In the Database Design markdown or pdf, provide the Data Definition Language (DDL) commands you used to create each of these tables in the database. Here's the syntax of the CREATE TABLE DDL command:
CREATE TABLE table_name (column1 datatype, column2 datatype, column3 datatype,...);

NOTE: For all our temp/ intermediate tables that we created we had the number of data points exceed 1000 entries. Only after combining and processing did the number decrease to below 1000.

NOTE: There are many more SQL commands we generated to get this project to work, which can be found in the database design folder in the Doc Folder on github.

5 Main Tables DDL:
DrugsReviews:

```
1.
2.  use team059;
3. DROP TABLE IF EXISTS Drugs_Reviews;
4.
5. create TABLE Drugs_Reviews(
6.       uniqueID INT PRIMARY KEY,
7.     drugName VARCHAR(50),
8.     condition_ VARCHAR(255),
9.     review TEXT,
10.    rating INT,
11.    date_ TEXT,
12.    usefulCount INT);
13.
14.
15. INSERT INTO Drugs_Reviews (uniqueID, drugName, condition_, review,
    rating, date_, usefulCount)
16. SELECT uniqueID, LOWER(drugName), condition_, review, rating, date_,
    usefulCount
17. FROM Temp_DrugsReview
18. WHERE drugName IN (SELECT Drugs.name FROM Drugs);
19. SELECT * FROM Drugs_Reviews;
```

Drugs and (Drug Relations):

```
CREATE TABLE Temp_Drugs (
    name VARCHAR(100) PRIMARY KEY,
    medical_condition VARCHAR(50),
    side_effects TEXT,
    generic_name VARCHAR(50),
    drug_classes VARCHAR(50),
    brand_names VARCHAR(50),
    activity FLOAT,
    rx_otc VARCHAR(10),
    pregnancy_category VARCHAR(1),
    csa VARCHAR(1),
    alcohol VARCHAR(1),
    related_drugs VARCHAR(20),
    medical_condition_description VARCHAR(255),
    rating FLOAT,
    no_of_reviews INT,
    drug_link VARCHAR(255),
    medical_condition_url VARCHAR(255)
);



CREATE TABLE Temp_SideEffects (
    id INT PRIMARY KEY,
    name VARCHAR(50),
    substitute0 VARCHAR(50),
    substitute1 VARCHAR(50),
    substitute2 VARCHAR(50),
    substitute3 VARCHAR(50),
    substitute4 VARCHAR(50),
    sideEffect0 VARCHAR(50),
    sideEffect1 VARCHAR(50),
    sideEffect2 VARCHAR(50),
    sideEffect3 VARCHAR(50),
    sideEffect4 VARCHAR(50),
    sideEffect5 VARCHAR(50),
    sideEffect6 VARCHAR(50),
    sideEffect7 VARCHAR(50),
    sideEffect8 VARCHAR(50),
    sideEffect9 VARCHAR(50),
    sideEffect10 VARCHAR(50),
    sideEffect11 VARCHAR(50),
    sideEffect12 VARCHAR(50),
    sideEffect13 VARCHAR(50),
    sideEffect14 VARCHAR(50),
    sideEffect15 VARCHAR(50),
```

```
    sideEffect16 VARCHAR(50),
    sideEffect17 VARCHAR(50),
    sideEffect18 VARCHAR(50),
    sideEffect19 VARCHAR(50),
    sideEffect20 VARCHAR(50),
    sideEffect21 VARCHAR(50),
    sideEffect22 VARCHAR(50),
    sideEffect23 VARCHAR(50),
    sideEffect24 VARCHAR(50),
    sideEffect25 VARCHAR(50),
    sideEffect26 VARCHAR(50),
    sideEffect27 VARCHAR(50),
    sideEffect28 VARCHAR(50),
    sideEffect29 VARCHAR(50),
    sideEffect30 VARCHAR(50),
    sideEffect31 VARCHAR(50),
    sideEffect32 VARCHAR(50),
    sideEffect33 VARCHAR(50),
    sideEffect34 VARCHAR(50),
    sideEffect35 VARCHAR(50),
    sideEffect36 VARCHAR(50),
    sideEffect37 VARCHAR(50),
    sideEffect38 VARCHAR(50),
    sideEffect39 VARCHAR(50),
    sideEffect40 VARCHAR(50),
    sideEffect41 VARCHAR(50),
    use0 VARCHAR(50),
    use1 VARCHAR(50),
    use2 VARCHAR(50),
    use3 VARCHAR(50),
    use4 VARCHAR(50),
    Chemical_Class VARCHAR(50),
    Habit_Forming VARCHAR(50),
    Therapeutic_Class VARCHAR(50),
    Action_Class VARCHAR(50)
);



CREATE TABLE Temp_DrugsReview (
    uniqueID INT PRIMARY KEY,
    drugName VARCHAR(50),
    condition_ VARCHAR(255),
    review TEXT,
    rating INT,
    date_ TEXT,
    usefulCount INT
```

```
);



CREATE TABLE Drugs (
    name VARCHAR(100) PRIMARY KEY,
    disease VARCHAR(50),
    side_effect1 VARCHAR(50),
    side_effect2 VARCHAR(50),
    side_effect3 VARCHAR(50),
    rating FLOAT,
    pregnancy_category VARCHAR(10),
    alcohol VARCHAR(10),
    FOREIGN KEY (disease) REFERENCES Diseases(name)
);


CREATE TABLE Combined_Drugs_SE (
    drug_name VARCHAR(100),
    medical_condition VARCHAR(50),
    side_effects VARCHAR(255),
    generic_name VARCHAR(255),
    drug_classes VARCHAR(255),
    brand_names VARCHAR(255),
    activity VARCHAR(255),
    rx_otc VARCHAR(255),
    pregnancy_category VARCHAR(10),
    csa VARCHAR(255),
    alcohol VARCHAR(10),
    related_drugs VARCHAR(255),
    medical_condition_description TEXT,
    rating FLOAT,
    no_of_reviews INT,
    drug_link VARCHAR(255),
    medical_condition_url VARCHAR(255),
    sideEffect0 VARCHAR(50),
    sideEffect1 VARCHAR(50),
    sideEffect2 VARCHAR(50)
);
INSERT INTO Drugs (name, disease, side_effect1, side_effect2,
side_effect3, rating, pregnancy_category, alcohol)
SELECT drug_name, medical_condition, sideEffect0, sideEffect1,
sideEffect2, rating, pregnancy_category, alcohol
FROM Combined_Drugs_SE
WHERE medical_condition IN (SELECT name FROM Diseases)
```

```
CREATE TABLE Drug_Relations (
    drug1 VARCHAR(100),
    drug2 VARCHAR(100),
    PRIMARY KEY (drug1, drug2),
    FOREIGN KEY (drug1) REFERENCES Drugs(name),
    FOREIGN KEY (drug2) REFERENCES Drugs(name)
);
```

