Minimal FD Set

channel_id -> channel_name
channel_id -> description
channel_id -> creation_date
channel_id -> last_login
channel_id -> channel_link
channel_id -> creator_id
channel_link -> channel_id
user_id -> name
user_id -> date_join
user_id -> password
user_id -> last_visited
user_id -> email_id
user_id -> dob
user_id -> country
email_id -> user_id
video_id -> title
video_id -> video_len
video_id -> video_size
video_id -> upload_date
video_id -> video_link
video_id -> description
video_id -> thumbnail_link
video_id -> captions_link
video_id -> license
video_id -> viewability
video_id -> channel_id
video_link -> video_id
thumbnail_link -> video_id
captions_link -> video_id
comment_id -> text
comment_id -> update_time
comment_id -> user_id
comment_id -> video_id
reply_comment_id -> org_comment_id
{user_id,video_id} -> like
{user_id,video_id} -> update_time

playlist_id -> title
playlist_id -> access
playlist_id -> description
playlist_id -> user_id
stream_id -> title
stream_id -> description
stream_id -> stream_link
stream_id -> thumbnail_link
stream_id -> view
stream_id -> Quality
stream_id -> start_time
stream_id -> end_time
stream_link -> stream_id
thumbnail_link -> stream_id
{user_id,stream_id} -> chat
{user_id,stream_id} -> chat_time
{user_id,stream_id} -> amount
{user_id,stream_id} -> chat
{user_id,stream_id} -> chat_time
{user_id,channel_id} -> notification_type
subscription_id -> user_id
subscription_id -> transaction_time
subscription_id -> payment_method
type -> duration
type -> amount
{user_id,channel_id} -> transaction_time
{user_id,channel_id} -> payment_method
{user_id,channel_id} -> amount
{channel_id,revenue_date} -> monthly_revenue
ad_id -> ad_url
ad_id -> redirect_url
ad_id -> ad_type
ad_id -> ad_from
ad_id -> amount_per_ad
ad_id -> no_of_ad
ad_id -> ad_duration
ad_id -> ad_category
ad_url -> ad_id
join_type -> amount
join_type -> duration

Proof that relations are in BCNF

1) channel :

```
channel_id -> channel_name
channel_id -> description
channel_id -> creation_date
channel_id -> last_login
channel_id -> channel_link
channel_id -> creator_id
channel_link -> channel_name
channel_link -> description
channel_link -> creation_date
channel_link -> last_login
channel_link -> channel_id
channel_link -> creator_id
```

- Here,
  $\{channel\_id\}^+$ = {channel_id,channel_name,creation_date,last_login,channel_link,creator_id}, also
  $\{channel\_link\}^+$ = {channel_id,channel_name,creation_date,last_login,channel_link,creator_ids}

- Therefore channel_id and channel_link both are candidate key and hence it is in BCNF normal form.

2) user :

```
user_id -> name
user_id -> date_join
user_id -> password
user_id -> last_visited
user_id -> email_id
```

```
user_id -> channel_id
user_id -> dob
user_id -> country
email_id -> name
email_id -> date_join
email_id -> password
email_id -> last_visited
email_id -> user_id
email_id -> channel_id
email_id -> dob
email_id -> country
```

- Here ,
  $\{user\_id\}^+$ =
  {user_id,name,password,last_visited,email_id,channel_id,dob,country},
  $\{email\_id\}^+$ =
  {user_id,name,password,last_visited,email_id,channel_id,dob,country}

- Therefore user_id and email_id are candidate keys and hence it is BCNF normal form .

