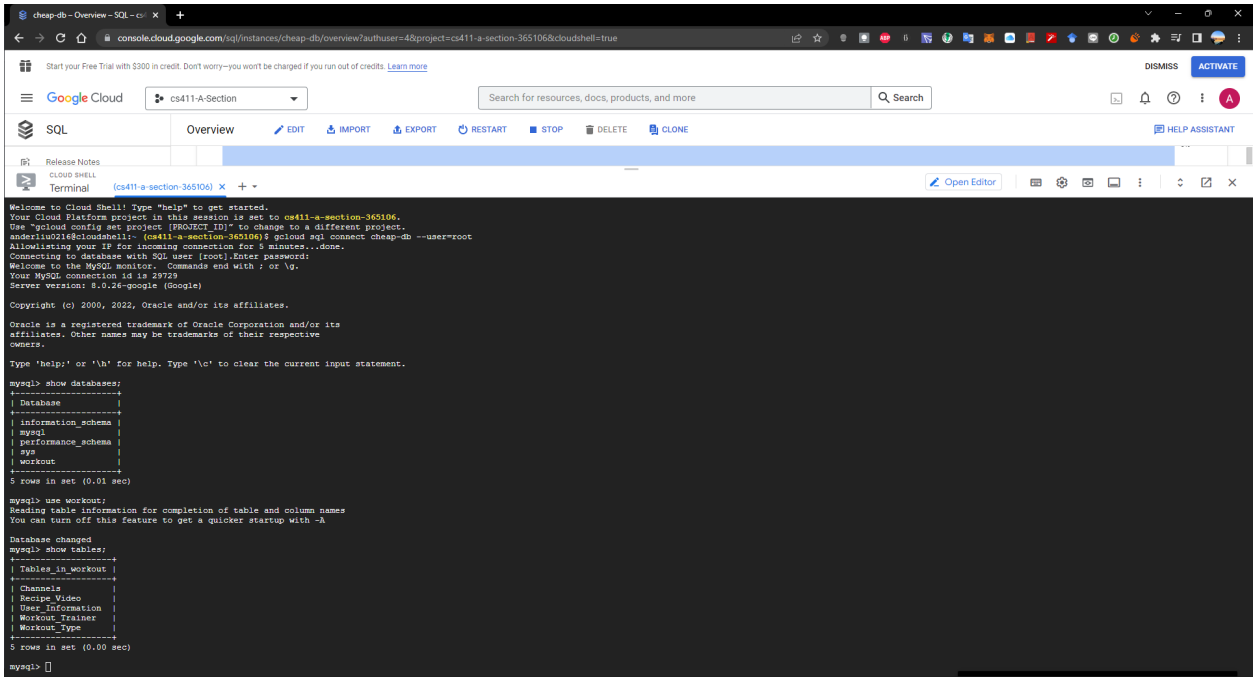
Project Stage 3

In project stage 3, we created a database with four tables, including a table for channel information, a table for workout videos based on workout type, a table for workout videos based on trainers, and a table for recipe videos.

1. **Submission location:** located within the doc folder
2. **Database implementation:**
    a. **MySQL@GCP**



