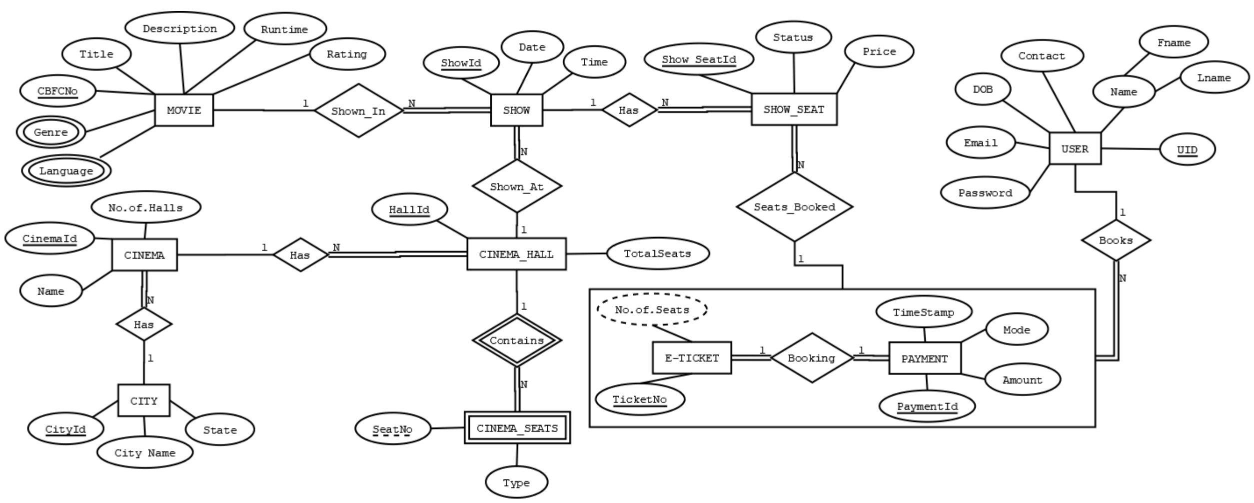
Normalization Proofs

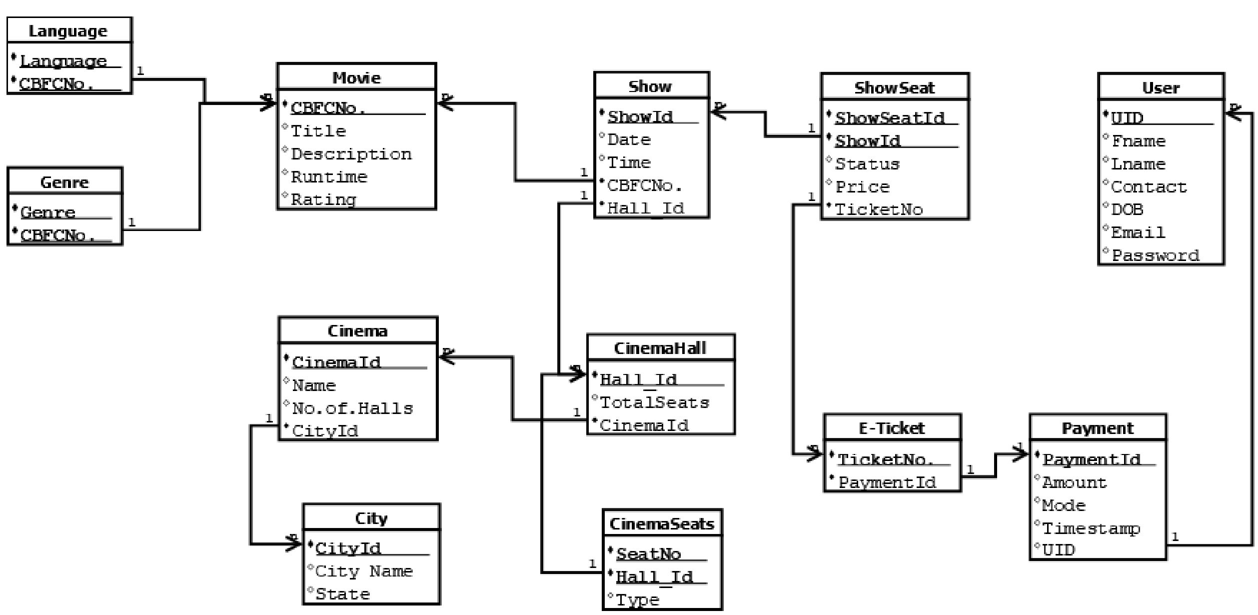
Project Title : Movie Booking System

Group Number : T604

ER Diagram



Relational Schema



Minimal FD Set

CBFC_No ➜ Title

CBFC_No ➜ Description

CBFC_No ➜ Runtime

CBFC_No ➜ Rating

Show_ID ➜ Date

Show_ID ➜ Time

Show_ID ➜ CBFC_No

Show_ID ➜ Hall_ID

Hall_ID ➜ Total_Seats

Hall_ID ➜ Cinema_ID

Cinema_ID ➜ Name

Cinema_ID ➜ No_of_Halls

Cinema_ID ➜ City_ID

City_ID ➜ City_Name

City_ID ➜ State

{Seat_No, Hall_ID} ➜ Type

{Show_Seat_ID, Show_ID} ➜ Status

{Show_Seat_ID, Show_ID} ➜ Price

{Show_Seat_ID, Show_ID} ➜ Ticket_No

Ticket_No ➜ Payment_ID

Payment_ID ➜ Amount

Payment_ID ➜ Mode

Payment_ID ➜ Timestamp

Payment_ID ➜ UID

UID ➜ Fname

UID ➜ Lname

UID ➜ Contact

UID ➜ DOB

UID ➜ Email

UID ➜ Password

Normalization Proof

Proof that the relations are in Boyce-Codd Normal Form (BCNF)

- **'Movie' Relation :**
  - **Attributes :**

    Movie {CBFC_No, Title, Description, Runtime, Rating}

  - **Functional Dependencies :**

    CBFC_No ➜ Title

    CBFC_No ➜ Description

    CBFC_No ➜ Runtime

    CBFC_No ➜ Rating

  Let X = CBFC_No

  X^+ = {CBFC_No, Title, Description, Runtime, Rating}

  So we can Say That X is the Primary Key for the given relation.

  Hence, **Primary Key = CBFC_No**

  For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

  Here, for the relation 'Movie', for every Functional Dependency, the left side is its super-key = CBFC_No.

  Hence, the relation **'Movie' is in BCNF.**

- **‘Language’ Relation :**
    - **Attributes :**

      Language {Language, CBFC_No}

  Let X = CBFC_No

  X^+ = {CBFC_No}

  This value of X does not give us all the attributes of the relation.

  Therefore we take, X = {Language, CBFC_No}

  X^+ = {Language, CBFC_No}

  So we can Say That X is the Primary Key for the given relation.