3) video :

```
video_id -> title
video_id -> video_len
video_id -> video_size
video_id -> upload_date
video_id -> video_link
video_id -> description
video_id -> thumbnail_link
video_id -> captions_link
video_id -> license
video_id -> viewability
video_id -> channel_id
video_link -> title
video_link -> video_len
video_link -> video_size
video_link -> upload_date
video_link -> video_id
video_link -> description
```

video_link -> thumbnail_link
video_link -> captions_link
video_link -> license
video_link -> viewability
video_link -> channel_id
thumbnail_link -> title
thumbnail_link -> video_len
thumbnail_link -> video_size
thumbnail_link -> upload_date
thumbnail_link -> video_link
thumbnail_link -> description
thumbnail_link -> video_id
thumbnail_link -> captions_link
thumbnail_link -> license
thumbnail_link -> viewability
thumbnail_link -> channel_id
captions_link -> video_id
captions_link -> title
captions_link -> video_len
captions_link -> video_size
captions_link -> upload_date
captions_link -> video_link
captions_link -> description
captions_link -> thumbnail_link
captions_link -> license
captions_link -> viewability
captions_link -> channel_id

- Here,
  $\{video\_id\}^+$ =
  {video_id,title,video_len,video_size,upload_date,video_link,
  description,upload_quality,
  thumbnail_link,captions_link,license,viewability,channel_id}
  $\{video\_link\}^+$ =
  {video_id,title,video_len,video_size,upload_date,video_link,
  description,upload_quality,
  thumbnail_link,captions_link,license,viewability,channel_id}
  $\{thumbnail\_link\}^+$ =
  {video_id,title,video_len,video_size,upload_date,video_link,
  description,upload_quality,

thumbnail_link,captions_link,license,viewability,channel_id}
{captions_link}$^+$ =
{video_id,title,video_len,video_size,upload_date,video_link,
description,upload_quality,
thumbnail_link,captions_link,license,viewability,channel_id}

- Therefore video_id,video_link,thumbnail_link,captions_link are candidate keys and hence it is in BCNF normal form.

4) reports :

{user_id,video_id} -> reason

- Here,
  {user_id,video_id}$^+$ = {user_id,video_id,reason}
- Therefore {user_id,video_id} is key and hence it is in BCNF normal form .

5) comment :

comment_id -> text
comment_id -> update_time
comment_id -> user_id
comment_id -> video_id

- Here,
  {comment_id}$^+$ = {comment_id,text,update_time,user_id,video_id}
- Therefore comment_id is key and hence it is in BCNF normal form .

6) reply :

reply_comment_id -> org_comment_id

- Here,
  $\{reply\_comment\_id\}^+ = \{reply\_comment\_id, org\_comment\_id\}$

- Therefore reply_comment_id is key and hence it is in BCNF normal form.

7) like_dislike :

```
{user_id,video_id} -> reaction
{user_id,video_id} -> update_time
```

- Here,
  $\{user\_id, video\_id\}^+ = \{video\_id, user\_id, reaction, update\_time\}$

- Therefore {user_id,video_id} is key and hence it is in BCNF normal form.

8) view :

- There is no projected fd for this relation Since all attributes together forms candidate key and hence it is in a BCNF normal form .

9) playlist :

```
playlist_id -> title
playlist_id -> access
playlist_id -> description
playlist_id -> creator_id
```

- Here,
  $\{playlist\_id\}^+ = \{title, access, description, creation\_id\}$

- Therefore playlist_id is key and hence it is in BCNF normal form .

10) playlist_video :

- There is no projected fd for this relation and hence candidate key is all attributes and hence it is in BCNF normal form .

11) live_stream :

stream_id -> title
stream_id -> description
stream_id -> stream_link
stream_id -> thumbnail_link
stream_id -> view
stream_id -> Quality
stream_id -> start_time
stream_id -> end_time
stream_link -> title
stream_link -> description
stream_link -> stream_id
stream_link -> thumbnail_link
stream_link -> view
stream_link -> Quality
stream_link -> start_time
stream_link -> end_time
thumbnail_link -> title
thumbnail_link -> description
thumbnail_link -> stream_link
thumbnail_link -> stream_id
thumbnail_link -> view
thumbnail_link -> Quality
thumbnail_link -> start_time
thumbnail_link -> end_time

- Here,
  $\{stream\_id\}^+$ =
  {stream_id,title,description,stream_link,view,quality,start_time, end_time}
  $\{stream\_link\}^+$ =
  {stream_id,title,description,stream_link,view,quality,start_time, end_time}
  $\{thumbnail\_link\}^+$ =
  {stream_id,title,description,stream_link,view,quality,start_time, end_time}

- Therefore stream_id,stream_link and thumbnail_link are candidate keys and Hence it is in BCNF normal form.

