Proof that relations are in Boyce-Codd Normal Form

1. 'Users' Relation :

- **Attributes :**
    Users{User_id,Gender,Account_type,Fname,Lname,DOB,Is_verified,Bio,Password,Profile_pic}

- ❖ **Functional Dependencies:**
    - ➢ User_id → Gender
    - ➢ User_id → Account_type
    - ➢ User_id → Fname
    - ➢ User_id → Lname
    - ➢ User_id → DOB
    - ➢ User_id → Is_verified
    - ➢ User_id → Bio
    - ➢ User_id → Password
    - ➢ User_id → Profile_pic

Let A = User_id,
Computing the attribute closure,
A^+ = {User_id, Gender, Account_type, Fname, Lname, DOB, Is_verified, Bio, Password, Profile_pic}

Thus, **Primary Key = User_id**

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

2. 'Post' Relation :

● **Attributes :**
  Post{Post_id,User_id,Caption,Video,Song,Image,Location,Post_time}

❖ **Functional Dependencies:**
  ➢ Post_id → User_id
  ➢ Post_id → Caption
  ➢ Post_id → Video
  ➢ Post_id → Song
  ➢ Post_id → Image
  ➢ Post_id → Location
  ➢ Post_id → Post_time

Let A = Post_id,
Computing the attribute closure,
A^+ =
{Post_id,User_id,Caption,Video,Song,Image,Location,Post_time}

Thus, **Primary Key = Post_id**

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

3. 'Post_comment' Relation :

- **Attributes :**
  Post_comment{Post_cmt_id,User_id,Post_id,Comment_time,TeAt_content}

- ❖ **Functional Dependencies:**
  - ➢ Post_cmt_id → User_id
  - ➢ Post_cmt_id → Post_id
  - ➢ Post_cmt_id → Comment_time
  - ➢ Post_cmt_id → TeAt_content

Let A = Post_cmt_id,
Computing the attribute closure,
A^+ = {Post_cmt_id,User_id,Post_id,Comment_time,TeAt_content}

Thus, **Primary Key = Post_cmt_id**

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

4. 'Groups' Relation :

- **Attributes :**
  Groups{Group_id, Group_name, Description, Date_created}

- ❖ **Functional Dependencies:**
  - ➢ Group_id → Group_name
  - ➢ Group_id → Description
  - ➢ Group_id → Date_created

Let A = Group_id,
Computing the attribute closure,
A^+ = {Group_id, Group_name, Description, Date_created}

Thus, **Primary Key = Group_id**

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

5. 'Post_likes' Relation :

- **Attributes :**
  Post_likes{Post_like_id, Like_time, User_id, Post_id}

- ❖ **Functional Dependencies:**
  - ➢ Post_like_id → Like_time
  - ➢ Post_like_id → User_id
  - ➢ Post_like_id → Post_id

Let A = Post_like_id,
Computing the attribute closure,
A^+ = {Post_like_id, Like_time, User_id, Post_id}

Thus, **Primary Key = Post_like_id**

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

6. 'Comment_Like' Relation :

- **Attributes :**
    Comment_Like{Comment_like_time, Comment_like_id, User_id, Post_cmt_id}

- ❖ **Functional Dependencies:**

    ➢ Comment_like_id → comment_like_time
    ➢ Comment_like_id → User_id
    ➢ Comment_like_id → Post_cmt_id

Let A = comment_like_id,
Computing the attribute closure,
A^+ = {comment_like_time, comment_like_id, User_id, post_cmt_id}

Thus, **Primary Key = comment_like_id**

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

7. 'Collection' Relation :

- **Attributes :**
  Collection{Collection_name, Description, Creation_date}

- ❖ **Functional Dependencies:**
  - ➢ Collection_name → Description
  - ➢ Collection_name → Creation_date

Let A = Collection_name,
Computing the attribute closure,
A^+ = {Collection_name, Description, Creation_date}

Thus, **Primary Key = Collection_name**

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

8. 'Ad' Relation :

- **Attributes :**

  Ad{Organizer_name, URL, TeAt_content}

- ❖ **Functional Dependencies:**
  - ➢ Organizer_name → URL
  - ➢ Organizer_name → TeAt_content

Let A = Organizer_name,
Computing the attribute closure,
A^+ = {Organizer_name, URL, TeAt_content}

Thus, **Primary Key = Organizer_name**

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

9. 'Tag' Relation :

- **Attributes :**

  Tag{User_id, Post_id}

Here **Primary key = {User_id,Post_id}** are the only attributes of the 'Tag' Relation so by the Theorem of Boyce-Codd Normal form , the relation **'Tag' is in BCNF.**

10. 'Placed_as' Relation :

- **Attributes :**
  Placed_as{Post_id, Organizer_name}

Here **Primary key = {Post_id, Organizer_name}** are the only attributes of the 'Placed_as' Relation so by the Theorem of Boyce-Codd Normal form , the relation **'Placed_as' is in BCNF.**

11. 'Saved_as' Relation :

- **Attributes :**
  Saved_as{Post_id, Collection_name}

Here **Primary key = {Post_id, Collection_name}** are the only attributes of the 'Saved_as' Relation so by the Theorem of Boyce-Codd Normal form , the relation **'Saved_as' is in BCNF.**

12. 'User_email' Relation :

- **Attributes :**
  User_email{User_id, Email_id}

Here **Primary key = {User_id, Email_id}** are the only attributes of the 'User_email' Relation so by the Theorem of Boyce-Codd Normal form , the relation **'User_email' is in BCNF.**

13. 'User_contact' Relation :

- **Attributes :**
  User_contact{User_id, Contact_no}

Here **Primary key = {User_id, Contact_no}** are the only attributes of the 'User_contact' Relation so by the Theorem of Boyce-Codd Normal form , the relation **'User_contact' is in BCNF.**

14. 'Follow' Relation :

- **Attributes :**
  Follow{Follower_id, Followee_id}

Here **Primary key = {Follower_id, Followee_id}** are the only attributes of the 'Follow' Relation so by the Theorem of Boyce-Codd Normal form , the relation **'Follow' is in BCNF.**

15. 'In' Relation :

- **Attributes :**
  In{Group_id, User_id}

Here **Primary key = {Group_id, User_id}** are the only attributes of the 'In' Relation so by the Theorem of Boyce-Codd Normal form , the relation **'In' is in BCNF.**

16. 'Message' Relation :

- **Attributes :**
    Message{Content, Message_timestamp, Receivedby_grp, Receivedby_user, Sendby_user}

- ❖ **Functional Dependencies:**
    - ➢ {Message_timestamp,Receivedby_user, Sendby_user}→Content

    - ➢ {Message_timestamp, Receivedby_user, Sendby_user} → Receivedby_grp

Let A = {Message_timestamp,Receivedby_user, Sendby_user}, Computing the attribute closure,
A^+ = {Content, Message_timestamp, Receivedby_grp, Receivedby_user, Sendby_user}

Thus, **Primary Key = {Message_timestamp,Receivedby_user, Sendby_user}**

The left side of all FDs in the minimal set of FDs for the relation 'Message' is {Message_timestamp,Receivedby_user, Sendby_user}, which is the primary key of this relation, so **"Message" is in BCNF.**