



NORMALIZATION PROOFS

Tourism Management
(Team ID – T209)

1. 'Customer' Relation :

Attributes : { CustID, Password, Fname, Mname, Lname, DOB }

Functional Dependencies :

CustID \rightarrow Password

CustID \rightarrow Fname

$\text{CustID} \rightarrow \text{Mname}$

$\text{CustID} \rightarrow \text{Lname}$

$\text{CustID} \rightarrow \text{DOB}$

Let $X = \text{CustID}$

$X^+ = \{ \text{CustID}, \text{Password}, \text{Fname}, \text{Mname}, \text{Lname}, \text{DOB} \}$

Thus, **Primary key = CustID**

The left side of all the FDs in the minimal set of FDs for the relation 'Customer' is CustID, which is the primary key of this relation, so "Customer" is in **BCNF**.

2. 'Emergency_Contact' Relation :

Attributes : { Contact_Name, CustID, Address, Relation, Contact_Number }

Functional Dependencies :

$\{ \text{Contact_Name}, \text{CustID} \} \rightarrow \text{Address}$

$\{ \text{Contact_Name}, \text{CustID} \} \rightarrow \text{Relation}$

$\{ \text{Contact_Name}, \text{CustID} \} \rightarrow \text{Contact_Number}$

Let $X = \{ \text{Contact_Name}, \text{CustID} \}$

$X^+ = \{ \text{Contact_Name}, \text{CustID}, \text{Address}, \text{Relation}, \text{Contact_Number} \}$

Thus, **Primary key = { Contact_Name, CustID }**

The left side of all the FDs in the minimal set of FDs for the relation 'Emergency_Contact' is { Contact_Name, CustID }, which is the primary key of this relation, so "Emergency_Contact" is in **BCNF**.

3. 'Customer_Contact' Relation :

Attributes : { CustID, Contact }

Primary key = { CustID, Contact }

There are no Functional Dependencies in this relation as the only two attributes are CustID and Contact, which itself are the primary key.

Thus the relation "Customer_Contact" is in **BCNF**.

4. 'Customer_Email' Relation :

Attributes : { CustID, Email }

Primary key = { CustID, Email }

There are no Functional Dependencies in this relation as the only two attributes are CustID and Email, which itself are the primary key.

Thus the relation "Customer_Email" is in **BCNF**.

5. 'Review' Relation :

Attributes : { CustID, R_Type, Rating, Text, R_Date }

Functional Dependencies :

$$\{ \text{CustID}, \text{R_type} \} \rightarrow \text{Rating}$$
$$\{ \text{CustID}, \text{R_type} \} \rightarrow \text{Text}$$
$$\{ \text{CustID}, \text{R_type} \} \rightarrow \text{R_Date}$$

Let $X = \{ \text{CustID}, \text{R_type} \}$

$X^+ = \{ \text{CustID}, \text{R_Type}, \text{Rating}, \text{Text}, \text{R_Date} \}$

Thus, **Primary key** = **$\{ \text{CustID}, \text{R_type} \}$**

The left side of all the FDs in the minimal set of FDs for the relation 'Review' is $\{ \text{CustID}, \text{R_type} \}$, which is the primary key of this relation, so "Review" is in **BCNF**.

6. 'Payment' Relation :

Attributes : $\{ \text{TransactionID}, \text{Method}, \text{Amount}, \text{Transaction_Date}, \text{Transaction_Status}, \text{CustID}, \text{BookingID}, \text{DID}, \text{AdminID} \}$

Functional Dependencies :

$$\text{TransactionID} \rightarrow \text{Method}$$
$$\text{TransactionID} \rightarrow \text{Amount}$$
$$\text{TransactionID} \rightarrow \text{Transaction_Date}$$
$$\text{TransactionID} \rightarrow \text{Transaction_Status}$$
$$\text{TransactionID} \rightarrow \text{CustID}$$

TransactionID \rightarrow BookingID

TransactionID \rightarrow DID

TransactionID \rightarrow AdminID

Let X = TransactionID

X+ = { TransactionID, Method, Amount, Transaction_Date,
Transaction_Status, CustID, BookingID, DID, AdminID }

Thus, **Primary key = TransactionID**

The left side of all the FDs in the minimal set of FDs for the relation 'Payment' is TransactionID, which is the primary key of this relation, so "Payment" is in **BCNF**.

7. 'Booking' Relation :

Attributes : { BookingID, Booking_Date, Booking_Status, Total_Cost,
No_of_Guests, Checkin_Date, Checkout_Date, CustID, DID,
AdminID }

Functional Dependencies :

BookingID \rightarrow Booking_Date

BookingID \rightarrow Booking_Status

BookingID \rightarrow Total_Cost

BookingID \rightarrow No_of_Guests

BookingID \rightarrow Checkin_Date

BookingID \rightarrow Checkout_Date

BookingID \rightarrow CustID

BookingID \rightarrow DID

BookingID \rightarrow AdminID

Let X = BookingID

X+ = { BookingID, Booking_Date, Booking_Status, Total_Cost, No_of_Guests, Checkin_Date, Checkout_Date, CustID, DID, AdminID }

Thus, **Primary key = BookingID**

The left side of all the FDs in the minimal set of FDs for the relation 'Booking' is BookingID, which is the primary key of this relation, so "Booking" is in **BCNF**.