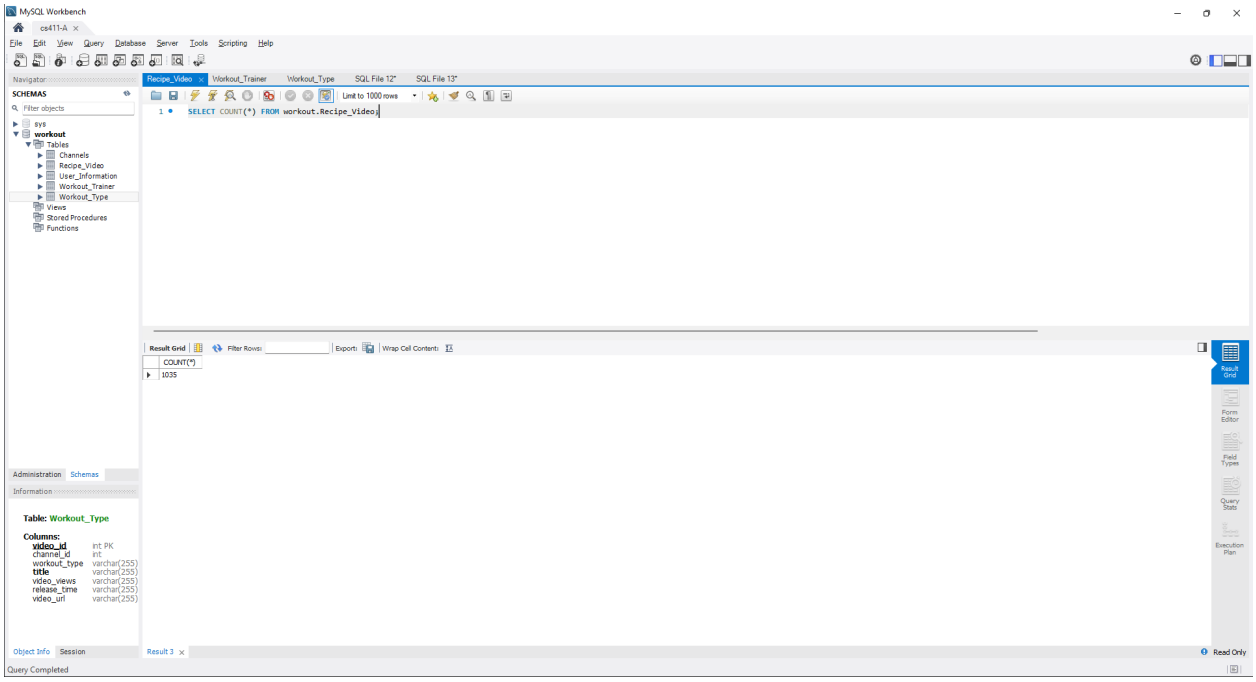
    b. **DDL (as shown below):**

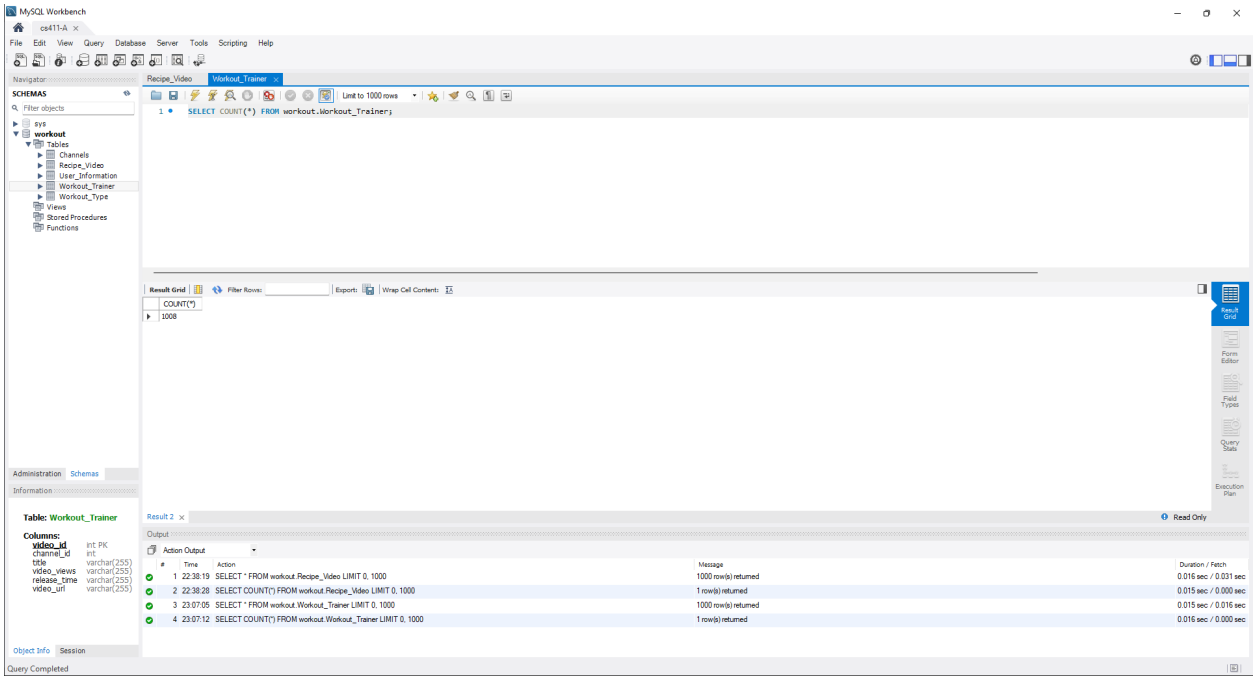
Data Definition Language (DDL)

```
create database workout;
use workout;

CREATE TABLE Channels (
channel_id INT NOT NULL,
channel_name VARCHAR(255) NOT NULL,
subscriber_num INT NOT NULL,
PRIMARY KEY (channel_id)
);

CREATE TABLE Workout_Type (
video_id INT NOT NULL,
channel_id INT NOT NULL,
```

```
workout_type VARCHAR(255),
title VARCHAR(255),
video_views VARCHAR(255),
release_time VARCHAR(255),
video_url VARCHAR(255),
PRIMARY KEY (video_id)
);

CREATE TABLE Workout_Trainer (
video_id INT NOT NULL,
channel_id INT NOT NULL,
title VARCHAR(255),
video_views VARCHAR(255),
release_time VARCHAR(255),
video_url VARCHAR(255),
PRIMARY KEY (video_id)
);

CREATE TABLE Recipe_Video (
video_id INT NOT NULL,
channel_id INT NOT NULL,
title VARCHAR(255),
video_views VARCHAR(255),
release_time VARCHAR(255),
video_url VARCHAR(255),
PRIMARY KEY (video_id)
);
```