Diseases:

```
-- use team059;

-- create table disease_precaution(
--    name VARCHAR(50) primary key,
--     precaution_1 VARCHAR(50),
--     precaution_2 VARCHAR(50),
--     precaution_3 VARCHAR(50),
--     precaution_4 VARCHAR(50));

-- create table disease_description(
--    name VARCHAR(50) primary key,
--     description VARCHAR(400));
--
-- create table Diseases(
--    name VARCHAR(50) primary key,
--     description VARCHAR(400),
--     precaution_1 VARCHAR(50),
--     precaution_2 VARCHAR(50),
--     precaution_3 VARCHAR(50),
--     precaution_4 VARCHAR(50));
--
-- insert into Diseases select * from disease_description natural join
disease_precaution;

-- delete from Diseases where name = 'Disease';

select * from Diseases;
```

Symptoms:

```
use team059;
```

```
create table Symptoms(patient_id INT primary key, disease VARCHAR(50),
itching TINYINT(1), skin_rash TINYINT(1), nodal_skin_eruptions TINYINT(1),
continuous_sneezing TINYINT(1), shivering TINYINT(1), chills TINYINT(1),
joint_pain TINYINT(1), stomach_pain TINYINT(1), acidity TINYINT(1),
ulcers_on_tongue TINYINT(1), muscle_wasting TINYINT(1), vomiting
TINYINT(1), burning_micturition TINYINT(1), spotting_urination TINYINT(1),
fatigue TINYINT(1), weight_gain TINYINT(1), anxiety TINYINT(1),
cold_hands_and_feets TINYINT(1), mood_swings TINYINT(1), weight_loss
TINYINT(1), restlessness TINYINT(1), lethargy TINYINT(1),
patches_in_throat TINYINT(1), irregular_sugar_level TINYINT(1), cough
TINYINT(1), high_fever TINYINT(1), sunken_eyes TINYINT(1), breathlessness
TINYINT(1), sweating TINYINT(1), dehydration TINYINT(1), indigestion
TINYINT(1), headache TINYINT(1), yellowish_skin TINYINT(1), dark_urine
TINYINT(1), nausea TINYINT(1), loss_of_appetite TINYINT(1),
pain_behind_the_eyes TINYINT(1), back_pain TINYINT(1), constipation
TINYINT(1), abdominal_pain TINYINT(1), diarrhoea TINYINT(1), mild_fever
TINYINT(1), yellow_urine TINYINT(1), yellowing_of_eyes TINYINT(1),
acute_liver_failure TINYINT(1), fluid_overload TINYINT(1),
swelling_of_stomach TINYINT(1), swelled_lymph_nodes TINYINT(1), malaise
TINYINT(1), blurred_and_distorted_vision TINYINT(1), phlegm TINYINT(1),
throat_irritation TINYINT(1), redness_of_eyes TINYINT(1), sinus_pressure
TINYINT(1), runny_nose TINYINT(1), congestion TINYINT(1), chest_pain
TINYINT(1), weakness_in_limbs TINYINT(1), fast_heart_rate TINYINT(1),
pain_during_bowel_movements TINYINT(1), pain_in_anal_region TINYINT(1),
bloody_stool TINYINT(1), irritation_in_anus TINYINT(1), neck_pain
TINYINT(1), dizziness TINYINT(1), cramps TINYINT(1), bruising TINYINT(1),
obesity TINYINT(1), swollen_legs TINYINT(1), swollen_blood_vessels
TINYINT(1), puffy_face_and_eyes TINYINT(1), enlarged_thyroid TINYINT(1),
brittle_nails TINYINT(1), swollen_extremeties TINYINT(1), excessive_hunger
TINYINT(1), extra_marital_contacts TINYINT(1), drying_and_tingling_lips
TINYINT(1), slurred_speech TINYINT(1), knee_pain TINYINT(1),
hip_joint_pain TINYINT(1), muscle_weakness TINYINT(1), stiff_neck
TINYINT(1), swelling_joints TINYINT(1), movement_stiffness TINYINT(1),
spinning_movements TINYINT(1), loss_of_balance TINYINT(1), unsteadiness
TINYINT(1), weakness_of_one_body_side TINYINT(1), loss_of_smell
TINYINT(1), bladder_discomfort TINYINT(1), foul_smell_of_urine TINYINT(1),
continuous_feel_of_urine TINYINT(1), passage_of_gases TINYINT(1),
internal_itching TINYINT(1), toxic_look_typhos TINYINT(1), depression
TINYINT(1), irritability TINYINT(1), muscle_pain TINYINT(1),
altered_sensorium TINYINT(1), red_spots_over_body TINYINT(1), belly_pain
TINYINT(1), abnormal_menstruation TINYINT(1), dischromic_patches
TINYINT(1), watering_from_eyes TINYINT(1), increased_appetite TINYINT(1),
polyuria TINYINT(1), family_history TINYINT(1), mucoid_sputum TINYINT(1),
rusty_sputum TINYINT(1), lack_of_concentration TINYINT(1),
visual_disturbances TINYINT(1), receiving_blood_transfusion TINYINT(1),
receiving_unsterile_injections TINYINT(1), coma TINYINT(1),
stomach_bleeding TINYINT(1), distention_of_abdomen TINYINT(1),
```

```
history_of_alcohol_consumption TINYINT(1), blood_in_sputum TINYINT(1),
prominent_veins_on_calf TINYINT(1), palpitations TINYINT(1),
painful_walking TINYINT(1), pus_filled_pimples TINYINT(1), blackheads
TINYINT(1), scurring TINYINT(1), skin_peeling TINYINT(1),
silver_like_dusting TINYINT(1), small_dents_in_nails TINYINT(1),
inflammatory_nails TINYINT(1), blister TINYINT(1), ed_sore_around_nose
TINYINT(1), yellow_crust_ooze TINYINT(1), foreign key (disease) references
Diseases(name) on delete cascade on update cascade);
```

