

CPSC 304 Project Cover Page

Milestone #: 4

Date: 1/12/2023

Group Number: 38

Name	Student Number	CS Alias (Userid)	Preferred E-mail Address
Michael Tham	36082469	s6f2k	mtham01@student.ubc.ca
Christopher Wong	78318987	k4g2g	chw2305@student.ubc.ca
Maureen Marthias	83217794	w5t9j	mmarthia@student.ubc.ca

By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)

In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia.

1. Repository Link

[Repository Link](#)

2. A short description of the final project, and what it accomplished.

Our final project was an application that displays Formula 1 (F1) race data and standings. We managed to create 5 pages – home, standings, results, drivers, and constructors. The home page contains a short description of what F1 is and links to each of our other 4 pages. In the standings page, the user would be able to select the different standings based on their desired year (e.g. 2023) and whether they would like to see the driver's standings or constructor's standings[year, track, pos, driver, time]. The results page shows the results of drivers in their past races. The user would be able to add and remove results as well as filter the results they see based on year and the city of the F1 track (e.g. Singapore). The user will also be able to see the fastest average race time. The drivers page allows the user to see data that can be filtered on the year and driver name. The user will also see the maximum average lap time in qualifying out of all the drivers. The constructors page allows the user to see data that can be filtered on the year and constructor name. The user will also be able to input and see which constructors have won more than a certain amount of races, calculate the number of races a constructor has been in, and see which constructor(s) have placed a certain position every season.

At the end of the project, as F1 fans, we all agreed that this application would be an efficient way for F1 fanatics to browse through and keep track of everything they need to know about F1 which was one of our motivations and goals as to creating this application.

3. A description of how your final schema differed from the schema you turned in If the final schema differed, explain why. Note that turning in a final schema that's different from what you planned is fine, we just want to know what changed and why.

We made a few changes to our schema that are noted below as we thought that the data would be cleaner and more efficient to pull from:

- From removing the 'Drivers', 'WorksFor', and 'Participate' tables, we made a new table called 'Drivers_WorksFor_Participate'.
- From removing the 'At' and 'Tracks' tables, we made a new table 'At_Tracks' to represent the 'Races', 'At', and 'Tracks' tables.
- We also made a new table called 'Driver_Rank_Standings_Withholds' and removed the table 'Season_Standings'.
- We also made a new table called 'Constructor_Rank_Standings_Withholds' and thereby removed 'Has' and 'Creates' as we included their attributes in this table.

- Removed the 'SetsGrid' table as we included the LapTimes attribute in the 'StartingGrid' and some of the ISA child entities – Qualifying, and Practice.
- To the 'GrandPrix_Results' table, we added new attributes – NumberOfLaps, RaceTime, Rank, and seasonID foreign key reference from the 'Seasons' table as new attributes and removed the 'GrandPrix' table. We realized we wanted to also display the number of laps
- Added the attribute LapTimes and RaceID foreign key reference from the 'Races' table to the 'StartingGrid' table

4. A copy of the schema and screenshots that show what data is present in each relation after the SQL script is run.


Seasons (SeasonID: INT, Year: INT)
PRIMARY KEY (SeasonID)

Data Present after SQL script is run:

	 SEASONID ▾	 YEAR ▾
1	1	2023
2	2	2022
3	3	2021
4	4	2020
5	5	2019

Constructors (Name: VARCHAR(50), TeamPrincipal: VARCHAR(50), Championships: INT)
UNIQUE (TeamPrincipal)
PRIMARY KEY (Name)

Data Present after SQL script is run:

	 NAME ▾	 TEAMPRINCIPAL ▾	 CHAMPIONSHIPS ▾
1	Mercedes-AMG Petronas F1 Team	Toto Wolff	9
2	Red Bull Racing	Christian Horner	6
3	Scuderia Ferrari	Mattia Binotto	16
4	Scuderia AlphaTauri	Laurent Mekies	0
5	McLaren F1 Team	Zak Brown	8

Partners (Name: VARCHAR(50), Type: VARCHAR(50), StartDate: DATE)
PRIMARY KEY (Name)

Data Present after SQL script is run:

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	NAME	TYPE	STARTDATE
1	SponsorA	Title Sponsor	2022-01-01
2	SponsorB	Official Partner	2021-03-15
3	SponsorC	Technical Partner	2022-05-20
4	SponsorD	Official Supplier	2020-12-10
5	SponsorE	Official Sponsor	2021-08-05

Races (RaceID: INT, RaceDate: DATE)
PRIMARY KEY (RaceID)

Data Present after SQL script is run:

	RACEID	RACEDATE
1	1	2023-03-31
2	2	2023-04-02
3	3	2023-06-16
4	4	2023-06-17
5	5	2023-08-20

Drivers_WorksFor_Participate (RaceID: INT NOT NULL, DName: VARCHAR(50), Podiums:
INT NOT NULL, Wins: INT NOT NULL, Championships: INT NOT NULL, CName:
VARCHAR(50) NOT NULL,)
PRIMARY KEY (RaceID, DName)
FOREIGN KEY (CName) REFERENCES Constructors(Name) ON DELETE CASCADE
FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE

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Data Present after SQL script is run:

	DNAME	PODIUMS	WINS	CHAMPIONSHIPS	CNAME	RACEID
1	Lewis Hamilton	197	103	7	Mercedes-AMG Petronas F1 Team	1
2	Max Verstappen	98	54	3	Red Bull Racing	1
3	Charles Leclerc	30	5	0	Scuderia Ferrari	1
4	Daniel Ricciardo	32	8	0	Scuderia AlphaTauri	1
5	Lando Norris	7	0	0	McLaren F1 Team	1
6	George Russell	1	1	0	Mercedes-AMG Petronas F1 Team	1
7	Sergio Perez	9	2	0	Red Bull Racing	1
8	Carlos Sainz	2	1	0	Scuderia Ferrari	1
9	Pierre Gasly	2	1	0	Scuderia AlphaTauri	1
10	Oscar Piastri	1	0	0	McLaren F1 Team	1
11	Lewis Hamilton	198	104	8	Mercedes-AMG Petronas F1 Team	2
12	Max Verstappen	99	54	3	Red Bull Racing	2
13	Charles Leclerc	31	5	0	Scuderia Ferrari	2
14	Daniel Ricciardo	32	8	0	Scuderia AlphaTauri	2
15	Lando Norris	7	0	0	McLaren F1 Team	2
16	George Russell	1	1	0	Mercedes-AMG Petronas F1 Team	2
17	Sergio Perez	9	2	0	Red Bull Racing	2
18	Carlos Sainz	2	1	0	Scuderia Ferrari	2
19	Pierre Gasly	2	1	0	Scuderia AlphaTauri	2
20	Oscar Piastri	1	0	0	McLaren F1 Team	2

At_Tracks (TracksID: INT, City: VARCHAR(50), RaceDate: DATE, LapDistance: INT, **RaceID: INT NOT NULL**)

PRIMARY KEY (TracksID)

FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE

Data Present after SQL script is run:

	TRACKSID	CITY	RACEDATE	LAPDISTANCE	RACEID
1	1	Melbourne	2019-03-31	58	1
2	2	Montreal	2020-04-02	70	2
3	3	Austin	2021-06-16	56	3
4	4	Singapore	2022-06-17	62	4
5	5	Barcelona	2023-08-20	66	5

Practice (**RaceID: INT**, DriverName: VARCHAR(50), LapTimes: VARCHAR(20), SessionID: INT)

PRIMARY KEY (RaceID, DriverName),

FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE

Data Present after SQL script is run:

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	RACEID	DRIVERNAME	LAPTICES	SESSIONID
1	1	Lewis Hamilton	00:01:05	1
2	1	Max Verstappen	00:01:06	1
3	1	Charles Leclerc	00:01:15	1
4	1	Daniel Ricciardo	00:01:32	1
5	1	Lando Norris	00:01:55	1
6	1	George Russell	00:02:08	1
7	1	Sergio Perez	00:02:10	1
8	1	Carlos Sainz	00:02:13	1
9	1	Pierre Gasly	00:02:21	1
10	1	Oscar Piastri	00:03:10	1
11	2	Lewis Hamilton	00:01:01	1
12	2	Max Verstappen	00:01:09	1
13	2	Charles Leclerc	00:01:30	1
14	2	Daniel Ricciardo	00:01:31	1
15	2	Lando Norris	00:01:32	1
16	2	George Russell	00:01:33	1
17	2	Sergio Perez	00:02:01	1
18	2	Carlos Sainz	00:02:02	1
19	2	Pierre Gasly	00:02:03	1
20	2	Oscar Piastri	00:02:04	1

Qualifying (RaceID INT, SessionID INT, DriverName: VARCHAR(50) NOT NULL, LapTimes: VARCHAR(20) NOT NULL)

PRIMARY KEY (RaceID, DriverName)

FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE

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Data Present after SQL script is run:

	RACEID	SESSIONID	DRIVERNAME	LAPTICES
1	1	1	Lewis Hamilton	00:01:08
2	1	1	Max Verstappen	00:01:18
3	1	1	Charles Leclerc	00:01:48
4	1	1	Daniel Ricciardo	00:01:38
5	1	1	Lando Norris	00:01:58
6	1	1	George Russell	00:01:08
7	1	1	Sergio Perez	00:01:15
8	1	1	Carlos Sainz	00:01:31
9	1	1	Pierre Gasly	00:01:40
10	1	1	Oscar Piastri	00:01:39
11	2	1	Lewis Hamilton	00:01:01
12	2	1	Max Verstappen	00:01:08
13	2	1	Charles Leclerc	00:01:28
14	2	1	Daniel Ricciardo	00:01:38
15	2	1	Lando Norris	00:01:58
16	2	1	George Russell	00:02:08
17	2	1	Sergio Perez	00:02:11
18	2	1	Carlos Sainz	00:02:35
19	2	1	Pierre Gasly	00:02:38
20	2	1	Oscar Piastri	00:02:39

StartingGrid (DriverName: VARCHAR(50), StartingPosition: INT NOT NULL, RaceID: INT NOT NULL, LapTimes: VARCHAR(20) NOT NULL)

PRIMARY KEY (DriverName)

FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE

Data Present after SQL script is run:

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	DRIVERNAME	STARTINGPOSITION	RACEID	LAPTICES
1	Lewis Hamilton	1	1	00:01:00
2	Max Verstappen	2	1	00:01:04
3	Charles Leclerc	3	1	00:01:08
4	Daniel Ricciardo	4	1	00:01:31
5	Lando Norris	5	1	00:01:31
6	George Russell	6	1	00:01:41
7	Sergio Perez	7	1	00:01:45
8	Carlos Sainz	8	1	00:01:48
9	Pierre Gasly	9	1	00:01:49
10	Oscar Piastri	10	1	00:01:50
11	Lewis Hamilton	1	2	00:01:01
12	Max Verstappen	2	2	00:01:09
13	Charles Leclerc	3	2	00:01:11
14	Daniel Ricciardo	4	2	00:01:21
15	Lando Norris	5	2	00:01:41
16	George Russell	6	2	00:01:51
17	Sergio Perez	7	2	00:02:45
18	Carlos Sainz	8	2	00:02:48
19	Pierre Gasly	9	2	00:02:49
20	Oscar Piastri	10	2	00:03:01