12) stream_tags :

- There is no projected fd for this relation and hence candidate key is all attributes and hence it is in BCNF normal form .

13) live_chat :

{user_id,stream_id} -> chat
{user_id,stream_id} -> chat_time

- Here,
  $\{user\_id,stream\_id\}^+ = \{user\_id,stream\_id,chat,chat\_time\}$
- Therefore {user_id,stream_id} is key and hence it is in BCNF normal form.

14) super_chat :

{user_id,stream_id} -> amount
{user_id,stream_id} -> chat
{user_id,stream_id} -> chat_time

- Here,
  $\{user\_id,stream\_id\}^+ = \{user\_id,stream\_id,amount,chat,chat\_time\}$

- Therefore {user_id,stream_id} is key and hence it is in BCNF normal form.

15) live_watching :

- There is no projected fd for this relation and hence candidate key is all attributes and hence it is in BCNF normal form .

16) added_to :

- There is no projected fd for this relation and hence candidate key is all attributes and hence it is in BCNF normal form .

17) saved :

- There is no projected fd for this relation Since all attributes together form the candidate key Hence it is in a BCNF normal form.

18) subscribes :

```
{user_id,channel_id} -> notification_type
```

- Here,
  $\{user\_id,channel\_id\}^+ = \{channel\_id,user\_id,notification\_type\}$
- Therefore {user_id,channel_id} is key and hence it is in BCNF normal form .

19) subscription :

```
subscription_id -> user_id
subscription_id -> transaction_time
subscription_id -> payment_method
```

- Here,
  $\{subscription\_id\}^+ =$
  {subscription_id,user_id,transaction_time,payment_mehod}
- Therefore subscription_id is key and hence it is in BCNF normal form .

20) subscription_type :

```
type -> duration
type -> amount
```

- Here,
  $\{type\}^+ = \{type,duration,amount\}$
- Therefore type is key and hence it is in BCNF normal form .

21) joins :

{user_id,channel_id} -> transaction_time
{user_id,channel_id} -> payment_method

- Here,
  $\{user\_id,channel\_id\}^+$ =
  {user_id,channel_id,payment_method,transaction_time}
- Therefore {user_id,channel_id} is key and hence it is in BCNF normal form .

22) category :

- There is no projected fd for this relation Since all attributes together form the candidate key Hence it is in a BCNF normal form.

23) tags :

- There is no projected fd for this relation Since all attributes together form the candidate key Hence it is in a BCNF normal form.

24) ad_impression :

- There is no projected fd for this relation Since all attributes together form the candidate key Hence it is in a BCNF normal form.

25) ad_conversion :

- There is no projected fd for this relation Since all attributes together form the candidate key Hence it is in a BCNF normal form.

26) revenue :

{channel_id,revenue_date} -> monthly_revenue

- Here,
  $\{channel\_id,revenue\_date\}^+$ = {channel_id,revenue_date,monthly_revenue}

- Therefore {channel_id,revenue_date} is key and hence it is in BCNF normal form .

27) ads :

```
ad_id -> ad_url
ad_id -> redirect_url
ad_id -> ad_type
ad_id -> ad_from
ad_id -> amount_per_ad
ad_id -> no_of_ad
ad_id -> ad_duration
ad_id -> ad_category
ad_url -> ad_id
ad_url -> redirect_url
ad_url -> ad_type
ad_url -> ad_from
ad_url -> amount_per_ad
ad_url -> no_of_ad
ad_url -> ad_duration
ad_url -> ad_category
```

- Here,
  $\{ad\_id\}^+$ =
  {ad_id,ad_url,redirect_url,ad_type,ad_from,amount_per_ad,no_of_ad, ad_duration}
  $\{ad\_url\}^+$ =
  {ad_url,ad_id,redirect_url,ad_type,ad_from,amount_per_ad,no_of_ad, ad_duration}

- Therefore ad_id and ad_url are candidate keys and Hence it is in BCNF normal form.