c. **Insert at least 1000 rows each in three of the tables** (screenshot found below):

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File Edit View Query Database Server Tools Scripting Help
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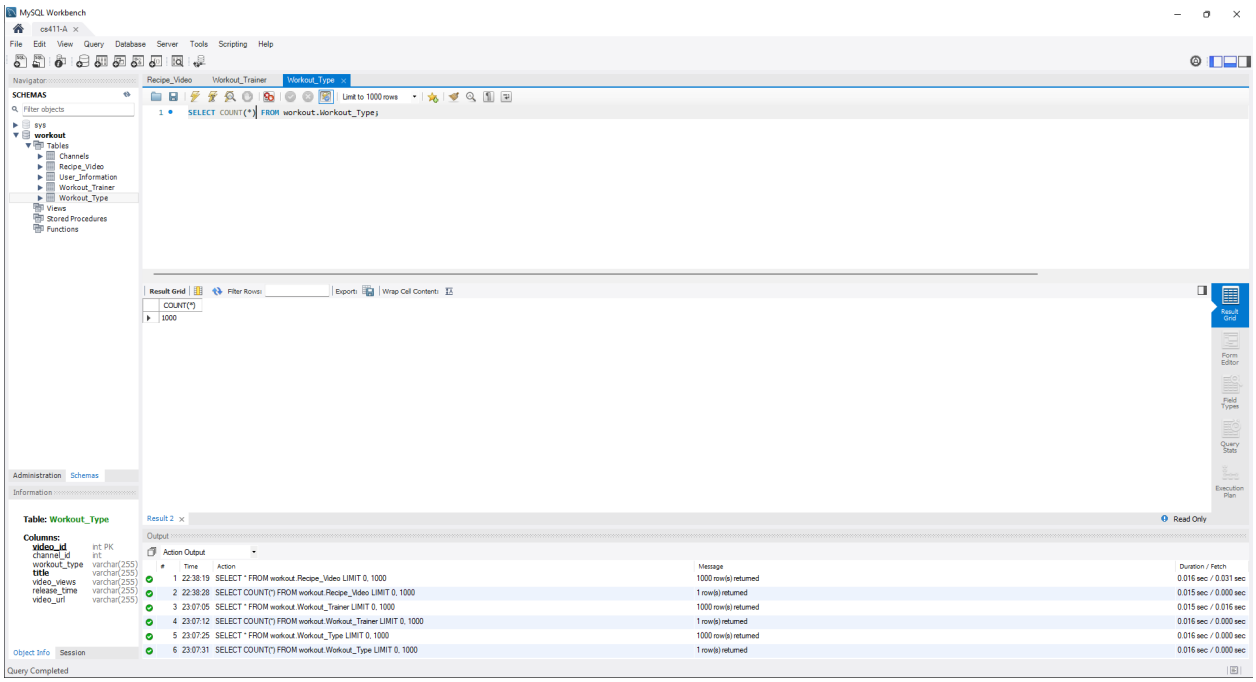
workout
Tables
Channels
Recipe_Video
User_Information
Workout_Trainer
Workout_Type
Views
Stored Procedures
Functions
Recipe_Video
Workout_Trainer
Limit to 1000 rows
1 SELECT COUNT(*) FROM workout.Workout_Trainer;
Result Grid
Filter Rows:
Export:
Wrap Cell Content:
COUNT(*)
1008
Result Grid
Form Editor
Field Types
Query Stats
Execution Plan
Administration
Schemas
Information
Table: Workout_Trainer
Columns:
video_id int PK
channel_id int
title varchar(255)
video_views varchar(255)
release_time varchar(255)
video_url varchar(255)
Object Info
Session
Result 2
Read Only
Output
Action Output
Time Action Message Duration / Fetch
1 22:38:19 SELECT * FROM workout.Recipe_Video LIMIT 0, 1000 1000 row(s) returned 0.016 sec / 0.031 sec
2 22:38:28 SELECT COUNT(*) FROM workout.Recipe_Video LIMIT 0, 1000 1 row(s) returned 0.015 sec / 0.000 sec
3 23:07:05 SELECT * FROM workout.Workout_Trainer LIMIT 0, 1000 1000 row(s) returned 0.015 sec / 0.016 sec
4 23:07:12 SELECT COUNT(*) FROM workout.Workout_Trainer LIMIT 0, 1000 1 row(s) returned 0.016 sec / 0.000 sec