GrandPrix_Results (**RaceID**: INT, DriverPosition: INT, DriverName: VARCHAR(50),
NumberOfLaps:INT NOT NULL, RaceTime: VARCHAR(20), **SeasonID**: INT NOT NULL,
StandingID: INT NOT NULL, Rank: INT NOT NULL)
 UNIQUE (SeasonID, DriverName, StandingID, Rank)
 PRIMARY KEY (RaceID, DriverPosition)
 FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE
 FOREIGN KEY (SeasonID) REFERENCES Seasons (SeasonID) ON DELETE CASCADE

Data Present after SQL script is run:

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RACEID	DRIVERPOSITION	DRIVERNAME	NUMBEROFLAPS	RACETIME	SEASONID	STANDINGID	RANK
1	1	1 Lewis Hamilton	53	1:11:56.136	1	1	1
2	1	2 Max Verstappen	53	1:12:02.736	1	1	2
3	1	3 Charles Leclerc	53	1:12:56.310	1	1	3
4	1	4 Daniel Ricciardo	53	1:13:32.436	1	1	4
5	1	5 Lando Norris	53	1:14:34.126	1	1	5
6	1	6 George Russell	53	1:15:32.436	1	1	6
7	1	7 Sergio Perez	53	1:15:42.555	1	1	7
8	1	8 Carlos Sainz	53	1:15:44.111	1	1	8
9	1	9 Pierre Gasly	53	1:15:45.001	1	1	9
10	1	10 Oscar Piastri	53	1:15:46.101	1	1	10
11	2	1 Lewis Hamilton	70	1:04:56.226	1	2	1
12	2	2 Max Verstappen	70	1:15:11.123	1	2	2
13	2	3 Charles Leclerc	70	1:15:56.111	1	2	3
14	2	4 Daniel Ricciardo	70	1:16:22.125	1	2	4
15	2	5 Lando Norris	70	1:16:56.136	1	2	5
16	2	6 George Russell	70	1:17:36.126	1	2	6
17	2	7 Sergio Perez	70	1:17:15.032	1	2	7
18	2	8 Carlos Sainz	70	1:18:23.123	1	2	8
19	2	9 Pierre Gasly	70	1:19:11.321	1	2	9
20	2	10 Oscar Piastri	70	1:20:56.045	1	2	10
21	1	1 Lewis Hamilton	53	1:11:56.136	2	1	1
22	1	2 Max Verstappen	53	1:12:02.736	2	1	2
23	1	3 Charles Leclerc	53	1:12:56.310	2	1	3
24	1	4 Daniel Ricciardo	53	1:13:32.436	2	1	4
25	1	5 Lando Norris	53	1:14:34.126	2	1	5
26	1	6 George Russell	53	1:15:32.436	2	1	6
27	1	7 Sergio Perez	53	1:15:42.555	2	1	7
28	1	8 Carlos Sainz	53	1:15:44.111	2	1	8
29	1	9 Pierre Gasly	53	1:15:45.001	2	1	9
30	1	10 Oscar Piastri	53	1:15:46.101	2	1	10

Driver_Rank_Standings_Withholds (SeasonID: INT, StandingID: INT, Rank: INT, DriverName: VARCHAR(50), **RaceID: INT NOT NULL**, DriverPosition: INT NOT NULL, DriverPoints: INT NOT NULL)

UNIQUE(RaceID, DriverPosition)

PRIMARY KEY (SeasonID, StandingID, Rank)

FOREIGN KEY (SeasonID) REFERENCES Seasons(SeasonID) ON DELETE CASCADE,

FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE

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Data Present after SQL script is run:

	SEASONID	STANDINGID	RANK	DRIVERNAME	RACEID	DRIVERPOSITION	DRIVERPOINTS
1	1	1	1	Lewis Hamilton	1	1	25
2	1	1	2	Max Verstappen	1	2	18
3	1	1	3	Charles Leclerc	1	3	15
4	1	1	4	Daniel Ricciardo	1	4	12
5	1	1	5	Lando Norris	1	5	10
6	1	1	6	George Russell	1	6	8
7	1	1	7	Sergio Perez	1	7	6
8	1	1	8	Carlos Sainz	1	8	4
9	1	1	9	Pierre Gasly	1	9	2
10	1	1	10	Oscar Piastri	1	10	1
11	2	2	1	Lewis Hamilton	2	1	25
12	2	2	2	Max Verstappen	2	2	18
13	2	2	3	Charles Leclerc	2	3	15
14	2	2	4	Daniel Ricciardo	2	4	12
15	2	2	5	Lando Norris	2	5	10
16	2	2	6	George Russell	2	6	8
17	2	2	7	Sergio Perez	2	7	6
18	2	2	8	Carlos Sainz	2	8	4
19	2	2	9	Pierre Gasly	2	9	2
20	2	2	10	Oscar Piastri	2	10	1

Constructor_Rank_Standings_Withholds (SeasonID: INT, StandingID: INT, Rank: INT,
Constructor: VARCHAR(50), **RaceID: INT NOT NULL**, ConstructorPosition: INT NOT NULL,
ConstructorPoints: INT NOT NULL)
UNIQUE(RaceID, ConstructorPosition)
PRIMARY KEY (SeasonID, StandingID, Rank)
FOREIGN KEY (SeasonID) REFERENCES Seasons(SeasonID) ON DELETE CASCADE,
FOREIGN KEY (RaceID) REFERENCES Races(RaceID) ON DELETE CASCADE

Data Present after SQL script is run:

	SEASONID	STANDINGID	RANK	CONSTRUCTOR	RACEID	CONSTRUCTORPOSITION	CONSTRUCTORPOINTS
1	1	1	1	Mercedes-AMG Petronas F1 Team	1	1	33
2	1	1	2	Red Bull Racing	1	2	24
3	1	1	3	Scuderia Ferrari	1	3	19
4	1	1	4	Scuderia AlphaTauri	1	4	14
5	1	1	5	McLaren F1 Team	1	5	11
6	2	2	1	Mercedes-AMG Petronas F1 Team	2	1	33
7	2	2	2	Red Bull Racing	2	2	24
8	2	2	3	Scuderia Ferrari	2	3	19
9	2	2	4	Scuderia AlphaTauri	2	4	14
10	2	2	5	McLaren F1 Team	2	5	11

Sponsors (PName: VARCHAR(50), CName: VARCHAR(50))
PRIMARY KEY (PName, CName)
FOREIGN KEY (PName) REFERENCES Partners(Name)
FOREIGN KEY (CName) REFERENCES Constructors(Name)

Data Present after SQL script is run:

	PNAME	CNAME
1	SponsorA	Mercedes-AMG Petronas F1 Team
2	SponsorB	Red Bull Racing
3	SponsorC	Scuderia Ferrari
4	SponsorD	Scuderia AlphaTauri
5	SponsorE	McLaren F1 Team

5. A list of all SQL queries used and where it can be found in the code (i.e., file name and line number(s)) and screenshots demonstrating the functionality of each query using the GUI.

a. INSERT operation

SQL Query - can be found in server-> results->repository->resultsRepository.js, Line 107-108

```
insert.sql

INSERT INTO GrandPrix_Results(RACEID, DRIVERPOSITION, DRIVENAME, NUMBEROFLAPS, RACETIME,
SEASONID, STANDINGID, RANK)
VALUES(:raceID, :driverPosition, :driverName, :numberOfLaps, :raceTime, :seasonID,
:standingID, :rank)
```

Data in GrandPrix_Results table before query is run

	RACEID	DRIVERPOSITION	DRIVENAME	NUMBEROFLAPS	RACETIME	SEASONID	STANDINGID	RANK
1	1	1	Lewis Hamilton	53	1:11:56.136	1	1	1
2	1	2	Max Verstappen	53	1:12:02.736	1	1	2
3	1	3	Charles Leclerc	53	1:12:56.310	1	1	3
4	1	4	Daniel Ricciardo	53	1:13:32.436	1	1	4
5	1	5	Lando Norris	53	1:14:34.126	1	1	5
6	1	6	George Russell	53	1:15:32.436	1	1	6
7	1	7	Sergio Perez	53	1:15:42.555	1	1	7
8	1	8	Carlos Sainz	53	1:15:44.111	1	1	8
9	1	9	Pierre Gasly	53	1:15:45.001	1	1	9
10	1	10	Oscar Piastri	53	1:15:46.101	1	1	10
11	2	1	Lewis Hamilton	70	1:04:56.226	2	2	1
12	2	3	Charles Leclerc	70	1:15:56.111	2	2	3
13	2	4	Daniel Ricciardo	70	1:16:22.125	2	2	4
14	2	5	Lando Norris	70	1:16:56.136	2	2	5
15	2	6	George Russell	70	1:17:36.126	2	2	6
16	2	7	Sergio Perez	70	1:17:15.032	2	2	7
17	2	8	Carlos Sainz	70	1:18:23.123	2	2	8
18	2	9	Pierre Gasly	70	1:19:11.321	2	2	9
19	2	10	Oscar Piastri	70	1:20:56.045	2	2	10

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GUI Action

Formula 1

[Home](#)[Standings](#)[Results](#)[Drivers](#)[Constructors](#)

F1 Results

Select Year
2023

Select Track
Montreal

ADD RESULT

REMOVE RESULT

Pos	Driver	Car	Laps	Time
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	70	1:04:56.226
3	Charles Leclerc	Scuderia Ferrari	70	1:15:56.111
4	Daniel Ricciardo	Scuderia AlphaTauri	70	1:16:22.125
5	Lando Norris	McLaren F1 Team	70	1:16:56.136
6	George Russell	Mercedes-AMG Petronas F1 Team	70	1:17:36.126
7	Sergio Perez	Red Bull Racing	70	1:17:15.032
8	Carlos Sainz	Scuderia Ferrari	70	1:18:23.123
9	Pierre Gasly	Scuderia AlphaTauri	70	1:19:11.321
10	Oscar Piastri	McLaren F1 Team	70	1:20:56.045

Formula 1

[Home](#)[Standings](#)[Results](#)[Drivers](#)[Constructors](#)

F1 Results

Select Year
2023

Select Track
Montreal

ADD RESULT

REMOVE RESULT

Pos	Driver	Car	Laps	Time
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	70	1:04:56.226
3	Charles Leclerc	Scuderia Ferrari	70	1:15:56.111
4	Daniel Ricciardo	Scuderia AlphaTauri	70	1:16:22.125
5	Lando Norris	McLaren F1 Team	70	1:16:56.136
6	George Russell	Mercedes-AMG Petronas F1 Team	70	1:17:36.126
7	Sergio Perez	Red Bull Racing	70	1:17:15.032
8	Carlos Sainz	Scuderia Ferrari	70	1:18:23.123
9	Pierre Gasly	Scuderia AlphaTauri	70	1:19:11.321
10	Oscar Piastri	McLaren F1 Team	70	1:20:56.045

Add new result

GrandPrix
Montreal

Position
2

Name
Max Verstappen

Laps
70

Time
1:15:11.123

Year
2023

CANCEL

ADD RESULT

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GUI Output

Formula 1

[Home](#) [Standings](#) [Results](#) [Drivers](#) [Constructors](#)

