DATABASE MANAGEMENT SYSTEMS - ASSIGNMENT 3

The Formula 1 Database

TeamMate 1 Royston E Tauro

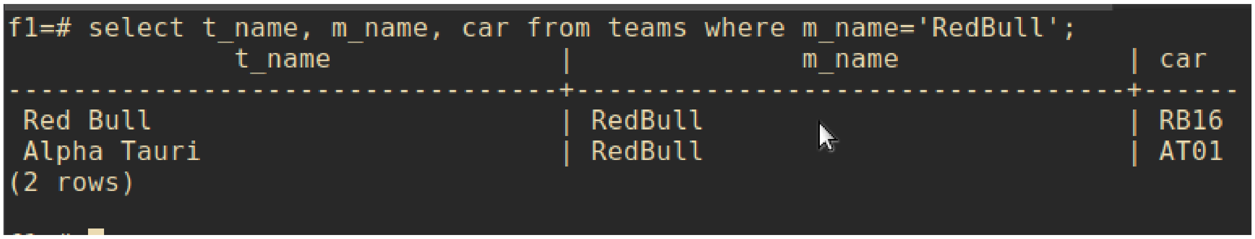
TeamMate 2 Rohan M

TeamMate 3 Rahul Manjunath

1. Simple Queries

a. Teams which have Redbull as their manufacturer

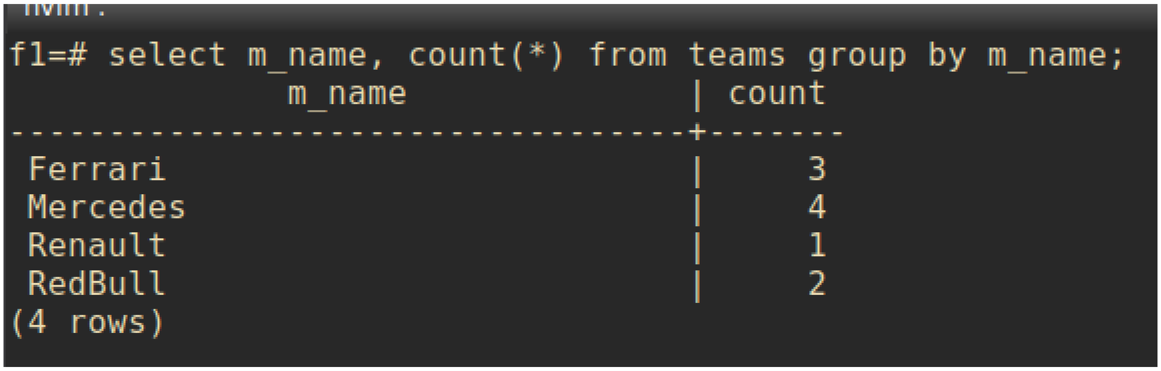
Query: - Select t_name, m_name, car from teams where m_name='RedBull';



```
f1=# select t_name, m_name, car from teams where m_name='RedBull';
            t_name              |              m_name              | car
--------------------------------+----------------------------------+------
 Red Bull                       | RedBull                          | RB16
 Alpha Tauri                    | RedBull                          | AT01
(2 rows)
```

b. Count all the manufacturers in a team

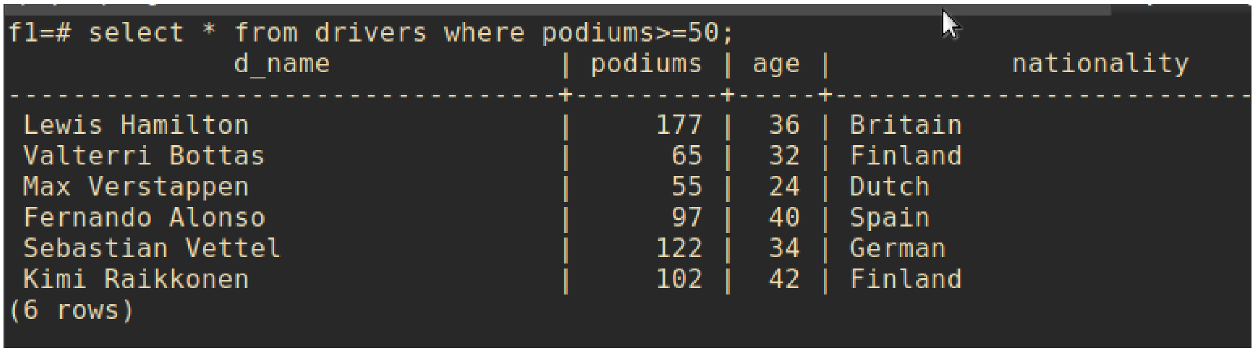
QUERY:- Select m_name, count(*) from teams group by m_name;



```
f1=# select m_name, count(*) from teams group by m_name;
              m_name              | count
----------------------------------+-------
 Ferrari                          |     3
 Mercedes                         |     4
 Renault                          |     1
 RedBull                          |     2
(4 rows)
```

c. Get all drivers who have podium finished above 50

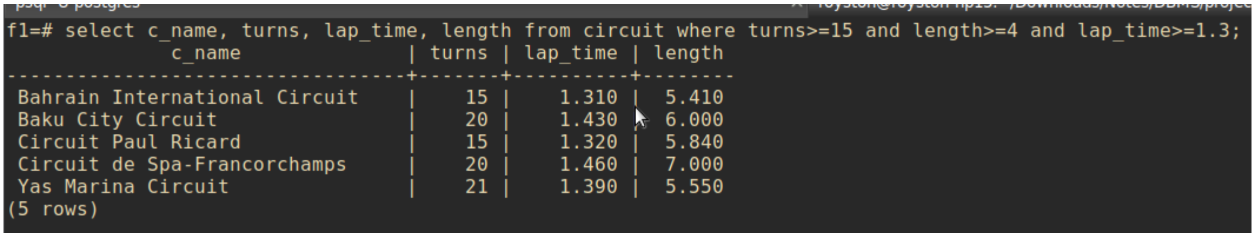
Query:- Select * from drivers where podiums>=50;



```
f1=# select * from drivers where podiums>=50;
              d_name              | podiums | age |          nationality
----------------------------------+---------+-----+--------------------------
 Lewis Hamilton                   |     177 |  36 | Britain
 Valterri Bottas                  |      65 |  32 | Finland
 Max Verstappen                   |      55 |  24 | Dutch
 Fernando Alonso                  |      97 |  40 | Spain
 Sebastian Vettel                 |     122 |  34 | German
 Kimi Raikkonen                   |     102 |  42 | Finland
(6 rows)
```

d. Get all circuits with turns greater than 15, length greater than 4 and lap time greater than 1.3

