{ \text{Inv\_House\_Name} , \text{Inv\_Phone\_No} \}$

**Candidate-Key:-** Inv\_Phone\_No

**Primary-Key:-** { Inv\_House\_Name, Inv\_Phone\_No }

- Since in this Minimal Set of FDs, the left side in all of the FDs is **Inv\_Phone\_No** which is **Candidate-Key** of this relation.  
Therefore, "Inv\_Phone\_No" is in BCNF

**(12) Shipping\_Address**

**Attributes:-** { User\_id , Apartment\_Name , City , Street , State , Pincode , Is\_Default }

User\_id  $\rightarrow$  Apartment\_Name

User\_id  $\rightarrow$  City

User\_id  $\rightarrow$  Street

User\_id  $\rightarrow$  State

User\_id  $\rightarrow$  Pincode

User\_id  $\rightarrow$  Is\_Default

- Let's take the closure of User\_id:-

$\text{User\_id}^+ = \{ \text{User\_id} , \text{Apartment\_Name} , \text{City} , \text{Street} , \text{State} , \text{Pincode} , \text{Is\_Default} \}$



**Candidate-Key:- User\_id**

**Primary-Key:- User\_id**

- Since in this Minimal Set of FDs, the left side in all of the FDs is **User\_id** which is **Candidate-Key** of this relation.  
Therefore, “Shipping\_Address” is in BCNF

### (13) User\_Phone

**Attributes:- { User\_id , Phone\_No }**

**Phone\_No  $\rightarrow$  User\_id**

- Let's take the closure of Phone\_No:-

**Phone\_No<sup>+</sup> = { User\_id , Phone\_No }**

**Candidate-Key:- Phone\_No**

**Primary-Key:- {User\_id , Phone\_No}**

- Since in this Minimal Set of FDs, the left side in all of the FDs is **Phone\_No** which is **Candidate-Key** of this relation.  
Therefore, “User\_Phone” is in BCNF

### (14) Contains

**Attributes:- { User\_id , Product\_id }**

- There does not exist any Functional Dependency  
**Primary\_Key:- { User\_id , Product\_id }**
- Since there does not exist any FD , Therefore the relation  
“Contains” is in BCNF

#### (15) Cart

Attributes:- { User\_id }

- There does not exist any Functional Dependency
- Primary\_Key:- { User\_id }
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

#### (16) Buyer

Attributes:- { User\_id }

- There does not exist any Functional Dependency
- Primary\_Key:- { User\_id }
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

#### (17) Product\_Image

Attributes:- {image\_url, Product\_id }

- There does not exist any Functional Dependency
- Primary\_Key:- {image\_url, Product\_id }
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

#### (18) Has\_Category

Attributes:- {Category\_Name, Product\_id }

- There does not exist any Functional Dependency
- Primary\_Key:- { Category\_Name ,Product\_id }
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(19) Category**

**Attributes:- { Category\_Name }**

- There does not exist any Functional Dependency
- Primary\_Key:- { Category\_Name }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(20) Category\_Has\_Subcategory**

**Attributes:- { Category\_Name, Subcategory\_Name }**

- There does not exist any Functional Dependency
- Primary\_Key:- { Category\_Name, Subcategory\_Name }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(21) Subcategory**

**Attributes:- { Subcategory\_Name }**

- There does not exist any Functional Dependency
- Primary\_Key:- { Subcategory\_Name }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(22) Has\_Subcategory**

**Attributes:- { Subcategory\_Name, Product\_id }**

- There does not exist any Functional Dependency
- Primary\_Key:- { Subcategory\_Name, Product\_id }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(23) Payment**

**Attributes:- { Transaction\_id }**

- There does not exist any Functional Dependency
- Primary\_Key:- { Transaction\_id }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(24) Watches**

**Attributes:- { User\_id , Product\_id }**

- There does not exist any Functional Dependency
- Primary\_Key:- { User\_id , Product\_id }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(25) Has\_Order**

**Attributes:- { Order\_id , Product\_id }**

- There does not exist any Functional Dependency
- Primary\_Key:- { Order\_id , Product\_id }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

### **(26) Delivers**

**Attributes:- { Shipper\_id , Order\_id }**

- There does not exist any Functional Dependency
- Primary\_Key:- { Shipper\_id , Order\_id }**
- Since there does not exist any FD , Therefore the relation “Contains” is in BCNF

**(27) Inv\_House**

**Attributes:- { Inv\_House\_Name}**

- **There does not exist any Functional Dependency**

**Primary\_Key:- { Inv\_House\_Name}**

- **Since there does not exist any FD , Therefore the relation “Contains” is in BCNF**