F1 Results

Select Year
2023

Select Track
Montreal

ADD RESULT

REMOVE RESULT

Pos	Driver	Car	Laps	Time
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	70	1:04:56.226
2	Max Verstappen	Red Bull Racing	70	1:15:11.123
3	Charles Leclerc	Scuderia Ferrari	70	1:15:56.111
4	Daniel Ricciardo	Scuderia AlphaTauri	70	1:16:22.125
5	Lando Norris	McLaren F1 Team	70	1:16:56.136
6	George Russell	Mercedes-AMG Petronas F1 Team	70	1:17:36.126
7	Sergio Perez	Red Bull Racing	70	1:17:15.032
8	Carlos Sainz	Scuderia Ferrari	70	1:18:23.123
9	Pierre Gasly	Scuderia AlphaTauri	70	1:19:11.321
10	Oscar Piastri	McLaren F1 Team	70	1:20:56.045

Data in GrandPrix_Results table after query is run

	RACEID	DRIVERPOSITION	DRIVERNAME	NUMBEROFLAPS	RACETIME	SEASONID	STANDINGID	RANK
1	1	1	Lewis Hamilton	53	1:11:56.136	1	1	1
2	1	2	Max Verstappen	53	1:12:02.736	1	1	2
3	1	3	Charles Leclerc	53	1:12:56.310	1	1	3
4	1	4	Daniel Ricciardo	53	1:13:32.436	1	1	4
5	1	5	Lando Norris	53	1:14:34.126	1	1	5
6	1	6	George Russell	53	1:15:32.436	1	1	6
7	1	7	Sergio Perez	53	1:15:42.555	1	1	7
8	1	8	Carlos Sainz	53	1:15:44.111	1	1	8
9	1	9	Pierre Gasly	53	1:15:45.001	1	1	9
10	1	10	Oscar Piastri	53	1:15:46.101	1	1	10
11	2	1	Lewis Hamilton	70	1:04:56.226	2	2	1
12	2	2	Max Verstappen	70	1:15:11.123	2	2	2
13	2	3	Charles Leclerc	70	1:15:56.111	2	2	3
14	2	4	Daniel Ricciardo	70	1:16:22.125	2	2	4
15	2	5	Lando Norris	70	1:16:56.136	2	2	5
16	2	6	George Russell	70	1:17:36.126	2	2	6
17	2	7	Sergio Perez	70	1:17:15.032	2	2	7
18	2	8	Carlos Sainz	70	1:18:23.123	2	2	8
19	2	9	Pierre Gasly	70	1:19:11.321	2	2	9
20	2	10	Oscar Piastri	70	1:20:56.045	2	2	10

b. DELETE operation

SQL Query - can be found in server-> results->repository->**resultsRepository.js, Line 136**

```
delete.sql

DELETE FROM GrandPrix_Results WHERE raceID=:raceID AND driverPosition=:position
```

Data in GrandPrix_Results table before query is run

	RACEID	DRIVERPOSITION	DRIVERNAME	NUMBEROFPLACES	RACETIME	SEASONID	STANDINGID	RANK
1	1	1	Lewis Hamilton	53	1:11:56.136	1	1	1
2	1	2	Max Verstappen	53	1:12:02.736	1	1	2
3	1	3	Charles Leclerc	53	1:12:56.310	1	1	3
4	1	4	Daniel Ricciardo	53	1:13:32.436	1	1	4
5	1	5	Lando Norris	53	1:14:34.126	1	1	5
6	1	6	George Russell	53	1:15:32.436	1	1	6
7	1	7	Sergio Perez	53	1:15:42.555	1	1	7
8	1	8	Carlos Sainz	53	1:15:44.111	1	1	8
9	1	9	Pierre Gasly	53	1:15:45.001	1	1	9
10	1	10	Oscar Piastri	53	1:15:46.101	1	1	10
11	2	1	Lewis Hamilton	70	1:04:56.226	2	2	1
12	2	2	Max Verstappen	70	1:15:11.123	2	2	2
13	2	3	Charles Leclerc	70	1:15:56.111	2	2	3
14	2	4	Daniel Ricciardo	70	1:16:22.125	2	2	4
15	2	5	Lando Norris	70	1:16:56.136	2	2	5
16	2	6	George Russell	70	1:17:36.126	2	2	6
17	2	7	Sergio Perez	70	1:17:15.032	2	2	7
18	2	8	Carlos Sainz	70	1:18:23.123	2	2	8
19	2	9	Pierre Gasly	70	1:19:11.321	2	2	9
20	2	10	Oscar Piastri	70	1:20:56.045	2	2	10

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GUI Action

Formula 1

HomeStandingsResultsDriversConstructors

F1 Results

Select Year
2023

Select Track
Montreal

ADD RESULT

REMOVE RESULT

Pos	Driver	Car	Laps	Time
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	70	1:04:56.226
2	Max Verstappen	Red Bull Racing	70	1:15:11.123
3	Charles Leclerc	Scuderia Ferrari	70	1:15:56.111
4	Daniel Ricciardo	Scuderia AlphaTauri	70	1:16:22.125
5	Lando Norris	McLaren F1 Team	70	1:16:56.136
6	George Russell	Mercedes-AMG Petronas F1 Team	70	1:17:36.126
7	Sergio Perez	Red Bull Racing	70	1:17:15.032
8	Carlos Sainz	Scuderia Ferrari	70	1:18:23.123
9	Pierre Gasly	Scuderia AlphaTauri	70	1:19:11.321
10	Oscar Piastri	McLaren F1 Team	70	1:20:56.045