28) Join_type :

```
join_type -> amount
join_type -> duration
```

- Here,

$\{type\}^+ = \{join\_type,amount,duration\}$

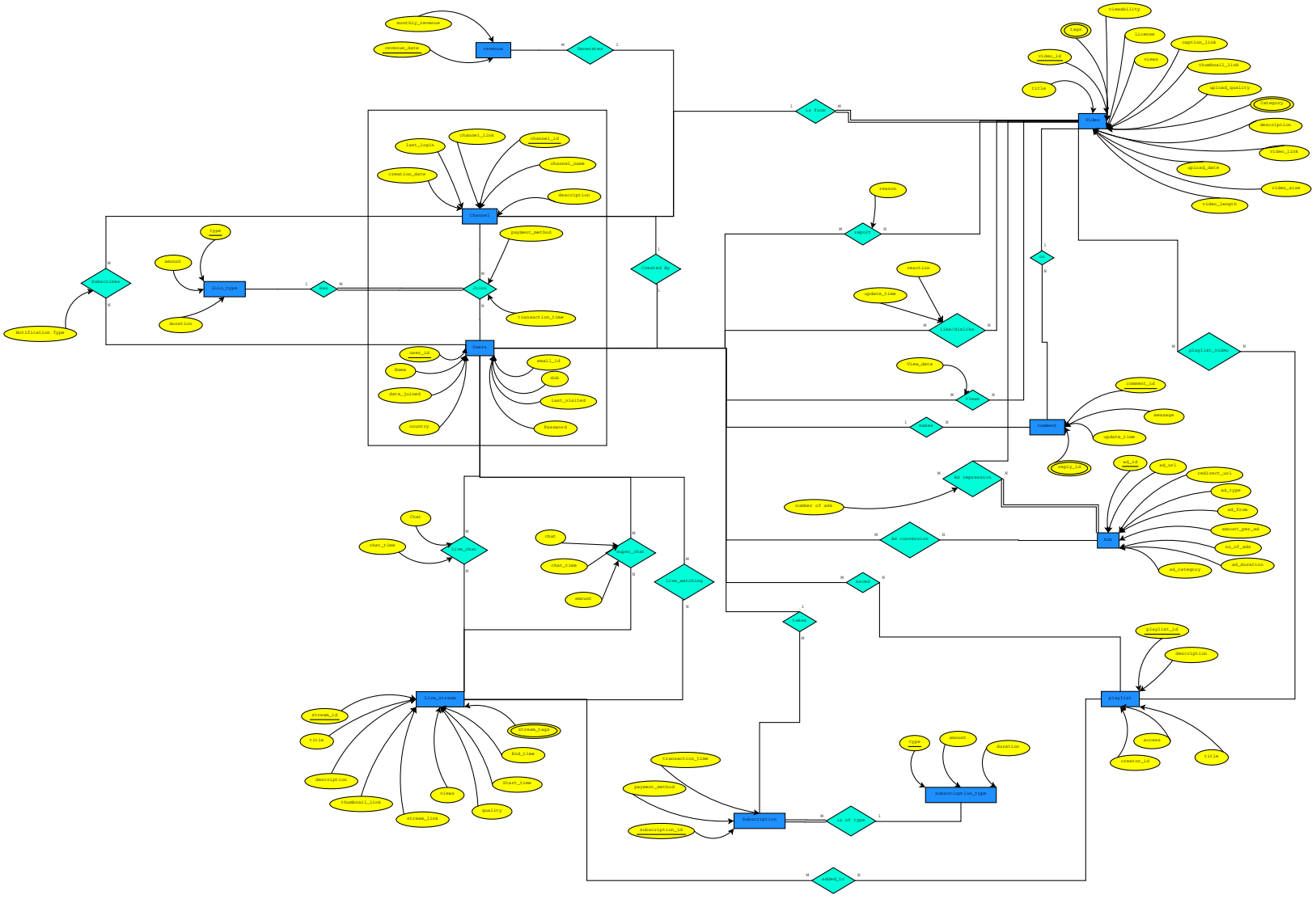
- Therefore join_type is candidate key and hence it is in BCNF normal form

