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|  | | **Database Management System Project** | |  | |
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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:-

Email+ = { Email , Password , first\_name , 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**

1. **User**

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

* + Let’s take the closure of User\_id:- User\_id+ = { User\_id , 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**

1. **Seller**

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

User\_id  Avg\_Rating User\_id  A/C\_Number

* + Let’s take the closure of User\_id:-

User\_id+ = { User\_id , item\_sold,Avg\_Rating , 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**

1. **Bank\_Details**

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

* + Let’s take the closure of A/C\_Number:- A/C\_Number+ = { A/C\_Number , 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**

1. **Product**

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

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

* + Let’s take the closure of Product\_id:- Product\_id+ = { Product\_id , Product\_Name ,

Watching\_Number ,Available\_Units , Price , Description , Avg\_Rating , 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**

1. **Product\_Review**

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

{Product\_id , User\_id }  Rating

{Product\_id , User\_id }  Comments

* + Let’stake the closure of { Product\_id, User\_id }:-

{Product\_id , User\_id}+ = {Product\_id, User\_id, Rating, 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**

1. **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:- Order\_id+ = { Order\_id , Order\_Date , Shipping\_Cost ,

Buyer\_User\_id , Transaction\_id ,Shipping\_Address\_User\_id, Total\_order\_cost }

Transaction\_id+ = { Order\_id , Order\_Date , Shipping\_Cost , Buyer\_User\_id , Transaction\_id ,Shipping\_Address\_User\_id, 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**

1. **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:-

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

tracking\_id+ = { tracking\_id , Est\_Delivery\_Date,

Delivered\_Date , Delivery\_Status, 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**

1. **Shipper**

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

Shipper\_id Shipper\_Name

* + Let’s take the closure of Shipper\_id:-

Shipper\_id+ = { Shipper\_id , Inv\_House\_Name , 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**

1. **Shipper\_Phone\_No**

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

* + Let’s take the closure of Phone\_No:- Phone\_No+ = { Shipper\_id , 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**

1. **Inv\_Phone\_No**

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

* + Let’s take the closure of Inv\_Phone\_No:- Inv\_Phone\_No+ = { Inv\_House\_Name , 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**

1. **Shipping\_Address**

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

User\_id  Apartment\_Name User\_id  City

User\_id  Street User\_id  State User\_id  Pincode User\_id  Is\_Default

* + Let’s take the closure of User\_id:-

User\_id+ = { User\_id , Apartment\_Name , City , Street , State , Pincode , 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**

1. **User\_Phone**

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

* + Let’s take the closure of Phone\_No:- Phone\_No+ = { 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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**

1. **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**