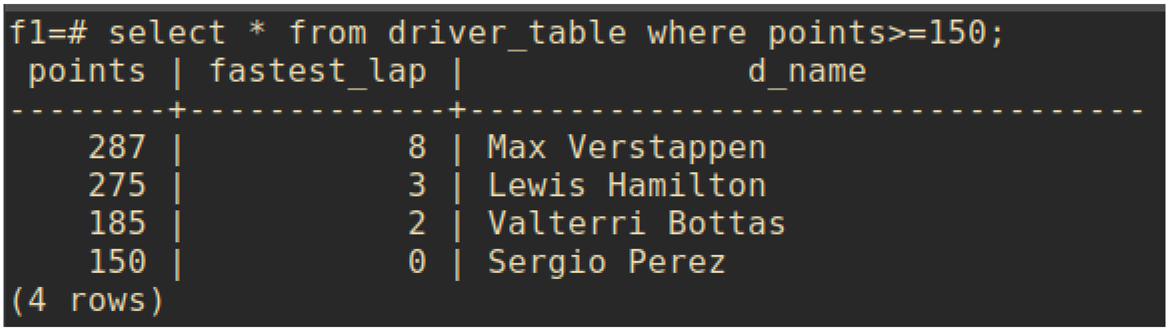
Query: Select c_name, turns, lap_time, length from circuit where turns>=15 and length>=4 and lap_time>=1.3



```
f1=# select c_name, turns, lap_time, length from circuit where turns>=15 and length>=4 and lap_time>=1.3;
             c_name              | turns | lap_time | length
---------------------------------+-------+----------+--------
 Bahrain International Circuit   |    15 |    1.310 |  5.410
 Baku City Circuit               |    20 |    1.430 |  6.000
 Circuit Paul Ricard             |    15 |    1.320 |  5.840
 Circuit de Spa-Francorchamps    |    20 |    1.460 |  7.000
 Yas Marina Circuit              |    21 |    1.390 |  5.550
(5 rows)
```

e. Get all drivers who have points more than 150

Query: Select * from driver_table where points>=150

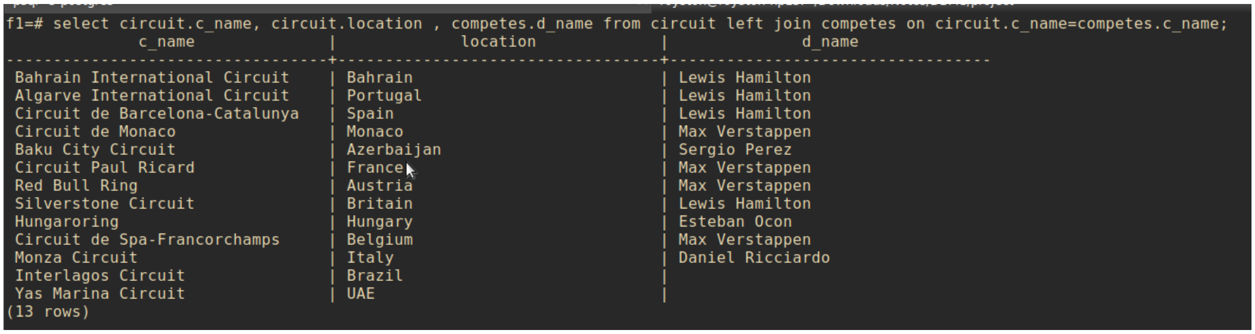


```
f1=# select * from driver_table where points>=150;
 points | fastest_lap |              d_name
--------+-------------+----------------------------------
    287 |           8 | Max Verstappen
    275 |           3 | Lewis Hamilton
    185 |           2 | Valterri Bottas
    150 |           0 | Sergio Perez
(4 rows)
```

2. Complex Queries

a. Get all winners of the circuits

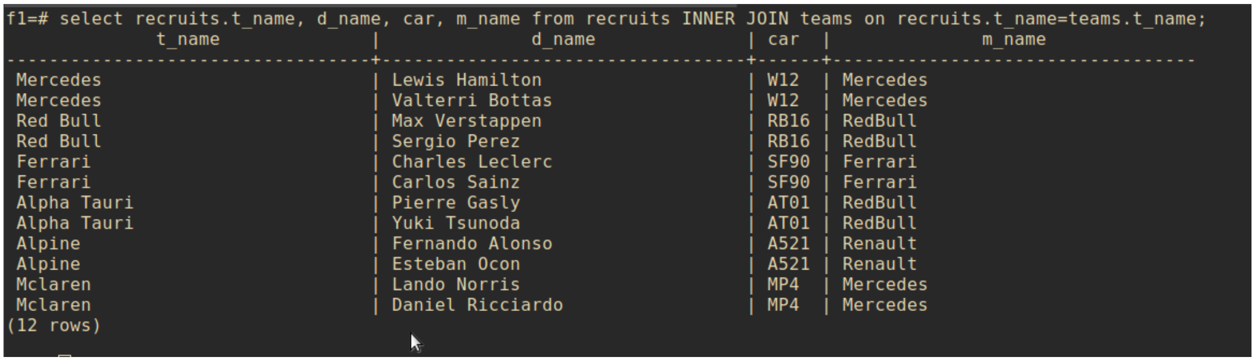
Query: select circuit.c_name, circuit.location , competes.d_name from circuit left join competes on circuit.c_name=competes.c_name



```
f1=# select circuit.c_name, circuit.location , competes.d_name from circuit left join competes on circuit.c_name=competes.c_name;
             c_name              |            location             |             d_name
---------------------------------+---------------------------------+---------------------------------
 Bahrain International Circuit   | Bahrain                         | Lewis Hamilton
 Algarve International Circuit   | Portugal                        | Lewis Hamilton
 Circuit de Barcelona-Catalunya  | Spain                           | Lewis Hamilton
 Circuit de Monaco               | Monaco                          | Max Verstappen
 Baku City Circuit               | Azerbaijan                      | Sergio Perez
 Circuit Paul Ricard             | France                          | Max Verstappen
 Red Bull Ring                   | Austria                         | Max Verstappen
 Silverstone Circuit             | Britain                         | Lewis Hamilton
 Hungaroring                     | Hungary                         | Esteban Ocon
 Circuit de Spa-Francorchamps    | Belgium                         | Max Verstappen
 Monza Circuit                   | Italy                           | Daniel Ricciardo
 Interlagos Circuit              | Brazil                          |
 Yas Marina Circuit              | UAE                             |
(13 rows)
```

b. Get all drivers represented by teams and the cars and manufacturers they have

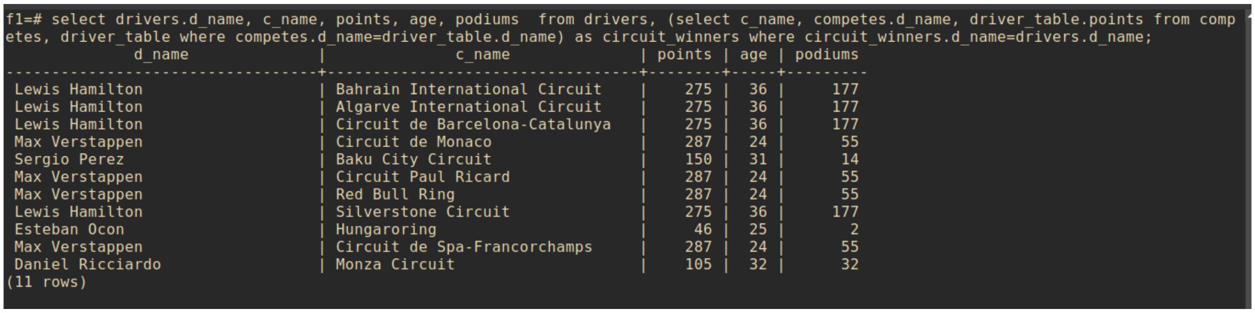
Query : select circuit.c_name, circuit.location , competes.d_name from circuit left join competes on circuit.c_name=competes.c_name



```
f1=# select recruits.t_name, d_name, car, m_name from recruits INNER JOIN teams on recruits.t_name=teams.t_name;
              t_name              |              d_name              | car  |              m_name
----------------------------------+----------------------------------+------+----------------------------------
 Mercedes                         | Lewis Hamilton                   | W12  | Mercedes
 Mercedes                         | Valterri Bottas                  | W12  | Mercedes
 Red Bull                         | Max Verstappen                   | RB16 | RedBull
 Red Bull                         | Sergio Perez                     | RB16 | RedBull
 Ferrari                          | Charles Leclerc                  | SF90 | Ferrari
 Ferrari                          | Carlos Sainz                     | SF90 | Ferrari
 Alpha Tauri                      | Pierre Gasly                     | AT01 | RedBull
 Alpha Tauri                      | Yuki Tsunoda                     | AT01 | RedBull
 Alpine                           | Fernando Alonso                  | A521 | Renault
 Alpine                           | Esteban Ocon                     | A521 | Renault
 Mclaren                          | Lando Norris                     | MP4  | Mercedes
 Mclaren                          | Daniel Ricciardo                 | MP4  | Mercedes
(12 rows)
```