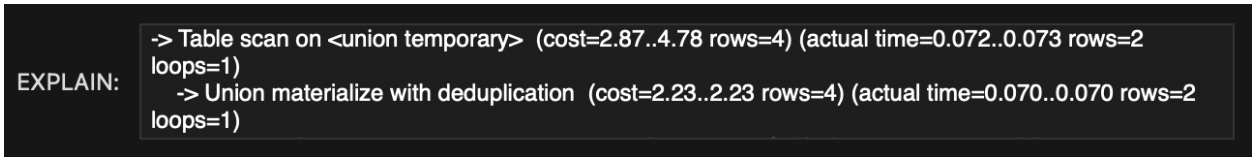
User Queries:

```
create table User_Queries(
      query_id INT Primary Key,
      itching TINYINT(1), skin_rash TINYINT(1), nodal_skin_eruptions
TINYINT(1), continuous_sneezing TINYINT(1), shivering TINYINT(1), chills
TINYINT(1), joint_pain TINYINT(1), stomach_pain TINYINT(1), acidity
TINYINT(1), ulcers_on_tongue TINYINT(1), muscle_wasting TINYINT(1),
vomiting TINYINT(1), burning_micturition TINYINT(1), spotting_urination
TINYINT(1), fatigue TINYINT(1), weight_gain TINYINT(1), anxiety
TINYINT(1), cold_hands_and_feets TINYINT(1), mood_swings TINYINT(1),
weight_loss TINYINT(1), restlessness TINYINT(1), lethargy TINYINT(1),
patches_in_throat TINYINT(1), irregular_sugar_level TINYINT(1), cough
TINYINT(1), high_fever TINYINT(1), sunken_eyes TINYINT(1), breathlessness
TINYINT(1), sweating TINYINT(1), dehydration TINYINT(1), indigestion
TINYINT(1), headache TINYINT(1), yellowish_skin TINYINT(1), dark_urine
TINYINT(1), nausea TINYINT(1), loss_of_appetite TINYINT(1),
pain_behind_the_eyes TINYINT(1), back_pain TINYINT(1), constipation
TINYINT(1), abdominal_pain TINYINT(1), diarrhoea TINYINT(1), mild_fever
TINYINT(1), yellow_urine TINYINT(1), yellowing_of_eyes TINYINT(1),
acute_liver_failure TINYINT(1), fluid_overload TINYINT(1),
swelling_of_stomach TINYINT(1), swelled_lymph_nodes TINYINT(1), malaise
TINYINT(1), blurred_and_distorted_vision TINYINT(1), phlegm TINYINT(1),
throat_irritation TINYINT(1), redness_of_eyes TINYINT(1), sinus_pressure
TINYINT(1), runny_nose TINYINT(1), congestion TINYINT(1), chest_pain
TINYINT(1), weakness_in_limbs TINYINT(1), fast_heart_rate TINYINT(1),
pain_during_bowel_movements TINYINT(1), pain_in_anal_region TINYINT(1),
bloody_stool TINYINT(1), irritation_in_anus TINYINT(1), neck_pain
TINYINT(1), dizziness TINYINT(1), cramps TINYINT(1), bruising TINYINT(1),
obesity TINYINT(1), swollen_legs TINYINT(1), swollen_blood_vessels
TINYINT(1), puffy_face_and_eyes TINYINT(1), enlarged_thyroid TINYINT(1),
brittle_nails TINYINT(1), swollen_extremeties TINYINT(1), excessive_hunger
TINYINT(1), extra_marital_contacts TINYINT(1), drying_and_tingling_lips
TINYINT(1), slurred_speech TINYINT(1), knee_pain TINYINT(1),
hip_joint_pain TINYINT(1), muscle_weakness TINYINT(1), stiff_neck
TINYINT(1), swelling_joints TINYINT(1), movement_stiffness TINYINT(1),
spinning_movements TINYINT(1), loss_of_balance TINYINT(1), unsteadiness
```

```
TINYINT(1), weakness_of_one_body_side TINYINT(1), loss_of_smell
TINYINT(1), bladder_discomfort TINYINT(1), foul_smell_of_urine TINYINT(1),
continuous_feel_of_urine TINYINT(1), passage_of_gases TINYINT(1),
internal_itching TINYINT(1), toxic_look_typhos TINYINT(1), depression
TINYINT(1), irritability TINYINT(1), muscle_pain TINYINT(1),
altered_sensorium TINYINT(1), red_spots_over_body TINYINT(1), belly_pain
TINYINT(1), abnormal_menstruation TINYINT(1), dischromic_patches
TINYINT(1), watering_from_eyes TINYINT(1), increased_appetite TINYINT(1),
polyuria TINYINT(1), family_history TINYINT(1), mucoid_sputum TINYINT(1),
rusty_sputum TINYINT(1), lack_of_concentration TINYINT(1),
visual_disturbances TINYINT(1), receiving_blood_transfusion TINYINT(1),
receiving_unsterile_injections TINYINT(1), coma TINYINT(1),
stomach_bleeding TINYINT(1), distention_of_abdomen TINYINT(1),
history_of_alcohol_consumption TINYINT(1), blood_in_sputum TINYINT(1),
prominent_veins_on_calf TINYINT(1), palpitations TINYINT(1),
painful_walking TINYINT(1), pus_filled_pimples TINYINT(1), blackheads
TINYINT(1), scurring TINYINT(1), skin_peeling TINYINT(1),
silver_like_dusting TINYINT(1), small_dents_in_nails TINYINT(1),
inflammatory_nails TINYINT(1), blister TINYINT(1), ed_sore_around_nose
TINYINT(1), yellow_crust_ooze TINYINT(1),
location POINT,
date DATE);
```