Query Completed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User_Information
Workout_Trainer
Workout_Type
Views
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Functions
Recipe_Video
Workout_Trainer
Workout_Type
Limit to 1000 rows
1 SELECT COUNT(*) FROM workout.Workout_Type;
Result Grid
Filter Rows:
Export:
Wrap Cell Content:
COUNT(*)
1000
Result Grid
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Information
Table: Workout_Type
Columns:
video_id int PK
channel_id int
workout_type varchar(255)
title varchar(255)
video_views varchar(255)
release_time varchar(255)
video_url varchar(255)
Object Info
Session
Result 2
Read Only
Output
Action Output
Time Action Message Duration / Fetch
1 22:38:19 SELECT * FROM workout.Recipe_Video LIMIT 0, 1000 1000 row(s) returned 0.016 sec / 0.031 sec
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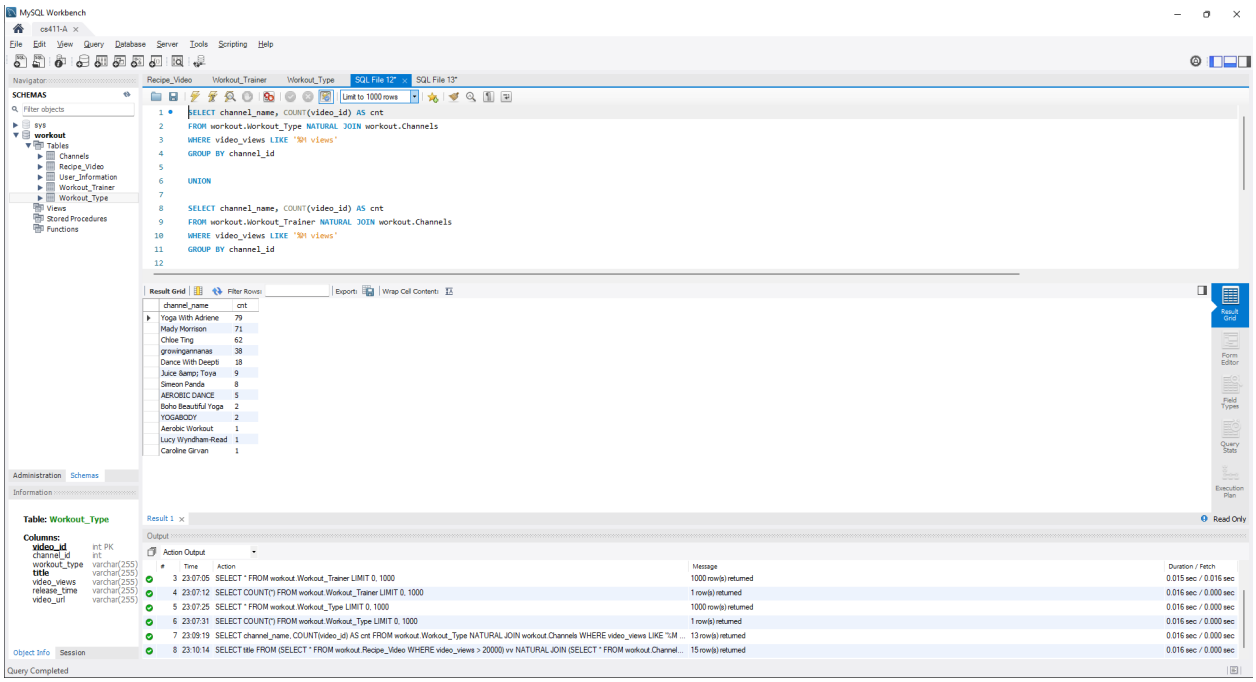
3 23:07:05 SELECT * FROM workout.Workout_Trainer LIMIT 0, 1000 1000 row(s) returned 0.015 sec / 0.016 sec
4 23:07:12 SELECT COUNT(*) FROM workout.Workout_Trainer LIMIT 0, 1000 1 row(s) returned 0.016 sec / 0.000 sec
5 23:07:25 SELECT * FROM workout.Workout_Type LIMIT 0, 1000 1000 row(s) returned 0.016 sec / 0.000 sec
6 23:07:31 SELECT COUNT(*) FROM workout.Workout_Type LIMIT 0, 1000 1 row(s) returned 0.016 sec / 0.000 sec
Query Completed