Formula 1

HomeStandingsResultsDriversConstructors

F1 Results

Select Year
2023

Select Track
Montreal

ADD RESULT

REMOVE RESULT

Pos	Driver	Car	Laps	Time
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	70	1:04:56.226
2	Max Verstappen	Red Bull Racing	70	1:15:11.123
3	Charles Leclerc	Scuderia Ferrari	70	1:15:56.111
4	Daniel Ricciardo	Scuderia AlphaTauri	70	1:16:22.125
5	Lando Norris	McLaren F1 Team	70	1:16:56.136
6	George Russell	Mercedes-AMG Petronas F1 Team	70	1:17:36.126
7	Sergio Perez	Red Bull Racing	70	1:17:15.032
8	Carlos Sainz	Scuderia Ferrari	70	1:18:23.123
9	Pierre Gasly	Scuderia AlphaTauri	70	1:19:11.321
10	Oscar Piastri	McLaren F1 Team	70	1:20:56.045

Remove result

Grand Prix
Montreal

Position
5

CANCELREMOVE RESULT

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GUI Output

Formula 1HomeStandingsResultsDriversConstructors

F1 Results

Select Year
2023

Select Track
Montreal

ADD RESULT

REMOVE RESULT

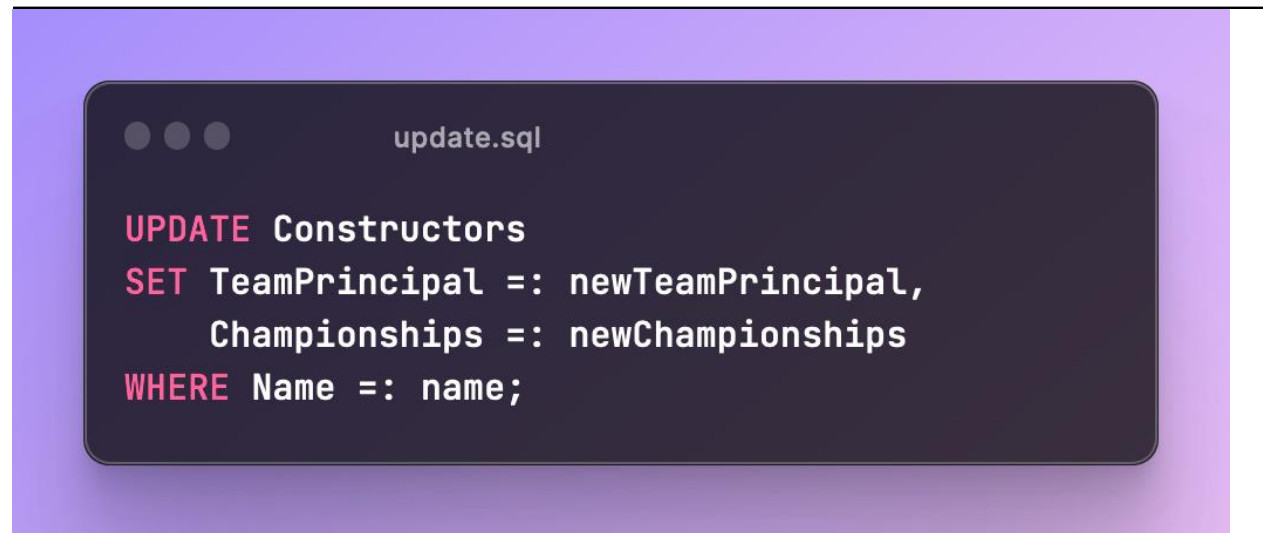
Pos	Driver	Car	Laps	Time
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	70	1:04:56.226
2	Max Verstappen	Red Bull Racing	70	1:15:11.123
3	Charles Leclerc	Scuderia Ferrari	70	1:15:56.111
4	Daniel Ricciardo	Scuderia AlphaTauri	70	1:16:22.125
6	George Russell	Mercedes-AMG Petronas F1 Team	70	1:17:36.126
7	Sergio Perez	Red Bull Racing	70	1:17:15.032
8	Carlos Sainz	Scuderia Ferrari	70	1:18:23.123
9	Pierre Gasly	Scuderia AlphaTauri	70	1:19:11.321
10	Oscar Piastri	McLaren F1 Team	70	1:20:56.045

Data in GrandPrix_Results table after query is run

	RACEID	DRIVERPOSITION	DRIVERNAME	NUMBEROFLAPS	RACETIME	SEASONID	STANDINGID	RANK
1	1	1	Lewis Hamilton	53	1:11:56.136	1	1	1
2	1	2	Max Verstappen	53	1:12:02.736	1	1	2
3	1	3	Charles Leclerc	53	1:12:56.310	1	1	3
4	1	4	Daniel Ricciardo	53	1:13:32.436	1	1	4
5	1	5	Lando Norris	53	1:14:34.126	1	1	5
6	1	6	George Russell	53	1:15:32.436	1	1	6
7	1	7	Sergio Perez	53	1:15:42.555	1	1	7
8	1	8	Carlos Sainz	53	1:15:44.111	1	1	8
9	1	9	Pierre Gasly	53	1:15:45.001	1	1	9
10	1	10	Oscar Piastri	53	1:15:46.101	1	1	10
11	2	1	Lewis Hamilton	70	1:04:56.226	2	2	1
12	2	2	Max Verstappen	70	1:15:11.123	2	2	2
13	2	3	Charles Leclerc	70	1:15:56.111	2	2	3
14	2	4	Daniel Ricciardo	70	1:16:22.125	2	2	4
15	2	6	George Russell	70	1:17:36.126	2	2	6
16	2	7	Sergio Perez	70	1:17:15.032	2	2	7
17	2	8	Carlos Sainz	70	1:18:23.123	2	2	8
18	2	9	Pierre Gasly	70	1:19:11.321	2	2	9
19	2	10	Oscar Piastri	70	1:20:56.045	2	2	10

c. UPDATE operation

SQL Query - can be found in server-> results->repository->**constructorsRepository.js**, Line 123-126