  Hence, **Primary Key = {Language, CBFC_No}**

  According to the Normal Form Theorem, a relation having only two attributes is always in Boyce-Codd Normal Form.

  Here, the relation ‘Language’ has only two attributes, namely, language and CBFC_No, Hence, the relation **‘Language’ is in BCNF.**

- **‘Genre’ Relation :**
  - **Attributes :**

    Genre {Genre, CBFC_No}

  Let X = CBFC_No

  X^+ = {CBFC_No}

  This value of X does not give us all the attributes of the relation.

  Therefore we take, X = {Genre, CBFC_No}

  X^+ = {Genre, CBFC_No}

  So we can Say That X is the Primary Key for the given relation.

  Hence, **Primary Key = {Genre, CBFC_No}**

  According to the Normal Form Theorem, a relation having only two attributes is always in Boyce-Codd Normal Form.

  Here, the relation ‘Genre’ has only two attributes, namely, genre and CBFC_No, Hence, the relation **‘Genre’ is in BCNF.**

- **‘Show’ Relation :**
    - **Attributes :**

      Show {Show_ID, Date, Time, CBFC_No, Hall_ID}

    - **Functional Dependencies :**

      Show_ID ➜ Date

      Show_ID ➜ Time

      Show_ID ➜ CBFC_No

      Show_ID ➜ Hall_ID

Let X = Show_ID

X^+ = {Show_ID, Date, Time, CBFC_No, Hall_ID}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = Show_ID**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘Show’, for every Functional Dependency, the left side is its super-key = Show_ID.

Hence, the relation **‘Show’ is in BCNF.**

- **‘Cinema Hall’ Relation :**
  - **Attributes :**

    Cinema Hall {Hall_ID, Total_Seats, Cinema_ID}

  - **Functional Dependencies :**

    Hall_ID ➜ Total_Seats

    Hall_ID ➜ Cinema_ID

Let X = Hall_ID

X^+ = {Hall_ID, Total_Seats, Cinema_ID}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = Hall_ID**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘Cinema Hall’, for every Functional Dependency, the left side is its super-key = Hall_ID.