3. Advance queries

a. **Query 1**: For the first query, we seek to find channels with video views over 1 million in each of the three video tables, and union the three tables.

```
SQL Query1:
SELECT channel_name, COUNT(video_id) AS cnt
FROM workout.Workout_Type NATURAL JOIN workout.Channels
WHERE video_views LIKE '%M views'
GROUP BY channel_id

UNION

SELECT channel_name, COUNT(video_id) AS cnt
FROM workout.Workout_Trainer NATURAL JOIN workout.Channels
WHERE video_views LIKE '%M views'
GROUP BY channel_id

UNION

SELECT channel_name, COUNT(video_id) AS cnt
FROM workout.Recipe_Video NATURAL JOIN workout.Channels
WHERE video_views LIKE '%M views'
GROUP BY channel_id

ORDER BY cnt DESC
LIMIT 15;
```

Screenshot of Query 1 (first 15 rows):

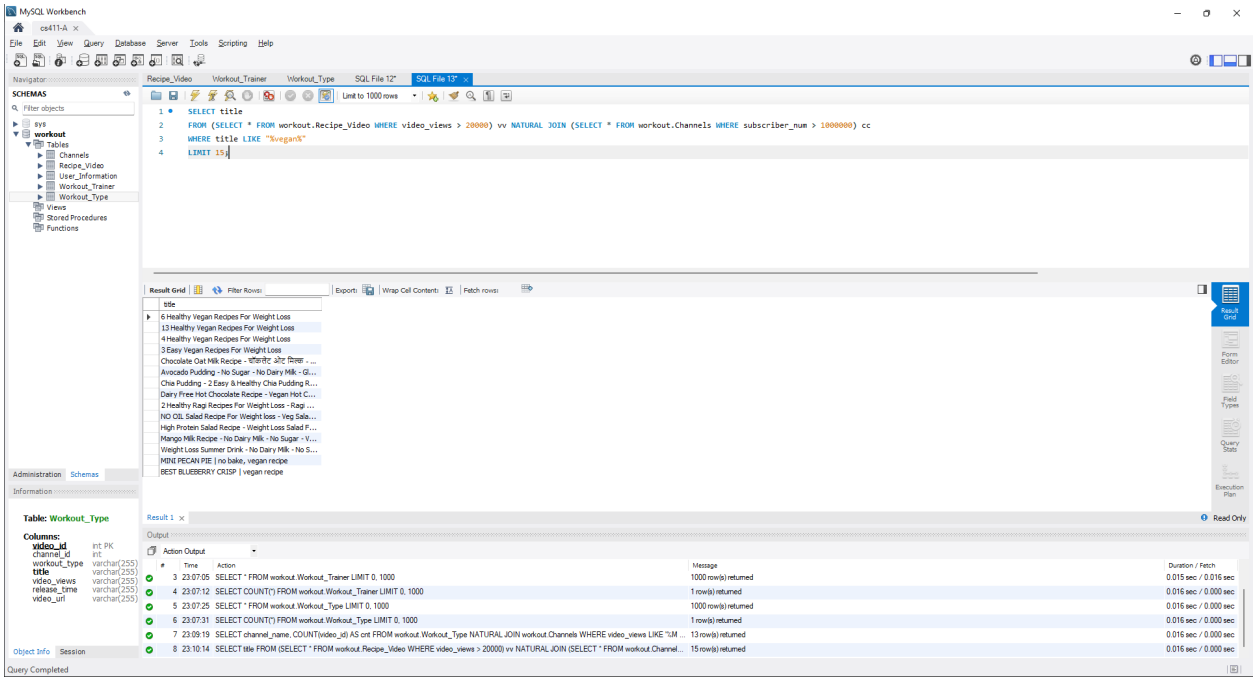


b. **Query 2**: For the second query, we aim to find all the recipe videos that posted vegan recipes from channels that have subscribers at a Million-subscriber level. To achieve that, we joined Recipe_Video and Channels, using subquery to find channels with millions of subscribers and “LIKE” to find vegan recipes.

SQL Query2:

```
SELECT title
FROM (SELECT * FROM workout.Recipe_Video WHERE video_views > 20000)
vv NATURAL JOIN (SELECT * FROM workout.Channels WHERE
subscriber_num > 1000000) cc
WHERE title LIKE "%vegan%"
LIMIT 15
```

Screenshot of Query 2 (first 15 rows):



4. Indexing Analysis

a. Indexing Analysis for Query1

For the first query, we seek to find channels with video views over 1 million in each of the three video tables, and union the three tables.

```
-> Sort: cnt DESC  (cost=2.50 rows=0) (actual time=0.020..0.021 rows=18 loops=1)
    -> Table scan on <union temporary>  (cost=2.50 rows=0) (actual time=0.001..0.003 rows=18 loops=1)
        -> Union materialize with deduplication  (cost=2.50..2.50 rows=0) (actual time=2.838..2.840 rows=18 loops=1)
            -> Table scan on <temporary>  (actual time=0.001..0.001 rows=7 loops=1)