GUI Action

Formula 1

HomeStandingsResultsDriversConstructors

F1 Constructors

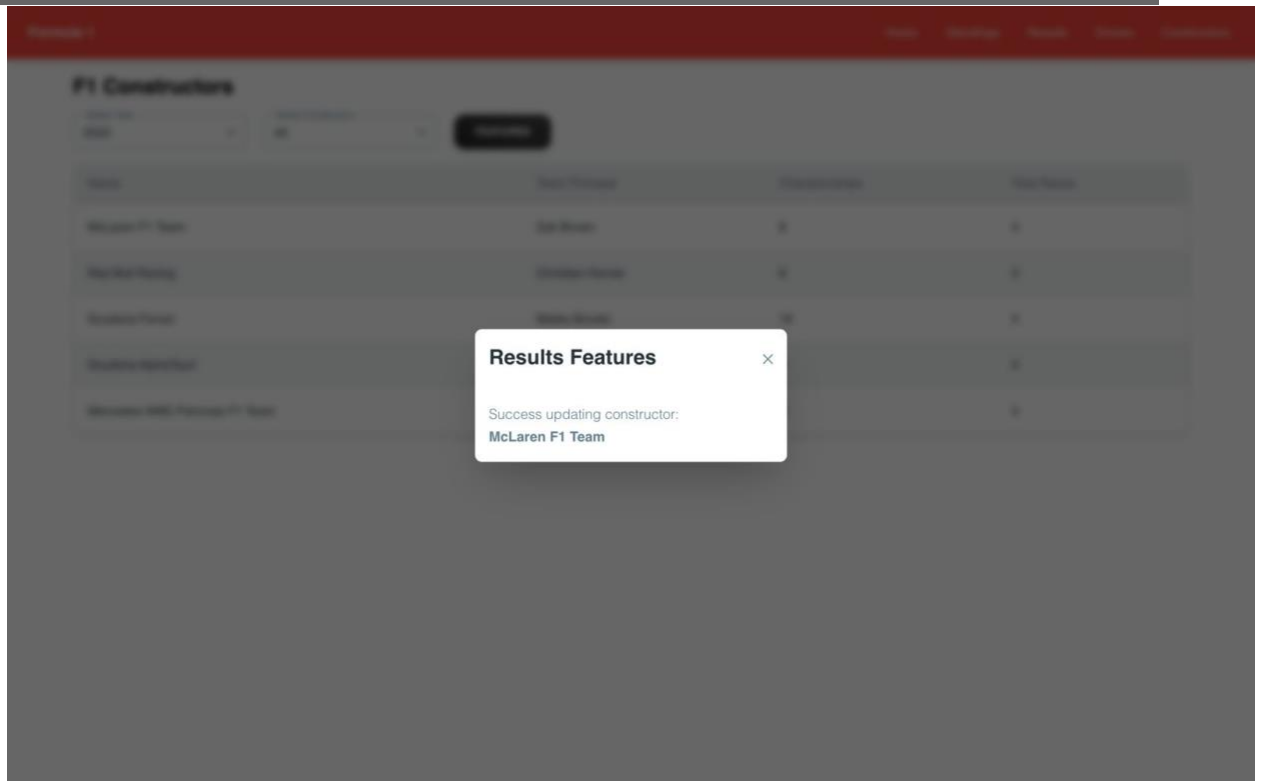
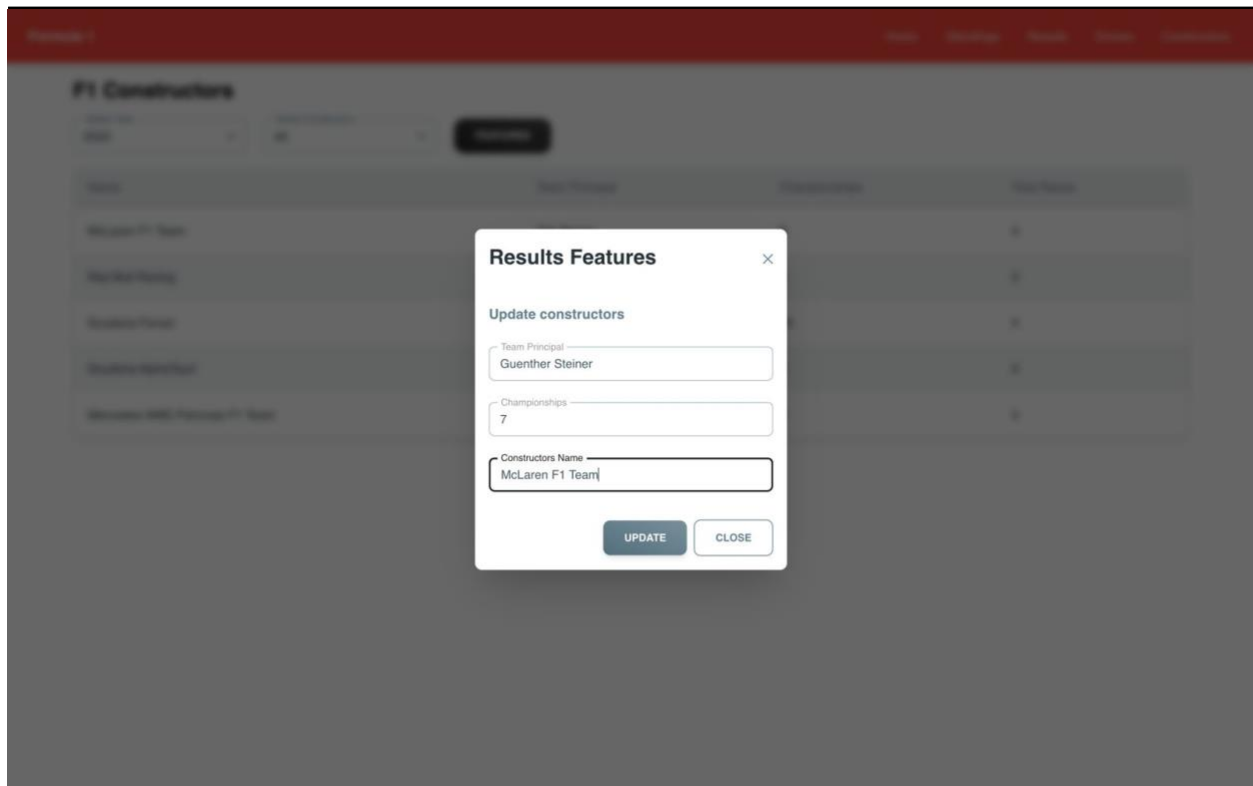
Select Year
2023