8. 'Admin' Relation :

Attributes : { AdminID, Password, Type, Fname, Mname, Lname }

Functional Dependencies :

AdminID \rightarrow Password

AdminID \rightarrow Type

AdminID \rightarrow Fname

$\text{AdminID} \rightarrow \text{Mname}$

$\text{AdminID} \rightarrow \text{Lname}$

Let $X = \text{AdminID}$

$X^+ = \{ \text{AdminID}, \text{Password}, \text{Type}, \text{Fname}, \text{Mname}, \text{Lname} \}$

Thus, **Primary key = AdminID**

The left side of all the FDs in the minimal set of FDs for the relation 'Admin' is AdminID, which is the primary key of this relation, so "Admin" is in **BCNF**.

9. 'Admin_Contact' Relation :

Attributes : { AdminID, Contact }

Primary key = { AdminID, Contact }

There are no Functional Dependencies in this relation as the only two attributes are AdminID and Contact, which itself are the primary key.

Thus the relation "Admin_Contact" is in **BCNF**.

10. 'Admin_Email' Relation :

Attributes : { AdminID, Email }

Primary key = { AdminID, Email }

There are no Functional Dependencies in this relation as the only two

attributes are AdminID and Email, which itself are the primary key.

Thus the relation "Admin_Email" is in **BCNF**.

11. 'Non_logged_in_user' Relation :

Attributes : { User_Name, DID }

Primary key = { User_Name, DID }

There are no Functional Dependencies in this relation as the only two attributes are User_Name and DID, which itself are the primary key.

Thus the relation "Non_logged_in_user" is in **BCNF**.

12. 'EventsAndFests' Relation :

Attributes : { DID, Event_Name, Event_Date, Description }

Functional Dependencies :

$\{ DID, Event_Name, Event_Date \} \rightarrow Description$

Let $X = \{ DID, Event_Name, Event_Date \}$

$X^+ = \{ DID, Event_Name, Event_Date, Description \}$

Thus, **Primary key = { DID, Event_Name, Event_Date }**

The left side of all the FDs in the minimal set of FDs for the relation 'EventsAndFests' is { DID, Event_Name, Event_Date }, which is the primary key of this relation, so "EventsAndFests" is in **BCNF**.

13. 'Popular_Attractions' Relation :

Attributes : { Popular_Attractions, DID }

Primary key = { Popular_Attractions, DID }

There are no Functional Dependencies in this relation as the only two attributes are Popular_Attractions and DID, which itself are the primary key.

Thus the relation "Popular_Attractions" is in **BCNF**.

14. 'Destination' Relation :

Attributes : { DID, Dname, Country, Description, Best_month_to_visit }

Functional Dependencies :

$DID \rightarrow Dname$

$DID \rightarrow Country$

$DID \rightarrow Description$

$DID \rightarrow Best_month_to_visit$

Let $X = DID$

$X^+ = \{ DID, Dname, Country, Description, Best_month_to_visit \}$

Thus, **Primary key = DID**

The left side of all the FDs in the minimal set of FDs for the relation 'Destination' is DID, which is the primary key of this relation, so "Destination" is in **BCNF**.

15. 'Transportation' Relation :

Attributes : { TransportationID, Price, Capacity, Trans_Type, DID, AdminID }

Functional Dependencies :

TransportationID \rightarrow Price

TransportationID \rightarrow Capacity

TransportationID \rightarrow Trans_Type

TransportationID \rightarrow DID

TransportationID \rightarrow AdminID

Let X = TransportationID

X+ = { TransportationID, Price, Capacity, Trans_Type, DID, AdminID }

Thus, **Primary key = TransportationID**

The left side of all the FDs in the minimal set of FDs for the relation 'Transportation' is TransportationID, which is the primary key of this relation, so "Transportation" is in **BCNF**.

16. 'Accommodation' Relation :

Attributes : { AccommodationID, Atype, Price_per_night, Aname, Availability, Docs_Required, DID, AdminID }

Functional Dependencies :

AccommodationID \rightarrow Atype

AccommodationID \rightarrow Price_per_night

AccommodationID \rightarrow Aname

AccommodationID \rightarrow Availability

AccommodationID \rightarrow Docs_Required

AccommodationID \rightarrow DID

AccommodationID \rightarrow AdminID

Let X = AccommodationID

X⁺ = { AccommodationID, Atype, Price_per_night, Aname, Availability, Docs_Required, DID, AdminID }

Thus, **Primary key = AccommodationID**

The left side of all the FDs in the minimal set of FDs for the relation 'Accommodation' is AccommodationID, which is the primary key of this relation, so "Accommodation" is in **BCNF**.

17. 'Activities' Relation :

Attributes : { ActivityID, Activity_Name, Activity_Type, Price, Duration, Availability, DID, AdminID }

Functional Dependencies :

ActivityID \rightarrow Activity_Name

ActivityID \rightarrow Activity_Type

ActivityID \rightarrow Price

ActivityID \rightarrow Duration

ActivityID \rightarrow Availability

ActivityID \rightarrow DID

ActivityID \rightarrow AdminID

Let X = ActivityID

X+ = { ActivityID, Activity_Name, Activity_Type, Price, Duration, Availability, DID, AdminID }

Thus, **Primary key** = ActivityID

The left side of all the FDs in the minimal set of FDs for the relation 'Activities' is ActivityID, which is the primary key of this relation, so "Activities" is in **BCNF**.

18. 'Refund' Relation :

Attributes : { Refund_Status, BookingID, TransactionID }

Primary key = { Refund_Status, BookingID, TransactionID }

There are no Functional Dependencies in this relation as the only two attributes are Refund_Status, BookingID and TransactionID which itself are the primary key.

Thus the relation "Refund" is in **BCNF**.