c. Get all the information of the drivers that have won a circuit

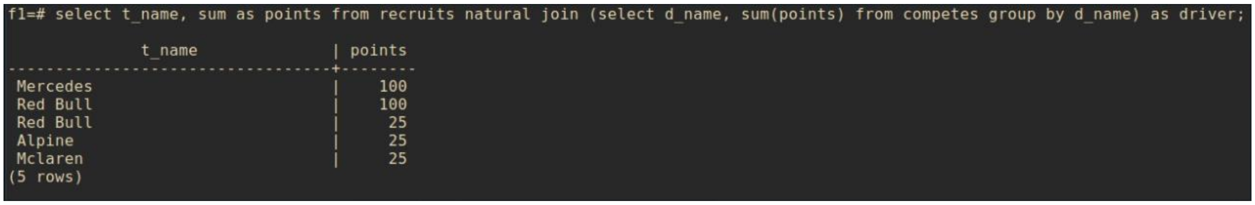
Query: select drivers.d_name, c_name, points, age, podiums from drivers, (select c_name, competes.d_name, driver_table.points from competes, driver_table where competes.d_name = driver_table.d_name) as circuit_winners where circuit_winners.d_name = drivers.d_name



```
f1=# select drivers.d_name, c_name, points, age, podiums  from drivers, (select c_name, competes.d_name, driver_table.points from comp
etes, driver_table where competes.d_name=driver_table.d_name) as circuit_winners where circuit_winners.d_name=drivers.d_name;
             d_name              |              c_name              | points | age | podiums
---------------------------------+----------------------------------+--------+-----+---------
 Lewis Hamilton                  | Bahrain International Circuit    |    275 |  36 |     177
 Lewis Hamilton                  | Algarve International Circuit    |    275 |  36 |     177
 Lewis Hamilton                  | Circuit de Barcelona-Catalunya   |    275 |  36 |     177
 Max Verstappen                  | Circuit de Monaco                |    287 |  24 |      55
 Sergio Perez                    | Baku City Circuit                |    150 |  31 |      14
 Max Verstappen                  | Circuit Paul Ricard              |    287 |  24 |      55
 Max Verstappen                  | Red Bull Ring                    |    287 |  24 |      55
 Lewis Hamilton                  | Silverstone Circuit              |    275 |  36 |     177
 Esteban Ocon                    | Hungaroring                      |     46 |  25 |       2
 Max Verstappen                  | Circuit de Spa-Francorchamps     |    287 |  24 |      55
 Daniel Ricciardo                | Monza Circuit                    |    105 |  32 |      32
(11 rows)
```

d. Get all points scored by a team w.r.t drivers only

Query: - select t_name, sum as points from recruits natural join (select d_name, sum(points) from competes group by d_name) as driver;

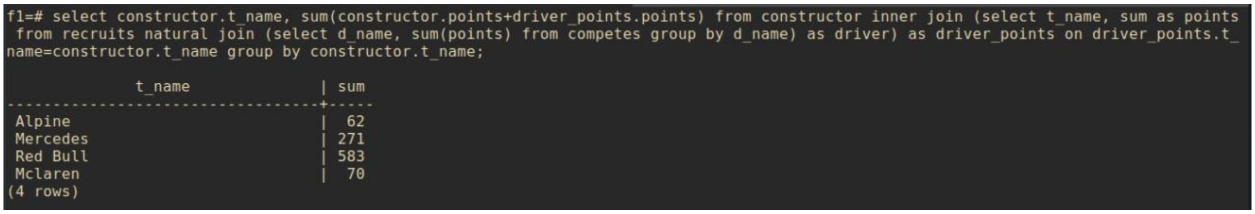


```
f1=# select t_name, sum as points from recruits natural join (select d_name, sum(points) from competes group by d_name) as driver;

             t_name              | points
---------------------------------+--------
 Mercedes                        |    100
 Red Bull                        |    100
 Red Bull                        |     25
 Alpine                          |     25
 Mclaren                         |     25
(5 rows)
```

e. Get all points scored by a team in both driver as well as constructor based championships

QUERY:- select constructor.t_name, sum (constructor.points + driver_points.points) from constructor inner join (select t_name, sum as points from recruits natural join (select d_name, sum(points) from competes group by d_name) as driver) as driver_points on driver_points.t_name = constructor.t_name group by constructor.t_name;



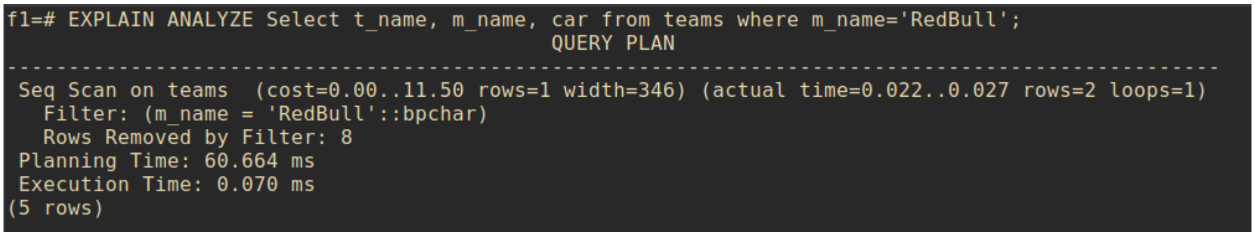
```
f1=# select constructor.t_name, sum(constructor.points+driver_points.points) from constructor inner join (select t_name, sum as points
 from recruits natural join (select d_name, sum(points) from competes group by d_name) as driver) as driver_points on driver_points.t_
name=constructor.t_name group by constructor.t_name;

              t_name              | sum
----------------------------------+-----
 Alpine                           |  62
 Mercedes                         | 271
 Red Bull                         | 583
 Mclaren                          |  70
(4 rows)
```