Advanced Query 1: List of substitute drugs

The advanced query for getting the list of substitute drugs cannot be indexed in more than one way as the overarching table only contains two columns which are both a necessary part of the indexing. Even when indexing on one column at a time the results do not change. Without indexing we found our overall cost to be 4.78 and after indexing we found our overall cost to be 4.78. Therefore indexing does not help improve our cost values.



The final query with indexing we decided on is as follows:

```
delimiter //
create procedure get_substitutes(in input_drug varchar(50), in
p_explain tinyint unsigned)
begin
```

```
      if (p_explain) then
            explain analyze

            SELECT drug2
            FROM Drug_Relations
            WHERE drug1 = input_drug

            UNION

            SELECT drug1
            FROM Drug_Relations
            WHERE drug2 = input_drug;
      else
            SELECT drug2
            FROM Drug_Relations
            WHERE drug1 = input_drug

            UNION

            SELECT drug1
            FROM Drug_Relations
            WHERE drug2 = input_drug;
      end if ;
end //
delimiter ;
```

Below are the top 12 rows from a query of get_substitutes(“Cephalexin”). It cannot display the top 15 rows because in our table there are only 12 substitute drugs for Cephalexin.

drug
Amikacin
Ancef
Cefoxitin
Claforan
Cleocin
Co-Trimoxazole
Erythromycin
Flagyl
Invanz
Maxipime
Tygacil
Vancomycin

Advanced Query 2: List of top 5 symptoms queried within the area within a timeframe

```
use team059;
drop procedure top_five_symptoms_area;


-- for loop all symptoms
delimiter //
create procedure top_five_symptoms_area(in user_input_location POINT, in input_date DATE, in duration INT, in distance FLOAT, in p_explain tinyint unsigned)
begin
    if (p_explain) then
        explain analyze
            with symptom_list as (
                SELECT *
                FROM User_Queries
                WHERE SQRT(POW(ST_X(user_input_location) - ST_X(location),2 ) + POW(ST_Y(user_input_location) - ST_Y(location),2)) <= distance -- distance
                AND ABS(input_date - date) <= duration -- date restriction
            )

            SELECT symptom , count(symptom) AS occurrence
                from (
                    select 'itching' as symptom from symptom_list where symptom_list.itching = 1 union all select 'skin_rash' as symptom from symptom_list where
                    ) as temp
                    group by symptom
                    ORDER BY occurrence DESC, symptom
                    LIMIT 5;
```

```
    else
            with symptom_list as (
                SELECT *
                FROM User_Queries
                WHERE SQRT(POW(ST_X(user_input_location) - ST_X(location),2 ) + POW(ST_Y(user_input_location) - ST_Y(location),2)) <= distance -- distance
                AND ABS(input_date - date) <= duration -- date restriction
            )

            SELECT symptom , count(symptom) AS occurrence
                from (
                    select 'itching' as symptom from symptom_list where symptom_list.itching = 1 union all select 'skin_rash' as symptom from symptom_list where
                    ) as temp
                    group by symptom
                    ORDER BY occurrence DESC, symptom
                    LIMIT 5;

    end if;
    end //
delimiter ;
```

The advanced query for getting the top five symptoms of the area within a certain distance from the user can be done by using the Two where clauses that satisfies the condition. The distance can be found by using the square root of the square of difference of the longitudes and latitudes. The date can be done by comparing the duration with the absolute value of the difference of date.

The User_Queries looks as below.

query_id	itching	skin_rash	nodal_skin_eruptio...	continuous_sneezi...	shivering	chills	joint_pain	stomach_pain	acidity	ulcers_on_tong...	muscle_wasting	vomiting	burning_micturit...	spotting_urinati...	fatigue	weigh
1	0	0	1	0	1	1	0	1	0	0	0	0	0	1	1	0
2	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	1
3	0	1	0	0	0	1	0	1	0	0	0	0	1	1	0	1
4	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0
5	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	1
6	0	1	1	0	0	1	0	1	0	0	0	0	1	1	0	1

By calling top_five_symptoms_area with the user location as point, user_date as date, distance, location, and an explain flag, The most common symptom shows up as follows based on the User_Queries that stores the input of multiple users.

```
call top_five_symptoms_area(POINT(73.199394, 59.865848), '2023-06-19', 100, 20, 0);


-- INSERT INTO User_Queries ()
-- VALUES
-- (1, 0, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1
-- (2, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 1
-- (3, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1
-- (4, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 1
-- (5, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1
-- (6, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1
-- SELECT * FROM User_Queries
```

The most common symptoms with the highest occurrences show up like the following table that meets the condition.

symptom	occurrence
blood_in_sputum	3
blurred_and_distorted_vision	3
chest_pain	3
coma	3
constipation	3

Advanced Query 3: The most common precautions for a symptom

When indexing our get_precautions query, we first tried indexing on Precaution1, Precaution2, Precaution3, and Precaution4. However, after comparing it to our unindexed results, we didn't find any difference as both had an overall cost of 154101.86 as seen below. Next, we indexed on Symptoms.disease which again yielded an identical cost of 154101.86. Finally, we attempted to index on Precaution1, Precaution2, Precaution3, Precaution4, and Symptoms.disease which got us an overall cost of 154101.86. All in all, when comparing indexing to no indexing, we achieve zero difference. Below are the final query with indexing, the top 15 rows from a query, and the results from our indexing:

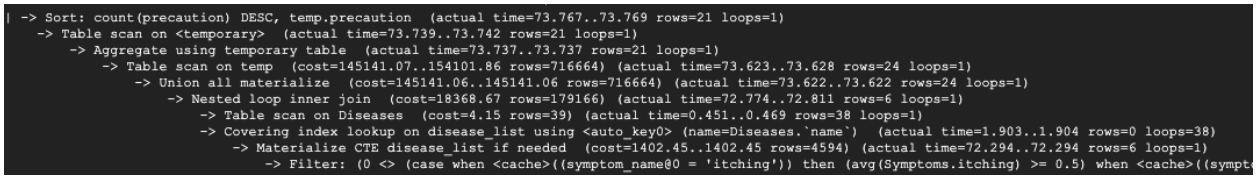
```
delimiter //
create procedure get_precautions(in symptom_name varchar(50), in
p_explain tinyint unsigned)
begin
      if (p_explain) then
      explain analyze
            with disease_list as (
            select disease as name from Symptoms group by disease
having case when symptom_name = 'itching' then avg(itching) >= 0.5
when symptom_name = 'skin_rash' then ...
```

```
mysql> call get_precautions('itching', 0);
+-----------------------------------+--------------------+
| precaution                        | count(precaution)  |
+-----------------------------------+--------------------+
| consult nearest hospital          |                  2 |
| eat healthy                       |                  2 |
| medication                        |                  2 |
| anti itch medicine                |                  1 |
| avoid public places               |                  1 |
| bath twice                        |                  1 |
| cold baths                        |                  1 |
| consult doctor                    |                  1 |
| consume milk thistle              |                  1 |
| consume neem leaves               |                  1 |
| drink plenty of water             |                  1 |
| eat fruits and high fiberous food |                  1 |
| follow up                         |                  1 |
| keep infected area dry            |                  1 |
| stop irritation                   |                  1 |
```

Index on Symptoms.disease

```
| -> Sort: count(precaution) DESC, temp.precaution  (actual time=73.767..73.769 rows=21 loops=1)
    -> Table scan on <temporary>  (actual time=73.739..73.742 rows=21 loops=1)
        -> Aggregate using temporary table  (actual time=73.737..73.737 rows=21 loops=1)
            -> Table scan on temp  (cost=145141.07..154101.86 rows=716664) (actual time=73.623..73.628 rows=24 loops=1)
                -> Union all materialize  (cost=145141.06..145141.06 rows=716664) (actual time=73.622..73.622 rows=24 loops=1)
                    -> Nested loop inner join  (cost=18368.67 rows=179166) (actual time=72.774..72.811 rows=6 loops=1)
                        -> Table scan on Diseases  (cost=4.15 rows=39) (actual time=0.451..0.469 rows=38 loops=1)
                        -> Covering index lookup on disease_list using <auto_key0> (name=Diseases.`name`)  (actual time=1.903..1.904 rows=0 loops=38)
                            -> Materialize CTE disease_list if needed  (cost=1402.45..1402.45 rows=4594) (actual time=72.294..72.294 rows=6 loops=1)
                                -> Filter: (0 <> (case when <cache>((symptom_name@0 = 'itching')) then (avg(Symptoms.itching) >= 0.5) when <cache>((sympt
```

index on Symptoms.disease and precautions



Index on precautions

```
EXPLAIN
"-> Sort: count(precaution) DESC, temp.precaution  (actual time=78.548..78.549 rows=21 loops=1)
    -> Table scan on <temporary>  (actual time=78.518..78.521 rows=21 loops=1)
        -> Aggregate using temporary table  (actual time=78.516..78.516 rows=21 loops=1)
            -> Table scan on temp  (cost=145141.07..154101.86 rows=716664) (actual
time=78.390..78.395 rows=24 loops=1)
                -> Union all materialize  (cost=145141.06..145141.06 rows=716664) (actual
time=78.388..78.388 rows=24 loops=1)
                    -> Nested loop inner join  (cost=18368.67 rows=179166) (actual
time=77.988..78.038 rows=6 loops=1)
                        -> Covering index scan on Diseases using precaution1_index  (cost=4.15
rows=39) (actual time=0.294..0.316 rows=38 loops=1)
                        -> Covering index lookup on disease_list using <auto_key0>
(name=Diseases.`name`)  (actual time=2.045..2.045 rows=0 loops=38)
                            -> Materialize CTE disease_list if needed  (cost=1402.45..1402.45
rows=4594) (actual time=77.660..77.660 rows=6 loops=1)
                                -> Filter: (0 <> (case when <cache>((symptom_name@0 = 'itching'))
```

No index

```
EXPLAIN
"-> Sort: count(precaution) DESC, temp.precaution  (actual time=75.105..75.107 rows=21 loops=1)
    -> Table scan on <temporary>  (actual time=75.075..75.079 rows=21 loops=1)
        -> Aggregate using temporary table  (actual time=75.073..75.073 rows=21 loops=1)
            -> Table scan on temp  (cost=145141.07..154101.86 rows=716664) (actual
time=74.870..74.874 rows=24 loops=1)
                -> Union all materialize  (cost=145141.06..145141.06 rows=716664) (actual
time=74.869..74.869 rows=24 loops=1)
                    -> Nested loop inner join  (cost=18368.67 rows=179166) (actual
time=74.556..74.595 rows=6 loops=1)
                        -> Table scan on Diseases  (cost=4.15 rows=39) (actual time=0.047..0.065
rows=38 loops=1)
                        -> Covering index lookup on disease_list using <auto_key0>
(name=Diseases.`name`)  (actual time=1.961..1.961 rows=0 loops=38)
                            -> Materialize CTE disease_list if needed  (cost=1402.45..1402.45
rows=4594) (actual time=74.482..74.482 rows=6 loops=1)
                                -> Filter: (0 <> (case when <cache>((symptom_name@0 = 'itching'))
```

Advanced Query 4: Drugs Table

This query finds the rating of drugs based on heuristics involving Drugs table and Drugs_Reviews table.