                -> Aggregate using temporary table  (actual time=0.824..0.825 rows=7 loops=1)
                    -> Nested loop inner join  (cost=142.14 rows=111) (actual time=0.150..0.736 rows=136 loops=1)
                        -> Filter: (Workout_Type.video_views like '%M views')  (cost=103.25 rows=111) (actual time=0.134..0.656 rows=136 loops=1)
                            -> Table scan on Workout_Type  (cost=103.25 rows=1000) (actual time=0.056..0.393 rows=1000 loops=1)
                        -> Single-row index lookup on Channels using PRIMARY (channel_id=Workout_Type.channel_id)  (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=136)
            -> Table scan on <temporary>  (actual time=0.001..0.002 rows=6 loops=1)
                -> Aggregate using temporary table  (actual time=1.281..1.282 rows=6 loops=1)
                    -> Nested loop inner join  (cost=145.00 rows=112) (actual time=0.246..1.128 rows=161 loops=1)
                        -> Filter: (Workout_Trainer.video_views like '%M views')  (cost=105.80 rows=112) (actual time=0.237..1.035 rows=161 loops=1)
                            -> Table scan on Workout_Trainer  (cost=105.80 rows=1008) (actual time=0.044..0.622 rows=1008 loops=1)
                        -> Single-row index lookup on Channels using PRIMARY (channel_id=Workout_Trainer.channel_id)  (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=161)
            -> Table scan on <temporary>  (actual time=0.000..0.001 rows=5 loops=1)
                -> Aggregate using temporary table  (actual time=0.687..0.688 rows=5 loops=1)
                    -> Nested loop inner join  (cost=147.75 rows=115) (actual time=0.133..0.636 rows=80 loops=1)
                        -> Filter: (Recipe_Video.video_views like '%M views')  (cost=107.50 rows=115) (actual time=0.126..0.596 rows=80 loops=1)
                            -> Table scan on Recipe_Video  (cost=107.50 rows=1035) (actual time=0.057..0.402 rows=1035 loops=1)
```