D. Performance Analysis

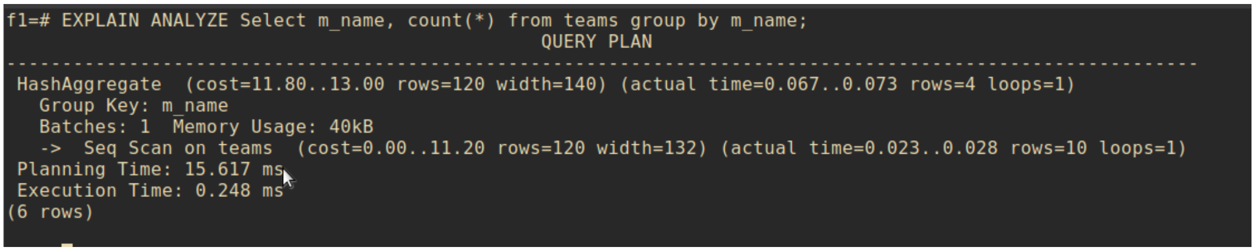
a. Simple Queries

i. Select t_name, m_name, car from teams where m_name='RedBull



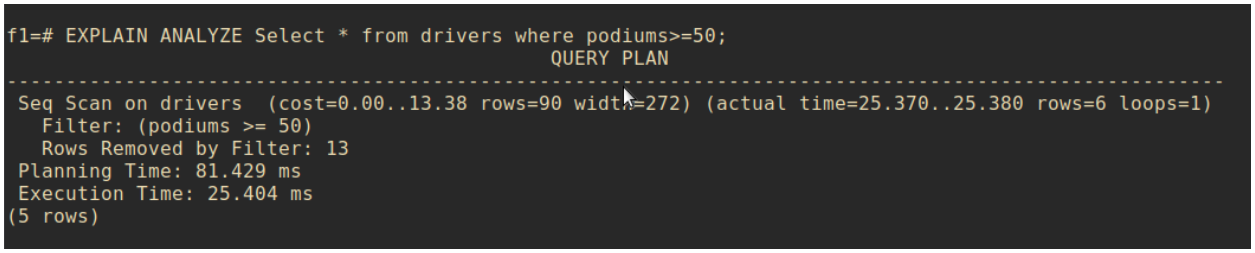
```
f1=# EXPLAIN ANALYZE Select t_name, m_name, car from teams where m_name='RedBull';
                                                  QUERY PLAN
---------------------------------------------------------------------------------------------------
 Seq Scan on teams  (cost=0.00..11.50 rows=1 width=346) (actual time=0.022..0.027 rows=2 loops=1)
   Filter: (m_name = 'RedBull'::bpchar)
   Rows Removed by Filter: 8
 Planning Time: 60.664 ms
 Execution Time: 0.070 ms
(5 rows)
```

ii. Select m_name, count(*) from teams group by m_name



```
f1=# EXPLAIN ANALYZE Select m_name, count(*) from teams group by m_name;
                                                 QUERY PLAN
------------------------------------------------------------------------------------------------------
 HashAggregate  (cost=11.80..13.00 rows=120 width=140) (actual time=0.067..0.073 rows=4 loops=1)
   Group Key: m_name
   Batches: 1  Memory Usage: 40kB
   ->  Seq Scan on teams  (cost=0.00..11.20 rows=120 width=132) (actual time=0.023..0.028 rows=10 loops=1)
 Planning Time: 15.617 ms
 Execution Time: 0.248 ms
(6 rows)
```

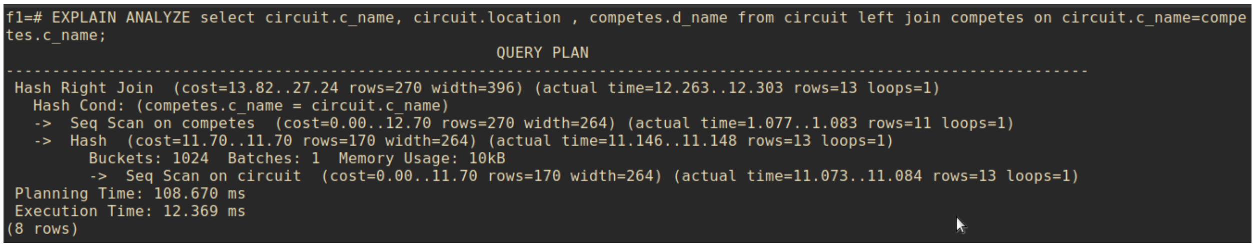
iii. Select * from drivers where podiums >= 50



```
f1=# EXPLAIN ANALYZE Select * from drivers where podiums>=50;
                                                  QUERY PLAN
------------------------------------------------------------------------------------------------------
 Seq Scan on drivers  (cost=0.00..13.38 rows=90 width=272) (actual time=25.370..25.380 rows=6 loops=1)
   Filter: (podiums >= 50)
   Rows Removed by Filter: 13
 Planning Time: 81.429 ms
 Execution Time: 25.404 ms
(5 rows)
```

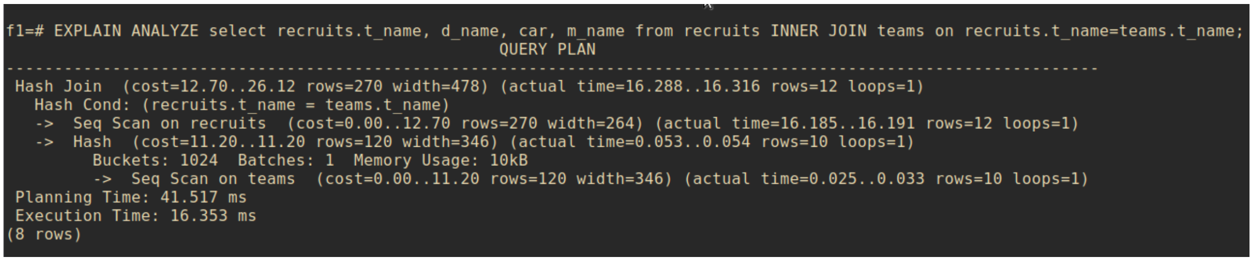
b. Complex Queries

i. Select circuit.c_name, circuit.location , competes.d_name from circuit left join competes on circuit.c_name=competes.c_name



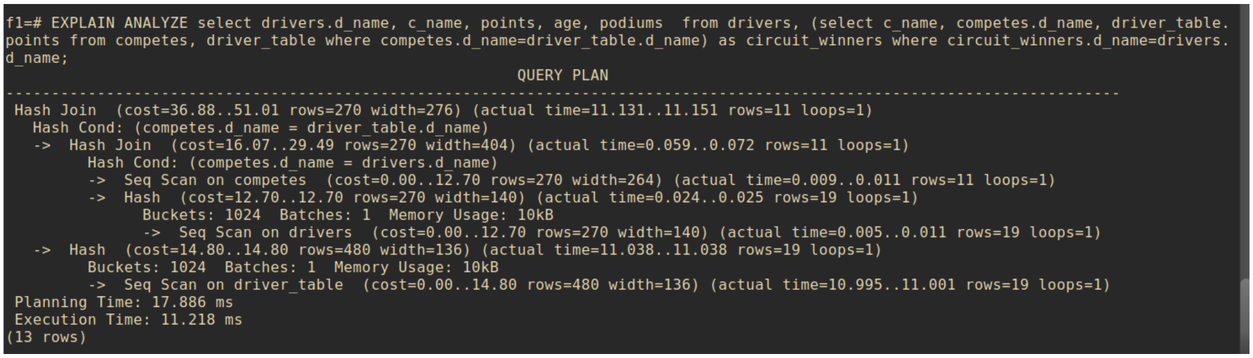
```
f1=# EXPLAIN ANALYZE select circuit.c_name, circuit.location , competes.d_name from circuit left join competes on circuit.c_name=compe
tes.c_name;
                                                        QUERY PLAN
-------------------------------------------------------------------------------------------------------------------------
 Hash Right Join  (cost=13.82..27.24 rows=270 width=396) (actual time=12.263..12.303 rows=13 loops=1)
   Hash Cond: (competes.c_name = circuit.c_name)
   ->  Seq Scan on competes  (cost=0.00..12.70 rows=270 width=264) (actual time=1.077..1.083 rows=11 loops=1)
   ->  Hash  (cost=11.70..11.70 rows=170 width=264) (actual time=11.146..11.148 rows=13 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 10kB
         ->  Seq Scan on circuit  (cost=0.00..11.70 rows=170 width=264) (actual time=11.073..11.084 rows=13 loops=1)
 Planning Time: 108.670 ms
 Execution Time: 12.369 ms
(8 rows)
```

