

Schema Refinement and Normalization

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1 Definitions of BCNF and 3NF

For all $X \rightarrow A \in F^+$

BCNF:

1. $A \in X$ or
2. X is a superkey.

3NF:

1. $A \in X$ or
2. X is a superkey or
3. A is part of some key for R .
4. q11 is skipped for the time being

2 Edge Cases Connector Cannot Catch Yet

1. Each movie must have at least one genre - Currently, *has_genre* table can exclude
2. Users can rate a movie if they are already subscribed to the platform that the movie can be rated. AND – if they have bought a ticket to the movie.
3. Q7 - If a film has many theatre ids
4. How to create only four time slots per day
5. q11 - add the new movie id to the director who logged into the system

3 Changes Made to the first ER Diagram

1. The foreign key condition in the Director table is updated to make sure the platform id in the Movies has the same platform of its director:

FOREIGN KEY (username, platform id) REFERENCES Director(username, platform id)

2. The primary key condition in the Director table is converted to UNIQUE constraint to allow directors to have no platforms:

UNIQUE (username, platform_id)

3. A constraint is added to Movie Sessions only to allow 4 different time slots per day:

CONSTRAINT CHK-TimeSlot CHECK (time slot between 1 and 4)

4. Check condition is added to Ratings to ensure only ratings between 0 and 5 are allowed:

CHECK rating-check (rating between 0 and 5)

5. A new table named *AverageRatings* is created

4 Relations and Their Normal Forms

Note, R represents all the attributes for a given relation. FDs include all functional dependencies for a given relation. Additionally, there have been made some assumptions about some attributes to ensure all functional dependencies of a given relation are included, although the absence of those assumptions would not change whether a given relation is in BCNF. For instance, we assumed that the movie name uniquely determines movie id, duration, etc.

4.1 User

User(username, password, name, surname)

FDs:

1. username \rightarrow R

User satisfies BCNF as username is a superkey (actually the primary key).

4.2 Rating Platform

Rating Platform(platform id, platform name,)

FDs:

1. (platform id, platform name) \rightarrow R

Rating Platform is in BCNF as both platform id and platform are the only two attributes and together primary key.

4.3 Directors

Directors(username)

The Directors table has only one attribute. The relation with rating platforms, movies, etc, will be represented through foreign keys in other tables.

FDs:

1. $\text{username} \rightarrow R$

Directors satisfies BCNF as username is a superkey.

4.4 Nations

Nations(nation)

Similarly, the Nations table has only one attribute, and its relation with directors will be represented through foreign keys in other tables.

FDs:

1. $\text{nation} \rightarrow R$

The Nations table satisfies BCNF as the username is a superkey..

4.5 Audience

Audience(username)

Finally, the Audience table has only one attribute as well and serves as an abstract table.

FDs:

1. $\text{username} \rightarrow R$

Audience satisfies BCNF as username is a superkey.

4.6 Ratings

Ratings(username, movie id, rating)

FDs:

1. $(\text{username, movie id}) \rightarrow R$

Ratings satisfies BCNF as username is a primary key.

4.7 Movies

Movies(movie id, duration, movie name,)

FDs:

1. $\text{movie id} \rightarrow R$
2. $\text{movie name} \rightarrow R$

Movies satisfies BCNF as username is a primary key and the movie name is unique.

4.8 Predecessors

Predecessors(movie id, predecessor)

FDs:

1. (movie id, predecessor) \rightarrow R

Predecessor is naturally in BCNF as the only two attributes together are primary key and hence satisfy the condition 2 for BCNF.

4.9 Genres

Genres(genre id, genre name)

FDs:

1. genre id \rightarrow R
2. genre name \rightarrow R

The Genres table satisfies condition 2 for BCNF and hence is in BCNF since both genre id and genre name are superkeys.

4.10 Theatre Location

Theatre Location(theatre id, theatre name, theatre district, theatre capacity)

FDs:

1. theatre id \rightarrow R

Theatre Location satisfies condition 2 for BCNF and is in BCNF.

4.11 Movie Sessions

Movie Sessions(session id, date, theatre id)

FDs:

1. session id \rightarrow R

The Movie Sessions table satisfies condition 2 for BCNF and is in BCNF.

4.12 Database Managers

Database Managers(username, password)

FDs:

1. username \rightarrow R

The Database Managers table satisfies condition 2 for BCNF and is in BCNF.

4.13 Nationality

Nationality(username, nation)

FDs:

1. $\text{username} \rightarrow \text{R}$

The Nationality is in BCNF as it satisfies the condition 2 for BCNF.

4.14 Rate

Rate(username, movie id, rating)

FDs:

1. $(\text{username}, \text{movie id}) \rightarrow \text{R}$

The Rate table is in BCNF as it satisfies condition 2 for BCNF as username and movie id are together primary key.

4.15 Genre

Genre(movie id, genre id)

FDs:

1. $\text{movie id} \rightarrow \text{R}$

The Genre table is in BCNF as it satisfies condition 2 for BCNF.

4.16 Subscription

Subscription(username, platform id, movie id)

FDs:

1. $(\text{username}, \text{platform id}, \text{movie id}) \rightarrow \text{R}$

The Subscription table is in BCNF as it satisfies condition 2 for BCNF (all attributes are together defined as primary key Subscription).

4.17 Bought

Bought(username, session id, movie id)

FDs:

1. $(\text{username}, \text{session id}, \text{movie id}) \rightarrow \text{R}$

The Bought table is in BCNF as it satisfies condition 2 for BCNF (all attributes are together defined as primary key Subscription again).

4.18 Subscription

Subscription(username, platform id, movie id)

FDs:

1. (username, platform id, movie id) \rightarrow R

The Subscription table is in BCNF as it satisfies condition 2 for BCNF (all attributes are together defined as primary key Subscription).

4.19 Bought

Bought(username, session id, movie id)

FDs:

1. (username, session id, movie id) \rightarrow R

The Bought table is in BCNF as it satisfies condition 2 for BCNF (all attributes are together defined as primary key Subscription).

4.20 Filmed

Filmed(session id, movie id, theatre id, time slot)

FDs:

1. (session id, movie id, theatre id) \rightarrow R

The Filmed table satisfies the second condition for BCNF and is in BCNF.

4.21 Directed By

Directed By(movie id, username)

FDs:

1. movie id \rightarrow R

The Directed By table satisfies the second condition for BCNF and is in BCNF.

4.22 Agreement

Agreement(username, platform id)

FDs:

1. (username, platform id) \rightarrow R

The Agreement table is in BCNF since it satisfies the second condition of BCNF.