-> Single-row index lookup on Channels using PRIMARY (channel_id=Recipe_Video.channel_id) (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=80)

CREATE INDEX video_views_idx ON workout.Recipe_Video(video_views);

-> Sort: cnt DESC (cost=2.50 rows=0) (actual time=0.023..0.024 rows=18 loops=1)
  -> Table scan on <union temporary> (cost=2.50 rows=0) (actual time=0.001..0.004 rows=18 loops=1)
    -> Union materialize with deduplication (cost=2.50..2.50 rows=0) (actual time=2.329..2.331 rows=18 loops=1)
      -> Table scan on <temporary> (actual time=0.001..0.002 rows=7 loops=1)
        -> Aggregate using temporary table (actual time=0.828..0.829 rows=7 loops=1)
          -> Nested loop inner join (cost=142.14 rows=111) (actual time=0.219..0.746 rows=136 loops=1)
            -> Filter: (Workout_Type.video_views like '%M views') (cost=103.25 rows=111) (actual time=0.200..0.675 rows=136 loops=1)
              -> Table scan on Workout_Type (cost=103.25 rows=1000) (actual time=0.060..0.456 rows=1000 loops=1)
            -> Single-row index lookup on Channels using PRIMARY (channel_id=Workout_Type.channel_id) (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=136)
      -> Table scan on <temporary> (actual time=0.000..0.001 rows=6 loops=1)
        -> Aggregate using temporary table (actual time=0.735..0.736 rows=6 loops=1)
          -> Nested loop inner join (cost=145.00 rows=112) (actual time=0.203..0.628 rows=161 loops=1)
            -> Filter: (Workout_Trainer.video_views like '%M views') (cost=105.80 rows=112) (actual time=0.195..0.566 rows=161 loops=1)
              -> Table scan on Workout_Trainer (cost=105.80 rows=1008) (actual time=0.062..0.375 rows=1008 loops=1)
            -> Single-row index lookup on Channels using PRIMARY (channel_id=Workout_Trainer.channel_id) (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=161)
      -> Table scan on <temporary> (actual time=0.001..0.001 rows=5 loops=1)
        -> Aggregate using temporary table (actual time=0.705..0.706 rows=5 loops=1)
          -> Nested loop inner join (cost=147.75 rows=115) (actual time=0.119..0.630 rows=80 loops=1)
            -> Filter: (Recipe_Video.video_views like '%M views') (cost=107.50 rows=115) (actual time=0.112..0.585 rows=80 loops=1)
              -> Table scan on Recipe_Video (cost=107.50 rows=1035) (actual time=0.047..0.365 rows=1035 loops=1)

-> Single-row index lookup on Channels using PRIMARY (channel_id=Recipe_Video.channel_id) (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=80)

After using indexing, the cost retained unchanged. The result indicts no improvements in indexing. Since we used forms of LIKE “%abc%” and LIKE “%abc”, indexing cannot be used. Therefore, no improvements were identified. While “abc%” can be used for indexing.

b. Indexing analysis for Query2

For the second query, we aim to find all the recipe videos that posted vegan recipes from channels that have subscribers at a Million-subscriber level. To achieve that, we joined Recipe_Video and Channels, using subquery to find channels with millions of subscribers and “LIKE” to find vegan recipes.