Hence, the relation **‘Cinema Hall’ is in BCNF.**

- **'Cinema' Relation :**
  - **Attributes :**

    Cinema {Cinema_ID, Name, No_of_Halls, City_ID}

  - **Functional Dependencies :**

    Cinema_ID ➜ Name

    Cinema_ID ➜ No_of_Halls

    Cinema_ID ➜ City_ID

Let X = Cinema_ID

X^+ = {Cinema_ID, Name, No_of_Halls, City_ID}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = Cinema_ID**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation 'Cinema', for every Functional Dependency, the left side is its super-key = Cinema_ID.

Hence, the relation **'Cinema' is in BCNF.**

- **‘City’ Relation :**
    - **Attributes :**

      City {City_ID, City_Name, State}

    - Functional Dependencies :

      City_ID ➜ City_Name

      City_ID ➜ State

Let X = City_ID

X^+ = {City_ID, City_Name, State}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = City_ID**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘Cinema Hall’, for every Functional Dependency, the left side is its super-key = City_ID.

Hence, the relation **‘City’ is in BCNF.**

- **‘Cinema Seats’ Relation :**
    - **Attributes :**

      Cinema Seats {Seat_No, Hall_ID, Type}

    - Functional Dependencies :

      {Seat_No, Hall_ID} ➜ Type

Let X = Seat_No

X^{+} = {Seat_No}

This value of X does not give us all the attributes of the relation.

Therefore we take, X = {Seat_No, Hall_ID}

X^{+} = {Seat_No, Hall_ID, Type}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = {Seat_No, Hall_ID}**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘Cinema Seats’, for every Functional Dependency, the left side is its super-key = {Seat_No, Hall_ID}.

Hence, the relation **‘Cinema Seats’ is in BCNF.**

- **‘Show Seat’ Relation :**
    - **Attributes :**

      Show Seat {Show_Seat_ID, Show_ID, Status, Price, Ticket_No}

    - Functional Dependencies :

      {Show_Seat_ID, Show_ID} ➜ Status

      {Show_Seat_ID, Show_ID} ➜ Price

      {Show_Seat_ID, Show_ID} ➜ Ticket_No

Let X = Show_Seat_No

X^+ = {Show_Seat_No}

This value of X does not give us all the attributes of the relation.

Therefore we take, X = {Show_Seat_No, Show_ID}

X^+ = {Show_Seat_ID, Show_ID, Status, Price, Ticket_No}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = {Show_Seat_No, Show_ID}**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘Show Seat’, for every Functional Dependency, the left side is its super-key = {Show_Seat_No, Show_ID}

Hence, the relation **‘Show Seat’ is in BCNF.**

- **‘E Ticket’ Relation :**
  - **Attributes :**

    E Ticket {Ticket_No, Payment_ID}

  - Functional Dependencies :

    Ticket_No ➜ Payment_ID

Let X = Ticket_No

X^+ = {Ticket_No, Payment_ID}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = Ticket_No**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘E Ticket’, for every Functional Dependency, the left side is its super-key = Ticket_No.

Also, according to the Normal Form Theorem, a relation having only two attributes is always in Boyce-Codd Normal Form.

Here, the relation ‘E Ticket’ has only two attributes, namely, Ticket_No and Payment_ID.

Hence, the relation **‘E Ticket’ is in BCNF.**

- **‘Payment’ Relation :**
    - **Attributes :**

      Payment {Payment_ID, Amount, Mode, Timestamp, UID}

    - Functional Dependencies :

      Payment_ID ➜ Amount

      Payment_ID ➜ Mode

      Payment_ID ➜ Timestamp

      Payment_ID ➜ UID

Let X = Payment_ID

X^+ = {Payment_ID, Amount, Mode, Timestamp, UID}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = Payment_ID**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘Payment’, for every Functional Dependency, the left side is its super-key = Payment_ID.

Hence, the relation **‘Payment’ is in BCNF.**

- **‘User’ Relation :**
  - **Attributes :**

    User {UID, Fname, Name, Contact, DOB, Email, Password}

  - Functional Dependencies :

    UID ➜ Fname

    UID ➜ Lname

    UID ➜ Contact

    UID ➜ DOB

    UID ➜ Email

    UID ➜ Password

Let X = UID

X^+ = {UID, Fname, Name, Contact, DOB, Email, Password}

So we can Say That X is the Primary Key for the given relation.

Hence, **Primary Key = UID**

For a relation R to be in Boyce-Codd Normal Form, for every Functional Dependency A → B that holds on relation on R, A is its super-key.

Here, for the relation ‘User’, for every Functional Dependency, the left side is its super-key = UID.

Hence, the relation **‘User’ is in BCNF.**