ii. Select recruits.t_name, d_name, car, m_name from recruits INNER JOIN teams on recruits.t_name=teams.t_name



```
f1=# EXPLAIN ANALYZE select recruits.t_name, d_name, car, m_name from recruits INNER JOIN teams on recruits.t_name=teams.t_name;
                                                        QUERY PLAN
-------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=12.70..26.12 rows=270 width=478) (actual time=16.288..16.316 rows=12 loops=1)
   Hash Cond: (recruits.t_name = teams.t_name)
   ->  Seq Scan on recruits  (cost=0.00..12.70 rows=270 width=264) (actual time=16.185..16.191 rows=12 loops=1)
   ->  Hash  (cost=11.20..11.20 rows=120 width=346) (actual time=0.053..0.054 rows=10 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 10kB
         ->  Seq Scan on teams  (cost=0.00..11.20 rows=120 width=346) (actual time=0.025..0.033 rows=10 loops=1)
 Planning Time: 41.517 ms
 Execution Time: 16.353 ms
(8 rows)
```

iii. Select drivers.d_name, c_name, points, age, podiums from drivers, (select c_name, competes.d_name, driver_table.points from competes, driver_table where competes.d_name=driver_table.d_name) as circuit_winners where circuit_winners.d_name=drivers.d_name

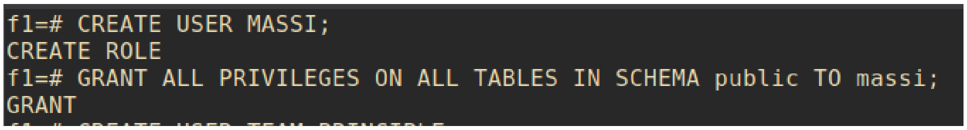


```
f1=# EXPLAIN ANALYZE select drivers.d_name, c_name, points, age, podiums  from drivers, (select c_name, competes.d_name, driver_table.
points from competes, driver_table where competes.d_name=driver_table.d_name) as circuit_winners where circuit_winners.d_name=drivers.
d_name;
                                                          QUERY PLAN
----------------------------------------------------------------------------------------------------------------------------
 Hash Join  (cost=36.88..51.01 rows=270 width=276) (actual time=11.131..11.151 rows=11 loops=1)
   Hash Cond: (competes.d_name = driver_table.d_name)
   ->  Hash Join  (cost=16.07..29.49 rows=270 width=404) (actual time=0.059..0.072 rows=11 loops=1)
         Hash Cond: (competes.d_name = drivers.d_name)
         ->  Seq Scan on competes  (cost=0.00..12.70 rows=270 width=264) (actual time=0.009..0.011 rows=11 loops=1)
         ->  Hash  (cost=12.70..12.70 rows=270 width=140) (actual time=0.024..0.025 rows=19 loops=1)
               Buckets: 1024  Batches: 1  Memory Usage: 10kB
               ->  Seq Scan on drivers  (cost=0.00..12.70 rows=270 width=140) (actual time=0.005..0.011 rows=19 loops=1)
   ->  Hash  (cost=14.80..14.80 rows=480 width=136) (actual time=11.038..11.038 rows=19 loops=1)
         Buckets: 1024  Batches: 1  Memory Usage: 10kB
         ->  Seq Scan on driver_table  (cost=0.00..14.80 rows=480 width=136) (actual time=10.995..11.001 rows=19 loops=1)
 Planning Time: 17.886 ms
 Execution Time: 11.218 ms
(13 rows)
```