Index strategy 1: indexing on Drugs_Reviews.drugName. Note that the primary key for Drugs_Reviews is uniqueID, not the drugName.

```
EXPLAIN
"-> Group aggregate: avg(Drugs.rating), avg(Drugs_Reviews.usefulCount)  (cost=653.20 rows=1441)
(actual time=0.096..1.864 rows=43 loops=1)
    -> Nested loop left join  (cost=509.05 rows=1441) (actual time=0.082..1.639 rows=848 loops=1)
        -> Index scan on Drugs using PRIMARY  (cost=4.55 rows=43) (actual time=0.041..0.051 rows=43
loops=1)
        -> Filter: (Drugs.`name` = Drugs_Reviews.drugName)  (cost=8.46 rows=34) (actual
time=0.017..0.036 rows=19 loops=43)
            -> Index lookup on Drugs_Reviews using special_rating_index1 (drugName=Drugs.`name`)
(cost=8.46 rows=34) (actual time=0.017..0.031 rows=19 loops=43)
"
```

Compared to no indexing:

```
EXPLAIN
"-> Table scan on <temporary>  (actual time=1.724..1.730 rows=43 loops=1)
    -> Aggregate using temporary table  (actual time=1.723..1.723 rows=43 loops=1)
        -> Left hash join (<hash>(Drugs.`name`)=<hash>(Drugs_Reviews.drugName)), extra conditions:
(Drugs.`name` = Drugs_Reviews.drugName)  (cost=3325.01 rows=33153) (actual time=0.897..1.156 rows=848
loops=1)
            -> Table scan on Drugs  (cost=4.55 rows=43) (actual time=0.025..0.039 rows=43 loops=1)
            -> Hash
                -> Table scan on Drugs_Reviews  (cost=1.97 rows=771) (actual time=0.365..0.695
rows=828 loops=1)
"
```

Since the query only joins based on Drugs.name and Drugs_Reviews.drugName and no condition in where or having, there can only be one meaningful indexing on Drugs_Reviews.drugName, since Drugs.name is a primary key.
The total cost from no-index is 3325.01 and with index on Drugs_Reviews.drugName is 653.20, thus using an index on Drugs_Reviews.drugName is a better result.
This makes sense because Drugs_Reviews.drugName is a foreign key with duplicates and is being used in a join.

```
mysql> call special_rating(0);
+----------------+-----------------------------------------------+
| name           | (0.7*AVG(usefulCount) + 0.3*AVG(Drugs.rating)) |
+----------------+-----------------------------------------------+
| acnex          |                                           6.5 |
| adoxa          |                      6.140000057220458 |
| aldactone      |                      26.54666663758977 |
| amikacin       |                                           3.5 |
| amikin         |                                          NULL |
| ancef          |                                          NULL |
| bactrim        |                          20.9450819668 |
| benzac         |                                          NULL |
| brevoxyl       |                                          NULL |
| cefoxitin      |                                          NULL |
| cephalexin     |                      27.19499988555908 |
| claforan       |                                          NULL |
| cleocin        |                                          23.8 |
| clindamycin    |                      17.020800028610232 |
| co-trimoxazole |                                          NULL |
```

Other Requirements:

Table Rows screenshot:

```
mysql> select count(*) from Symptoms;
+----------+
| count(*) |
+----------+
|     4598 |
+----------+
1 row in set (0.19 sec)

mysql> select count(*) from Temp_DrugsReview;
+----------+
| count(*) |
+----------+
|    53766 |
+----------+
1 row in set (11.28 sec)

mysql> select count(*) from Temp_Drugs;
+----------+
| count(*) |
+----------+
|     2913 |
+----------+
1 row in set (1.46 sec)

mysql>
```

```
mysql> describe Symptoms;
+--------------------------------+-------------+------+-----+---------+-------+
| Field                          | Type        | Null | Key | Default | Extra |
+--------------------------------+-------------+------+-----+---------+-------+
| patient_id                     | int         | NO   | PRI | NULL    |       |
| disease                        | varchar(50) | YES  | MUL | NULL    |       |
| itching                        | tinyint(1)  | YES  |     | NULL    |       |
| skin_rash                      | tinyint(1)  | YES  |     | NULL    |       |
| nodal_skin_eruptions           | tinyint(1)  | YES  |     | NULL    |       |
| continuous_sneezing            | tinyint(1)  | YES  |     | NULL    |       |
| shivering                      | tinyint(1)  | YES  |     | NULL    |       |
| chills                         | tinyint(1)  | YES  |     | NULL    |       |
| joint_pain                     | tinyint(1)  | YES  |     | NULL    |       |
| stomach_pain                   | tinyint(1)  | YES  |     | NULL    |       |
| acidity                        | tinyint(1)  | YES  |     | NULL    |       |
| ulcers_on_tongue               | tinyint(1)  | YES  |     | NULL    |       |
| muscle_wasting                 | tinyint(1)  | YES  |     | NULL    |       |
| vomiting                       | tinyint(1)  | YES  |     | NULL    |       |
| burning_micturition            | tinyint(1)  | YES  |     | NULL    |       |
| spotting_urination             | tinyint(1)  | YES  |     | NULL    |       |
| fatigue                        | tinyint(1)  | YES  |     | NULL    |       |
| weight_gain                    | tinyint(1)  | YES  |     | NULL    |       |
```

```
| palpitations                  | tinyint(1)   | YES  |     | NULL    |       |
| painful_walking               | tinyint(1)   | YES  |     | NULL    |       |
| pus_filled_pimples            | tinyint(1)   | YES  |     | NULL    |       |
| blackheads                    | tinyint(1)   | YES  |     | NULL    |       |
| scurring                      | tinyint(1)   | YES  |     | NULL    |       |
| skin_peeling                  | tinyint(1)   | YES  |     | NULL    |       |
| silver_like_dusting           | tinyint(1)   | YES  |     | NULL    |       |
| small_dents_in_nails          | tinyint(1)   | YES  |     | NULL    |       |
| inflammatory_nails            | tinyint(1)   | YES  |     | NULL    |       |
| blister                       | tinyint(1)   | YES  |     | NULL    |       |
| ed_sore_around_nose           | tinyint(1)   | YES  |     | NULL    |       |
| yellow_crust_ooze             | tinyint(1)   | YES  |     | NULL    |       |
+-------------------------------+--------------+------+-----+---------+-------+
133 rows in set (0.00 sec)
```

```
mysql> describe Drugs;
+--------------------+--------------+------+-----+---------+-------+
| Field              | Type         | Null | Key | Default | Extra |
+--------------------+--------------+------+-----+---------+-------+
| name               | varchar(100) | NO   | PRI | NULL    |       |
| disease            | varchar(50)  | YES  | MUL | NULL    |       |
| side_effect1       | varchar(50)  | YES  |     | NULL    |       |
| side_effect2       | varchar(50)  | YES  |     | NULL    |       |
| side_effect3       | varchar(50)  | YES  |     | NULL    |       |
| rating             | float        | YES  |     | NULL    |       |
| pregnancy_category | varchar(10)  | YES  |     | NULL    |       |
| alcohol            | varchar(10)  | YES  |     | NULL    |       |
+--------------------+--------------+------+-----+---------+-------+
8 rows in set (0.00 sec)
```

```
mysql> describe Drug_Relations;
+-------+-------------+------+-----+---------+-------+
| Field | Type        | Null | Key | Default | Extra |
+-------+-------------+------+-----+---------+-------+
| drug1 | varchar(100) | NO   | PRI | NULL    |       |
| drug2 | varchar(100) | NO   | PRI | NULL    |       |
+-------+-------------+------+-----+---------+-------+
2 rows in set (0.01 sec)
```

```
mysql> describe User_Queries;
+--------------------------------+------------+------+-----+---------+-------+
| Field                          | Type       | Null | Key | Default | Extra |
+--------------------------------+------------+------+-----+---------+-------+
| query_id                       | int        | NO   | PRI | NULL    |       |
| itching                        | tinyint(1) | YES  |     | NULL    |       |
| skin_rash                      | tinyint(1) | YES  |     | NULL    |       |
| nodal_skin_eruptions           | tinyint(1) | YES  |     | NULL    |       |
| continuous_sneezing            | tinyint(1) | YES  |     | NULL    |       |
| shivering                      | tinyint(1) | YES  |     | NULL    |       |
| chills                         | tinyint(1) | YES  |     | NULL    |       |
| joint_pain                     | tinyint(1) | YES  |     | NULL    |       |
| stomach_pain                   | tinyint(1) | YES  |     | NULL    |       |
| acidity                        | tinyint(1) | YES  |     | NULL    |       |
| ulcers_on_tongue               | tinyint(1) | YES  |     | NULL    |       |
| muscle_wasting                 | tinyint(1) | YES  |     | NULL    |       |
| vomiting                       | tinyint(1) | YES  |     | NULL    |       |
| burning_micturition            | tinyint(1) | YES  |     | NULL    |       |
| spotting_urination             | tinyint(1) | YES  |     | NULL    |       |
| fatigue                        | tinyint(1) | YES  |     | NULL    |       |
| weight_gain                    | tinyint(1) | YES  |     | NULL    |       |
| anxiety                        | tinyint(1) | YES  |     | NULL    |       |
| cold_hands_and_feets           | tinyint(1) | YES  |     | NULL    |       |
| mood_swings                    | tinyint(1) | YES  |     | NULL    |       |
| weight_loss                    | tinyint(1) | YES  |     | NULL    |       |
| restlessness                   | tinyint(1) | YES  |     | NULL    |       |
| lethargy                       | tinyint(1) | YES  |     | NULL    |       |
| patches_in_throat              | tinyint(1) | YES  |     | NULL    |       |
```

```
| lack_of_concentration          | tinyint(1) | YES  |     | NULL    |       |
| visual_disturbances            | tinyint(1) | YES  |     | NULL    |       |
| receiving_blood_transfusion    | tinyint(1) | YES  |     | NULL    |       |
| receiving_unsterile_injections | tinyint(1) | YES  |     | NULL    |       |
| coma                           | tinyint(1) | YES  |     | NULL    |       |
| stomach_bleeding               | tinyint(1) | YES  |     | NULL    |       |
| distention_of_abdomen          | tinyint(1) | YES  |     | NULL    |       |
| history_of_alcohol_consumption | tinyint(1) | YES  |     | NULL    |       |