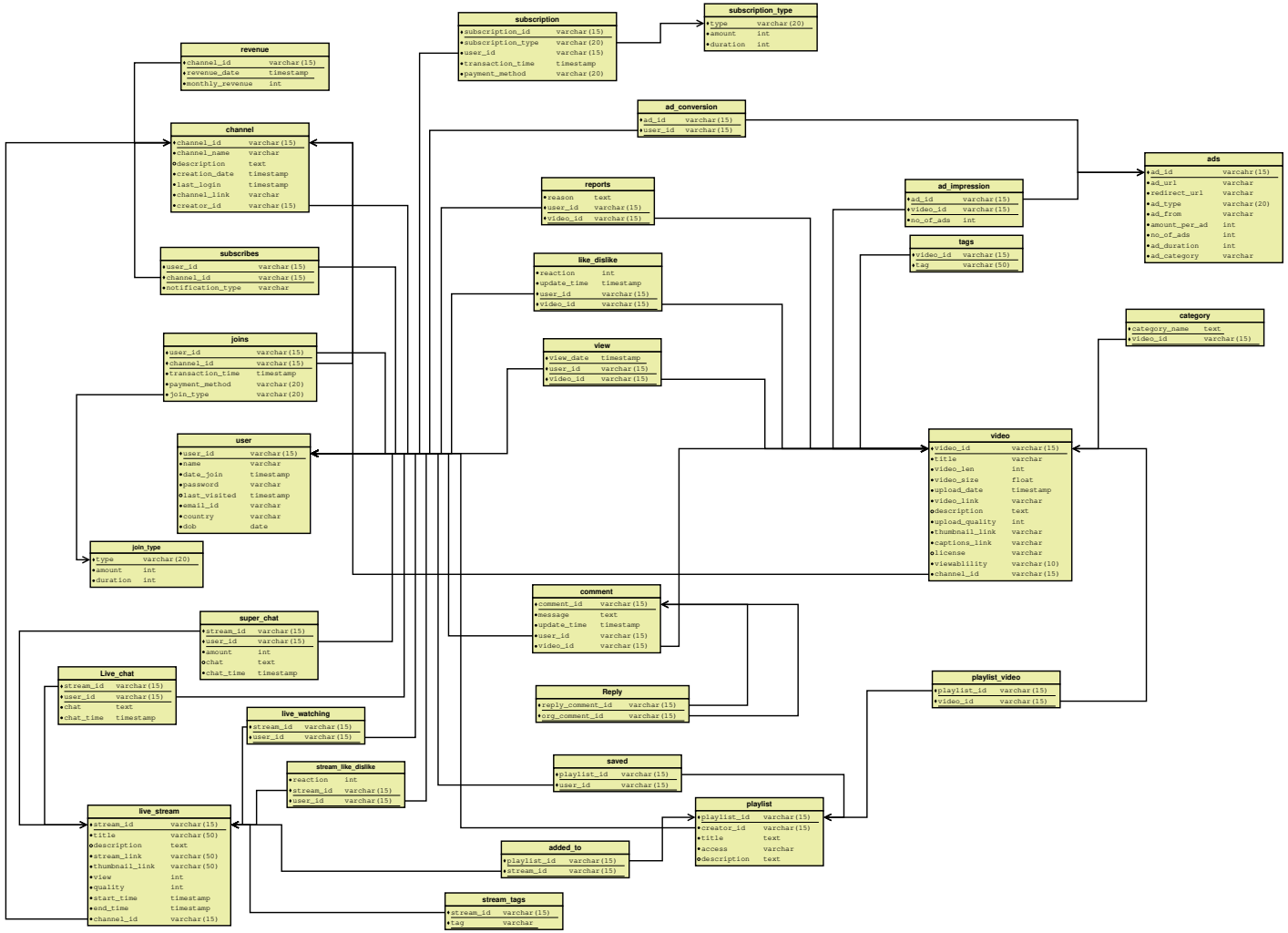
29) Stream_like_dislike :