E. User Levels

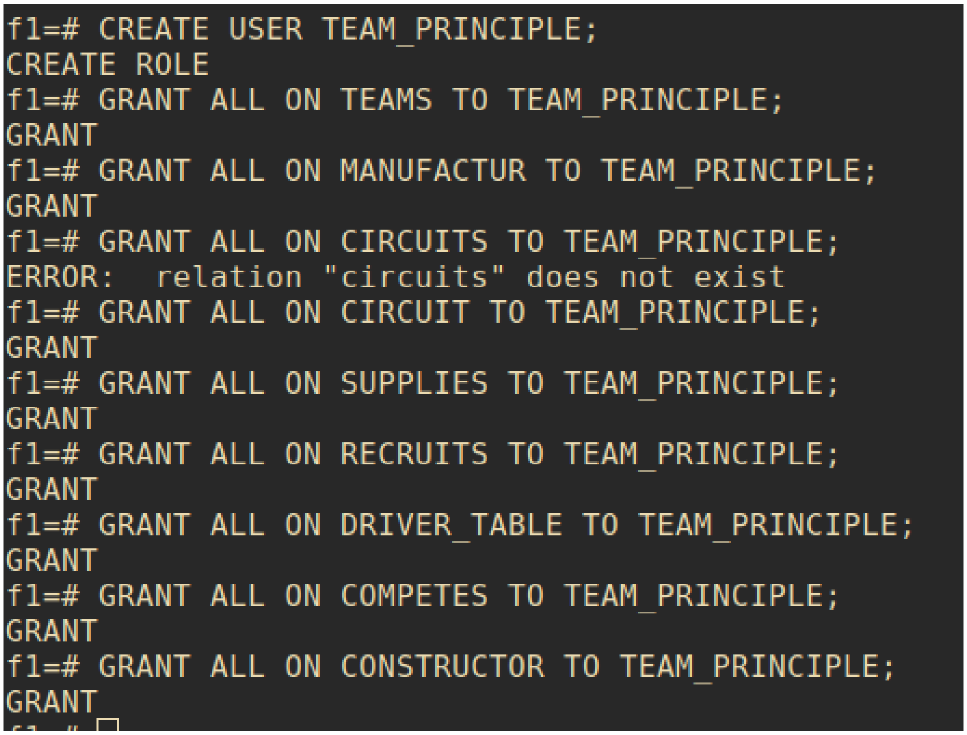
a. CREATE Roles

I. MASSI- All privileges



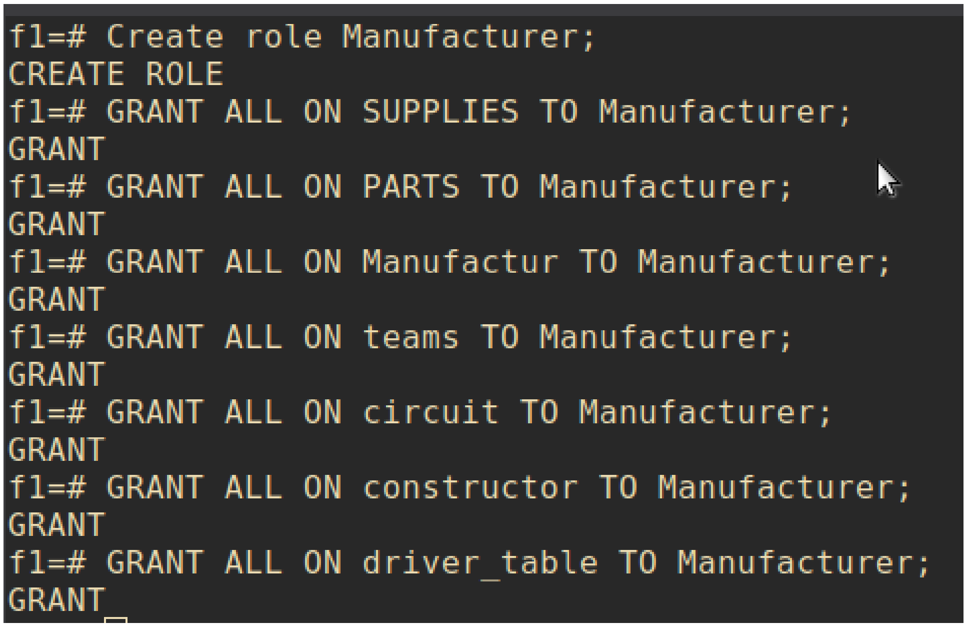
```
f1=# CREATE USER MASSI;
CREATE ROLE
f1=# GRANT ALL PRIVILEGES ON ALL TABLES IN SCHEMA public TO massi;
GRANT
f1=# CREATE USER TEAM_PRINCIPLE
```

II. TEAM_PRINCIPLE – Teams, recruits, driver_table, competes, circuits, manufactr, supplies, constructor



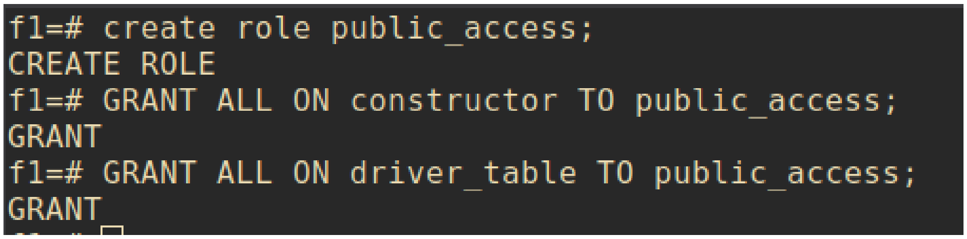
```
f1=# CREATE USER TEAM_PRINCIPLE;
CREATE ROLE
f1=# GRANT ALL ON TEAMS TO TEAM_PRINCIPLE;
GRANT
f1=# GRANT ALL ON MANUFACTUR TO TEAM_PRINCIPLE;
GRANT
f1=# GRANT ALL ON CIRCUITS TO TEAM_PRINCIPLE;
ERROR:  relation "circuits" does not exist
f1=# GRANT ALL ON CIRCUIT TO TEAM_PRINCIPLE;
GRANT
f1=# GRANT ALL ON SUPPLIES TO TEAM_PRINCIPLE;
GRANT
f1=# GRANT ALL ON RECRUITS TO TEAM_PRINCIPLE;
GRANT
f1=# GRANT ALL ON DRIVER_TABLE TO TEAM_PRINCIPLE;
GRANT
f1=# GRANT ALL ON COMPETES TO TEAM_PRINCIPLE;
GRANT
f1=# GRANT ALL ON CONSTRUCTOR TO TEAM_PRINCIPLE;
GRANT
f1=#
```

III. Manufacturer – Manufaturer table, supplies table, parts table, teams table, circuits table, constructor table and driver_table



```
f1=# Create role Manufacturer;
CREATE ROLE
f1=# GRANT ALL ON SUPPLIES TO Manufacturer;
GRANT
f1=# GRANT ALL ON PARTS TO Manufacturer;
GRANT
f1=# GRANT ALL ON Manufactur TO Manufacturer;
GRANT
f1=# GRANT ALL ON teams TO Manufacturer;
GRANT
f1=# GRANT ALL ON circuit TO Manufacturer;
GRANT
f1=# GRANT ALL ON constructor TO Manufacturer;
GRANT
f1=# GRANT ALL ON driver_table TO Manufacturer;
GRANT
```

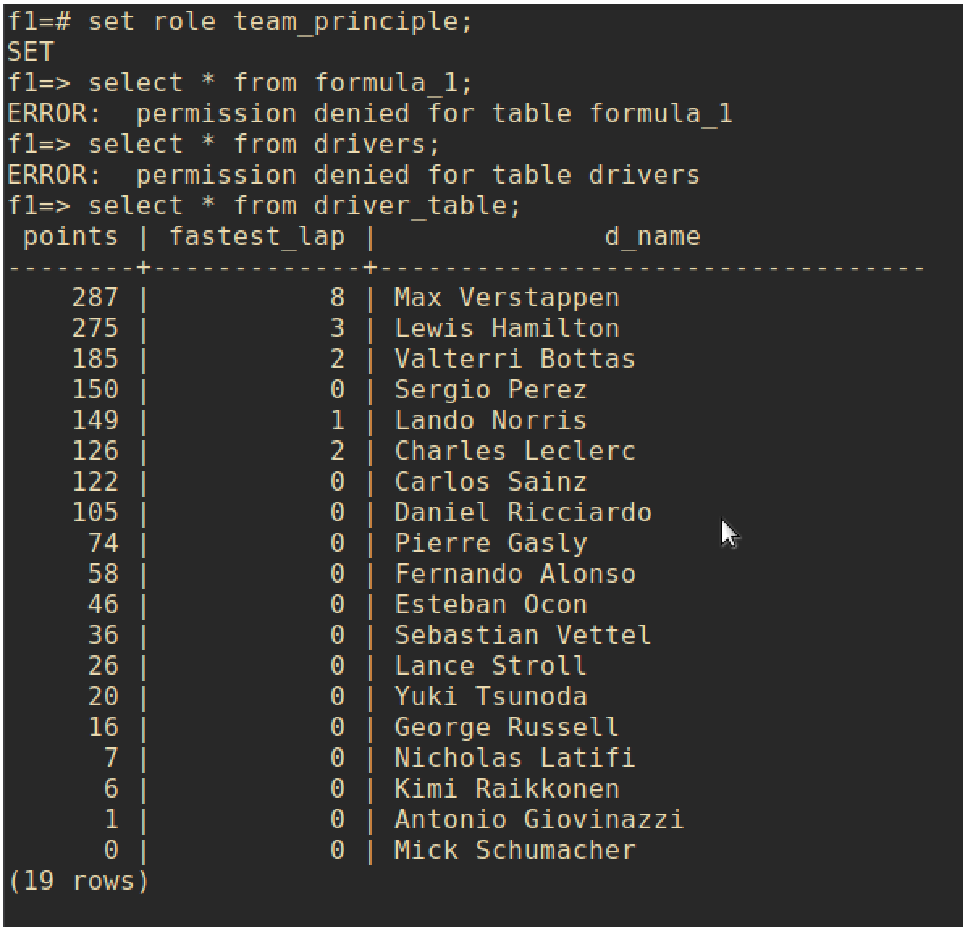
IV. Public access – only constructor and driver_table table



```
f1=# create role public_access;
CREATE ROLE
f1=# GRANT ALL ON constructor TO public_access;
GRANT
f1=# GRANT ALL ON driver_table TO public_access;
GRANT
```