| blood_in_sputum                | tinyint(1) | YES  |     | NULL    |       |
| prominent_veins_on_calf        | tinyint(1) | YES  |     | NULL    |       |
| palpitations                   | tinyint(1) | YES  |     | NULL    |       |
| painful_walking                | tinyint(1) | YES  |     | NULL    |       |
| pus_filled_pimples             | tinyint(1) | YES  |     | NULL    |       |
| blackheads                     | tinyint(1) | YES  |     | NULL    |       |
| scurring                       | tinyint(1) | YES  |     | NULL    |       |
| skin_peeling                   | tinyint(1) | YES  |     | NULL    |       |
| silver_like_dusting            | tinyint(1) | YES  |     | NULL    |       |
| small_dents_in_nails           | tinyint(1) | YES  |     | NULL    |       |
| inflammatory_nails             | tinyint(1) | YES  |     | NULL    |       |
| blister                        | tinyint(1) | YES  |     | NULL    |       |
| ed_sore_around_nose            | tinyint(1) | YES  |     | NULL    |       |
| yellow_crust_ooze              | tinyint(1) | YES  |     | NULL    |       |
| location                       | point      | YES  |     | NULL    |       |
| date                           | date       | YES  |     | NULL    |       |
+--------------------------------+------------+------+-----+---------+-------+
134 rows in set (0.01 sec)
```

```
mysql> describe Diseases
    -> ;
+--------------+--------------+------+-----+---------+-------+
| Field        | Type         | Null | Key | Default | Extra |
+--------------+--------------+------+-----+---------+-------+
| name         | varchar(50)  | NO   | PRI | NULL    |       |
| description  | varchar(400) | YES  |     | NULL    |       |
| precaution_1 | varchar(50)  | YES  |     | NULL    |       |
| precaution_2 | varchar(50)  | YES  |     | NULL    |       |
| precaution_3 | varchar(50)  | YES  |     | NULL    |       |
| precaution_4 | varchar(50)  | YES  |     | NULL    |       |
+--------------+--------------+------+-----+---------+-------+
6 rows in set (0.00 sec)

mysql> describe Drugs;
+--------------------+--------------+------+-----+---------+-------+
| Field              | Type         | Null | Key | Default | Extra |
+--------------------+--------------+------+-----+---------+-------+
| name               | varchar(100) | NO   | PRI | NULL    |       |
| disease            | varchar(50)  | YES  | MUL | NULL    |       |
| side_effect1       | varchar(50)  | YES  |     | NULL    |       |
| side_effect2       | varchar(50)  | YES  |     | NULL    |       |
| side_effect3       | varchar(50)  | YES  |     | NULL    |       |
| rating             | float        | YES  |     | NULL    |       |
| pregnancy_category | varchar(10)  | YES  |     | NULL    |       |
| alcohol            | varchar(10)  | YES  |     | NULL    |       |
+--------------------+--------------+------+-----+---------+-------+
8 rows in set (0.00 sec)
```

```
mysql> describe Temp_Drugs;
+------------------------------+--------------+------+-----+---------+-------+
| Field                        | Type         | Null | Key | Default | Extra |
+------------------------------+--------------+------+-----+---------+-------+
| name                         | varchar(100) | NO   | PRI | NULL    |       |
| medical_condition            | varchar(50)  | YES  |     | NULL    |       |
| side_effects                 | text         | YES  |     | NULL    |       |
| generic_name                 | varchar(50)  | YES  |     | NULL    |       |
| drug_classes                 | varchar(50)  | YES  |     | NULL    |       |
| brand_names                  | varchar(50)  | YES  |     | NULL    |       |
| activity                     | float        | YES  |     | NULL    |       |
| rx_otc                       | varchar(10)  | YES  |     | NULL    |       |
| pregnancy_category           | varchar(1)   | YES  |     | NULL    |       |
| csa                          | varchar(1)   | YES  |     | NULL    |       |
| alcohol                      | varchar(1)   | YES  |     | NULL    |       |
| related_drugs                | varchar(20)  | YES  |     | NULL    |       |
| medical_condition_description | varchar(255) | YES  |     | NULL    |       |
| rating                       | float        | YES  |     | NULL    |       |
| no_of_reviews                | int          | YES  |     | NULL    |       |
| drug_link                    | varchar(255) | YES  |     | NULL    |       |
| medical_condition_url        | varchar(255) | YES  |     | NULL    |       |
+------------------------------+--------------+------+-----+---------+-------+
17 rows in set (0.01 sec)
```

```
mysql> describe Combined_Drugs_SE;
+------------------------------+--------------+------+-----+---------+-------+
| Field                        | Type         | Null | Key | Default | Extra |
+------------------------------+--------------+------+-----+---------+-------+
| drug_name                    | varchar(100) | YES  |     | NULL    |       |
| medical_condition            | varchar(50)  | YES  |     | NULL    |       |
| side_effects                 | varchar(255) | YES  |     | NULL    |       |
| generic_name                 | varchar(255) | YES  |     | NULL    |       |
| drug_classes                 | varchar(255) | YES  |     | NULL    |       |
| brand_names                  | varchar(255) | YES  |     | NULL    |       |
| activity                     | varchar(255) | YES  |     | NULL    |       |
| rx_otc                       | varchar(255) | YES  |     | NULL    |       |
| pregnancy_category           | varchar(10)  | YES  |     | NULL    |       |
| csa                          | varchar(255) | YES  |     | NULL    |       |
| alcohol                      | varchar(10)  | YES  |     | NULL    |       |
| related_drugs                | varchar(255) | YES  |     | NULL    |       |
| medical_condition_description | text         | YES  |     | NULL    |       |
| rating                       | float        | YES  |     | NULL    |       |
| no_of_reviews                | int          | YES  |     | NULL    |       |
| drug_link                    | varchar(255) | YES  |     | NULL    |       |
| medical_condition_url        | varchar(255) | YES  |     | NULL    |       |
| sideEffect0                  | varchar(50)  | YES  |     | NULL    |       |
| sideEffect1                  | varchar(50)  | YES  |     | NULL    |       |
| sideEffect2                  | varchar(50)  | YES  |     | NULL    |       |
+------------------------------+--------------+------+-----+---------+-------+
20 rows in set (0.00 sec)
```

```
mysql> describe Temp_DrugsReview;
+-------------+--------------+------+-----+---------+-------+
| Field       | Type         | Null | Key | Default | Extra |
+-------------+--------------+------+-----+---------+-------+
| uniqueID    | int          | NO   | PRI | NULL    |       |
| drugName    | varchar(50)  | YES  |     | NULL    |       |
| condition_  | varchar(255) | YES  |     | NULL    |       |
| review      | text         | YES  |     | NULL    |       |
| rating      | int          | YES  |     | NULL    |       |
| date_       | text         | YES  |     | NULL    |       |
| usefulCount | int          | YES  |     | NULL    |       |
+-------------+--------------+------+-----+---------+-------+
7 rows in set (0.00 sec)
```