-> Limit: 15 row(s) (cost=121.91 rows=15) (actual time=0.420..1.376 rows=15 loops=1)
  -> Nested loop inner join (cost=121.91 rows=19) (actual time=0.419..1.373 rows=15 loops=1)
    -> Filter: ((Recipe_Video.title like '%vegan%') and (Recipe_Video.video_views > 20000)) (cost=108.50 rows=38) (actual time=0.201..1.312 rows=75 loops=1)
      -> Table scan on Recipe_Video (cost=108.50 rows=1035) (actual time=0.182..0.535 rows=1031 loops=1)
    -> Filter: (Channels.subscriber_num > 1000000) (cost=0.25 rows=0) (actual time=0.001..0.001 rows=0 loops=75)
      -> Single-row index lookup on Channels using PRIMARY (channel_id=Recipe_Video.channel_id) (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=75)

CREATE INDEX video_views_idx ON workout.Recipe_Video(video_views);

-> Limit: 15 row(s) (cost=121.91 rows=15) (actual time=0.279..1.257 rows=15 loops=1)
  -> Nested loop inner join (cost=121.91 rows=19) (actual time=0.278..1.255 rows=15 loops=1)
    -> Filter: ((Recipe_Video.title like '%vegan%') and (Recipe_Video.video_views > 20000)) (cost=108.50 rows=38) (actual time=0.088..1.202 rows=75 loops=1)
      -> Table scan on Recipe_Video (cost=108.50 rows=1035) (actual time=0.072..0.434 rows=1031 loops=1)
    -> Filter: (Channels.subscriber_num > 1000000) (cost=0.25 rows=0) (actual time=0.001..0.001 rows=0 loops=75)

-> Single-row index lookup on Channels using PRIMARY (channel_id=Recipe_Video.channel_id) (cost=0.25 rows=1) (actual time=0.000..0.000 rows=1 loops=75)

CREATE INDEX subscriber_num_idx ON workout.Channels(subscriber_num);

-> Limit: 15 row(s) (cost=121.91 rows=15) (actual time=0.298..1.391 rows=15 loops=1)
  -> Nested loop inner join (cost=121.91 rows=19) (actual time=0.297..1.388 rows=15 loops=1)
    -> Filter: ((Recipe_Video.title like '%vegan%') and (Recipe_Video.video_views > 20000)) (cost=108.50 rows=38) (actual time=0.104..1.280 rows=75 loops=1)
      -> Table scan on Recipe_Video (cost=108.50 rows=1035) (actual time=0.089..0.486 rows=1031 loops=1)
    -> Filter: (Channels.subscriber_num > 1000000) (cost=0.25 rows=0) (actual time=0.001..0.001 rows=0 loops=75)
      -> Single-row index lookup on Channels using PRIMARY (channel_id=Recipe_Video.channel_id) (cost=0.25 rows=1) (actual time=0.001..0.001 rows=1 loops=75)

CREATE INDEX title_idx ON workout.Recipe_Video(title);

-> Limit: 15 row(s) (cost=121.91 rows=13) (actual time=0.305..1.354 rows=15 loops=1)
  -> Nested loop inner join (cost=121.91 rows=13) (actual time=0.304..1.352 rows=15 loops=1)
    -> Filter: ((Recipe_Video.title like '%vegan%') and (Recipe_Video.video_views > 20000)) (cost=108.50 rows=38) (actual time=0.107..1.283 rows=75 loops=1)
      -> Table scan on Recipe_Video (cost=108.50 rows=1035) (actual time=0.090..0.445 rows=1031 loops=1)
    -> Filter: (Channels.subscriber_num > 1000000) (cost=0.25 rows=0) (actual time=0.001..0.001 rows=0 loops=75)
      -> Single-row index lookup on Channels using PRIMARY (channel_id=Recipe_Video.channel_id) (cost=0.25 rows=1) (actual time=0.001..0.001 rows=1 loops=75)

Whether using indexing on workout.Recipe_Video(video_views) or workout.Channels(subscriber_num), the cost retained unchanged. The result indicts no improvements in indexing.

After using indexing on workout.Recipe_Video(title), the cost retained unchanged. The result indicts no improvements in indexing. Since we used forms of LIKE “%abc%”, indexing cannot be used. Therefore, no improvements were identified. While “abc%” can be used for indexing.

After using indexing on the second query twice, the cost when indexing “Recipe_Video.title like '%vegan%'” remains unchanged: the cost is 147.75 for the first time and 147.75 for the second time. The cost when indexing workout.Recipe_Video(video_views) also remains unchanged: 108.50 for the first time and 108.50 for the second time. Indexing on workout.Channels(subscriber_num) also remained unchanged: 121.91 for both first and second time. The result indicates no improvements in indexing.