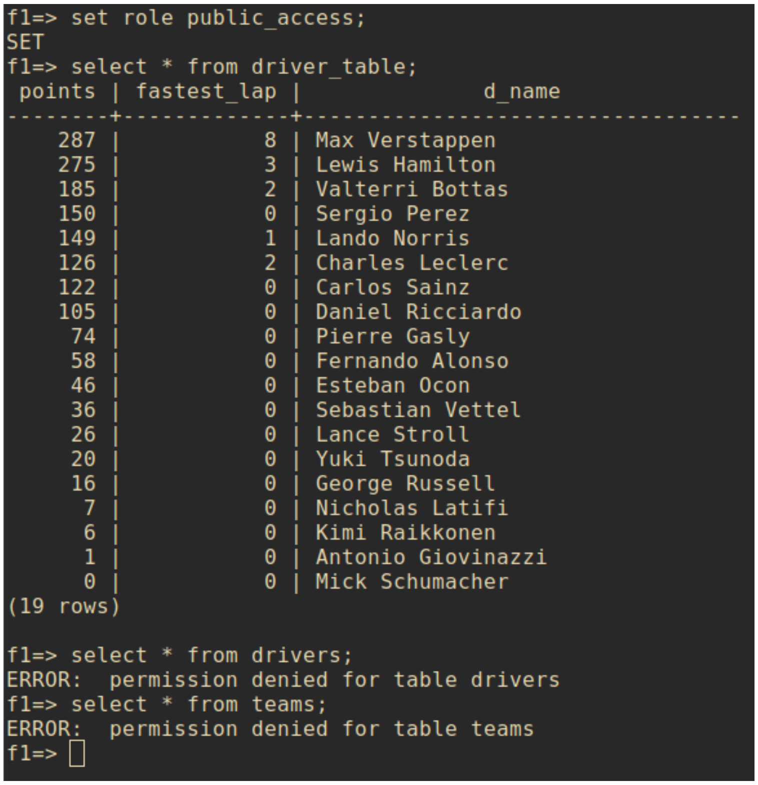
b. Privileges

I. Team_principle



```
f1=# set role team_principle;
SET
f1=> select * from formula_1;
ERROR:  permission denied for table formula_1
f1=> select * from drivers;
ERROR:  permission denied for table drivers
f1=> select * from driver_table;
 points | fastest_lap |              d_name
--------+-------------+----------------------------------
    287 |           8 | Max Verstappen
    275 |           3 | Lewis Hamilton
    185 |           2 | Valterri Bottas
    150 |           0 | Sergio Perez
    149 |           1 | Lando Norris
    126 |           2 | Charles Leclerc
    122 |           0 | Carlos Sainz
    105 |           0 | Daniel Ricciardo
     74 |           0 | Pierre Gasly
     58 |           0 | Fernando Alonso
     46 |           0 | Esteban Ocon
     36 |           0 | Sebastian Vettel
     26 |           0 | Lance Stroll
     20 |           0 | Yuki Tsunoda
     16 |           0 | George Russell
      7 |           0 | Nicholas Latifi
      6 |           0 | Kimi Raikkonen
      1 |           0 | Antonio Giovinazzi
      0 |           0 | Mick Schumacher
(19 rows)
```

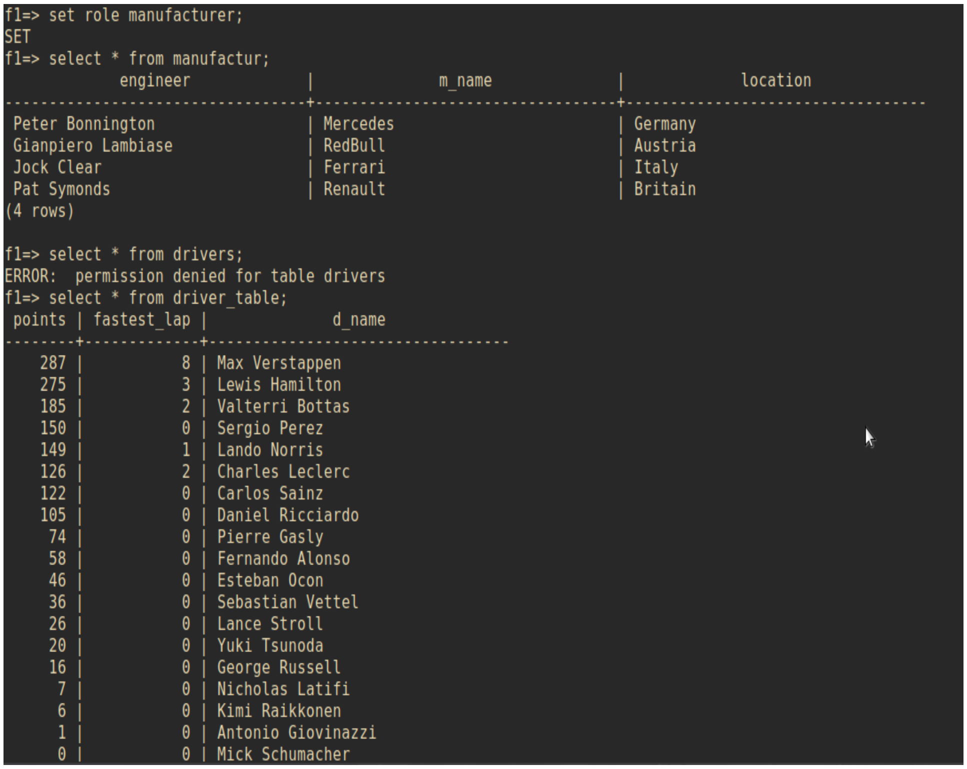
II. Public access



```
f1=> set role public_access;
SET
f1=> select * from driver_table;
 points | fastest_lap |               d_name
--------+-------------+----------------------------------
    287 |           8 | Max Verstappen
    275 |           3 | Lewis Hamilton
    185 |           2 | Valterri Bottas
    150 |           0 | Sergio Perez
    149 |           1 | Lando Norris
    126 |           2 | Charles Leclerc
    122 |           0 | Carlos Sainz
    105 |           0 | Daniel Ricciardo
     74 |           0 | Pierre Gasly
     58 |           0 | Fernando Alonso
     46 |           0 | Esteban Ocon
     36 |           0 | Sebastian Vettel
     26 |           0 | Lance Stroll
     20 |           0 | Yuki Tsunoda
     16 |           0 | George Russell
      7 |           0 | Nicholas Latifi
      6 |           0 | Kimi Raikkonen
      1 |           0 | Antonio Giovinazzi
      0 |           0 | Mick Schumacher
(19 rows)

f1=> select * from drivers;
ERROR:  permission denied for table drivers
f1=> select * from teams;
ERROR:  permission denied for table teams
f1=> 
```