$\{stream\_id,user\_id\} \rightarrow reaction$

- Here,
  $\{stream\_id,user\_id\}^+ = \{steam\_id,user\_id,reaction\}$

- Therefore $\{stream\_id,user\_id\}$ is candidate key and Hence it is in BCNF normal form


monthly_revenue
revenue_date
revenue
generates
viewability
user
license
video_id
views
caption_link
title
thumbnail_link
upload_quality
category
description
video_link
upload_date
video_size
video_length
is from
last_login
channel_link
channel_id
creation_date
channel_name
description
Channel
type
amount
payment_method
duration
transaction_time
Join_type
Join
Pay
Subscribes
Notification type
created by
User
user_id
email_id
name
dob
date_joined
last_visited
country
password
report
reason
reaction
update_time
like/dislike
View
View date
playlist_video
comment_id
message
update_time
reply_id
Comment
make
Ad impression
Number of ads
ad_id
ad_url
redirect_url
ad_type
ad_from
amount_per_ad
no_of_ads
ad_duration
ad_category
Ad
Ad conversion
chat
chat_time
live_chat
chat
chat_time
amount
super_chat
live_watching
save
add
playlist_id
description
Playlist
access
creator_id
title
live_stream
stream_id
title
description
thumbnail_link
stream_link
stream_type
duration
start_time
views
quality
transaction_time
payment_method
subscription_id
Subscription
is of type
type
amount
duration
subscription_type
added_to


revenue
channel_id varchar(15)
revenue_date timestamp
monthly_revenue int
subscription
subscription_id varchar(15)
subscription_type varchar(20)
user_id varchar(15)
transaction_time timestamp
payment_method varchar(20)
subscription_type
type varchar(20)
amount int
duration int
ad_conversion
ad_id varchar(15)
user_id varchar(15)
channel
channel_id varchar(15)
channel_name varchar
description text
creation_date timestamp
last_login timestamp
channel_link varchar
creator_id varchar(15)
reports
reason text
user_id varchar(15)
video_id varchar(15)
ad_impression
ad_id varchar(15)
video_id varchar(15)
no_of_ads int
ads
ad_id varcahr(15)
ad_url varchar
redirect_url varchar
ad_type varchar(20)
ad_from varchar
amount_per_ad int
no_of_ads int
ad_duration int
ad_category varchar
tags
video_id varchar(15)
tag varchar(50)
subscribes
user_id varchar(15)
channel_id varchar(15)
notification_type varchar
like_dislike
reaction int
update_time timestamp
user_id varchar(15)
video_id varchar(15)
category
category_name text
video_id varchar(15)
joins
user_id varchar(15)
channel_id varchar(15)
transaction_time timestamp
payment_method varchar(20)
join_type varchar(20)
view
view_date timestamp
user_id varchar(15)
video_id varchar(15)
user
user_id varchar(15)
name varchar
date_join timestamp
password varchar
last_visited timestamp
email_id varchar
country varchar
dob date
video
video_id varchar(15)
title varchar
video_len int
video_size float
upload_date timestamp
video_link varchar
description text
upload_quality int
thumbnail_link varchar
captions_link varchar
license varchar
viewablility varchar(10)
channel_id varchar(15)
join_type
type varchar(20)
amount int
duration int
comment
comment_id varchar(15)
message text
update_time timestamp
user_id varchar(15)
video_id varchar(15)
super_chat
stream_id varchar(15)
user_id varchar(15)
amount int
chat text
chat_time timestamp
Live_chat
stream_id varchar(15)
user_id varchar(15)
chat text
chat_time timestamp
Reply
reply_comment_id varchar(15)
org_comment_id varchar(15)
playlist_video
playlist_id varchar(15)
video_id varchar(15)
live_watching
stream_id varchar(15)
user_id varchar(15)
saved
playlist_id varchar(15)
user_id varchar(15)
stream_like_dislike
reaction int
stream_id varchar(15)
user_id varchar(15)
playlist
playlist_id varchar(15)
creator_id varchar(15)
title text
access varchar
description text
live_stream
stream_id varchar(15)
title varchar(50)
description text
stream_link varchar(50)
thumbnail_link varchar(50)
view int
quality int
start_time timestamp
end_time timestamp
channel_id varchar(15)
added_to
playlist_id varchar(15)
stream_id varchar(15)
stream_tags
stream_id varchar(15)
tag varchar