III. Manufacturer



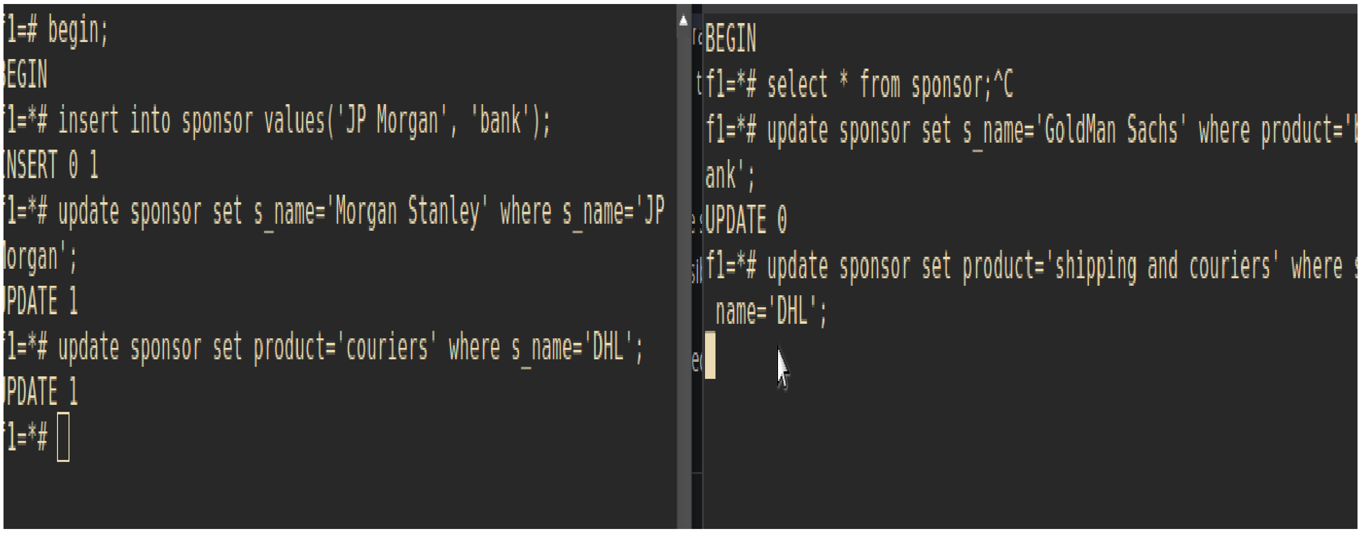
```
f1=> set role manufacturer;
SET
f1=> select * from manufactur;
           engineer            |             m_name             |            location
-------------------------------+--------------------------------+--------------------------------
 Peter Bonnington              | Mercedes                       | Germany
 Gianpiero Lambiase            | RedBull                        | Austria
 Jock Clear                    | Ferrari                        | Italy
 Pat Symonds                   | Renault                        | Britain
(4 rows)

f1=> select * from drivers;
ERROR:  permission denied for table drivers
f1=> select * from driver_table;
 points | fastest_lap |             d_name
--------+-------------+--------------------------------
    287 |           8 | Max Verstappen
    275 |           3 | Lewis Hamilton
    185 |           2 | Valterri Bottas
    150 |           0 | Sergio Perez
    149 |           1 | Lando Norris
    126 |           2 | Charles Leclerc
    122 |           0 | Carlos Sainz
    105 |           0 | Daniel Ricciardo
     74 |           0 | Pierre Gasly
     58 |           0 | Fernando Alonso
     46 |           0 | Esteban Ocon
     36 |           0 | Sebastian Vettel
     26 |           0 | Lance Stroll
     20 |           0 | Yuki Tsunoda
     16 |           0 | George Russell
      7 |           0 | Nicholas Latifi
      6 |           0 | Kimi Raikkonen
      1 |           0 | Antonio Giovinazzi
      0 |           0 | Mick Schumacher
```

F. Concurrent Transactions

Locks:

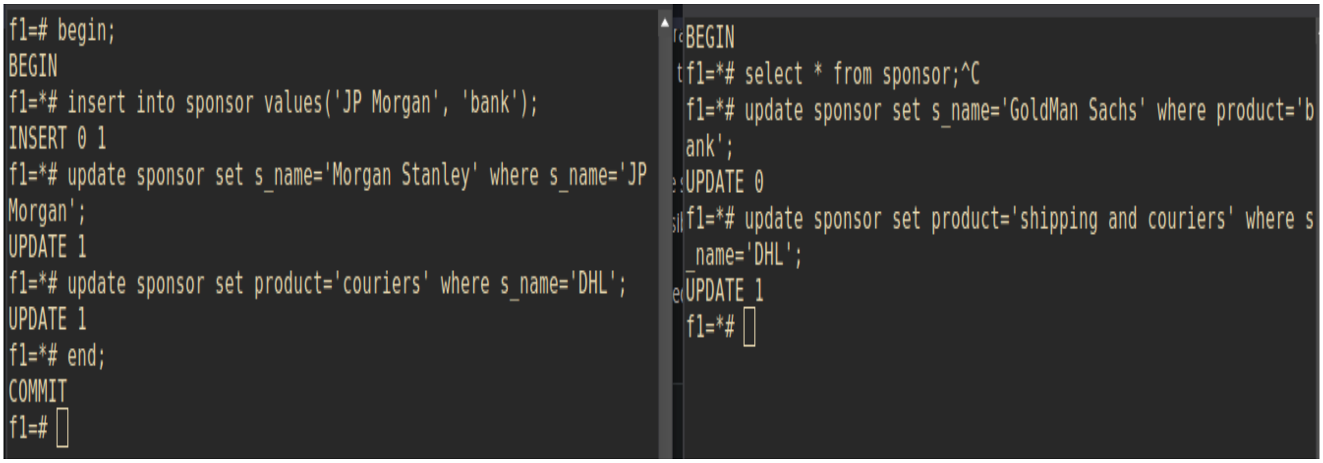
There is a lock set on sponsor which has the s_name as ‘DHL’ and hence in transaction 2, the update statement is waiting to execute until the lock is releases



```
f1=# begin;
BEGIN
f1=*# insert into sponsor values('JP Morgan', 'bank');
INSERT 0 1
f1=*# update sponsor set s_name='Morgan Stanley' where s_name='JP
Morgan';
UPDATE 1
f1=*# update sponsor set product='couriers' where s_name='DHL';
UPDATE 1
f1=*# 
```

```
BEGIN
f1=*# select * from sponsor;^C
f1=*# update sponsor set s_name='GoldMan Sachs' where product='b
ank';
UPDATE 0
f1=*# update sponsor set product='shipping and couriers' where s
_name='DHL';
```

Lock released



```
f1=# begin;
BEGIN
f1=*# insert into sponsor values('JP Morgan', 'bank');
INSERT 0 1
f1=*# update sponsor set s_name='Morgan Stanley' where s_name='JP
Morgan';
UPDATE 1
f1=*# update sponsor set product='couriers' where s_name='DHL';
UPDATE 1
f1=*# end;
COMMIT
f1=# 
```

```
BEGIN
f1=*# select * from sponsor;^C
f1=*# update sponsor set s_name='GoldMan Sachs' where product='b
ank';
UPDATE 0
f1=*# update sponsor set product='shipping and couriers' where s
_name='DHL';
UPDATE 1
f1=*# 
```

G. Work Division

The queries were done by Rohan. The concurrent transactions and user privileges was done by Royston. Performance Analysis was done by Rahul