Select Constructor
All

FEATURES

Name	Team Principal	Championships	Total Races
McLaren F1 Team	Zak Brown	8	4
Red Bull Racing	Christian Horner	6	4
Scuderia Ferrari	Mattia Binotto	16	4
Scuderia AlphaTauri	Laurent Mekies	0	4
Mercedes-AMG Petronas F1 Team	Toto Wolff	9	4

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Department of Computer Science



F1 Constructors

Select Year
2023

Select Constructor
All

FEATURES

Name	Team Principal	Championships	Total Races
McLaren F1 Team	Guenter Steiner	7	4
Red Bull Racing	Christian Horner	6	4
Scuderia Ferrari	Mattia Binotto	16	4
Scuderia AlphaTauri	Laurent Mekies	0	4
Mercedes-AMG Petronas F1 Team	Toto Wolff	9	4

d. Selection

SQL Query - can be found in server->repository->standingsRepository.js, Line 6-11

```
selection.sql

SELECT drsw.Rank, drsw.DRIVERNAME as DRIVER, dwfp.CNAME as CAR,
drsw.DRIVERPOINTS AS Points
  FROM Driver_Rank_Standings_Withholds drsw
    JOIN Seasons s ON drsw.SeasonID = s.SeasonID AND s.Year =
:selectedSeason
    JOIN Drivers_WorksFor_Participate dwfp
      ON drsw.RaceID = dwfp.RaceID AND drsw.DRIVERNAME = dwfp.DNAME
 WHERE drsw.STANDINGID = :selectedStandingID
```

GUI Action

Formula 1

HomeStandingsResultsDriversConstructors

F1 Standings

Select Year2023

Select StandingDrivers

	Driver	Car	Pts
2013			
2014			
2015	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	25
2016			
2017	Max Verstappen	Red Bull Racing	18
2018	Charles Leclerc	Scuderia Ferrari	15
2019			
2020	Daniel Ricciardo	Scuderia AlphaTauri	12
2021	Lando Norris	McLaren F1 Team	10
2022			
2023	George Russell	Mercedes-AMG Petronas F1 Team	8
7	Sergio Perez	Red Bull Racing	6
8	Carlos Sainz	Scuderia Ferrari	4
9	Pierre Gasly	Scuderia AlphaTauri	2
10	Oscar Piastri	McLaren F1 Team	1

Formula 1

HomeStandingsResultsDriversConstructors

F1 Standings

Select Year2023

Select StandingDrivers

Rank	Driver	Car	Pts
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	25
2	Max Verstappen	Red Bull Racing	18
3	Charles Leclerc	Scuderia Ferrari	15
4	Daniel Ricciardo	Scuderia AlphaTauri	12
5	Lando Norris	McLaren F1 Team	10
6	George Russell	Mercedes-AMG Petronas F1 Team	8
7	Sergio Perez	Red Bull Racing	6
8	Carlos Sainz	Scuderia Ferrari	4
9	Pierre Gasly	Scuderia AlphaTauri	2
10	Oscar Piastri	McLaren F1 Team	1

e. Projection

SQL Query - can be found in server->repository->Repository.js, Line -

Data in Results table before query is run

GUI Action

GUI Output

Data in Results table after query is run

f. Join

SQL Query - can be found in server->repository->resultsRepository.js, Line 34-39

```
join.sql

SELECT r.RACEID, t.CITY as GP, t.RACEDATE, r.DRIVERNAME as Winner, dwp.CNAME,
r.NUMBEROFLAPS, r.RACETIME FROM GRANDPRIX_RESULTS r
JOIN Seasons s ON r.SeasonID = s.SeasonID AND s.Year = :selectedSeason
JOIN AT_TRACKS T on r.RACEID = T.RACEID
JOIN DRIVERS_WORKSFOR_PARTICIPA2TE DWP on r.RACEID = DWP.RACEID AND r.DRIVERNAME =
DWP.DNAME
WHERE t.CITY = :selectedTrack
```

GUI Action

Formula 1 Home Standings Results Drivers Constructors

F1 Results

Select Year
2023

Select Track
Melbourne

STATISTICS

ADD RESULT

REMOVE RESULT

	Car	Laps	Time
2013			
2014			
2015	Hamilton Mercedes-AMG Petronas F1 Team	53	1:11:56.136
2016	Verstappen Red Bull Racing	53	1:12:02.736
2017	Vettel Scuderia Ferrari	53	1:12:56.310
2018	Leclerc Scuderia Ferrari	53	1:12:56.310
2019	Alonso Scuderia Ferrari	53	1:13:32.436
2020	Alonso Scuderia Ferrari	53	1:13:32.436
2021	Verstappen Mercedes-AMG Petronas F1 Team	53	1:14:34.126
2022	Verstappen Mercedes-AMG Petronas F1 Team	53	1:15:32.436
2023	Verstappen Mercedes-AMG Petronas F1 Team	53	1:15:32.436
7	Sergio Perez Red Bull Racing	53	1:15:42.555
8	Carlos Sainz Scuderia Ferrari	53	1:15:44.111
9	Pierre Gasly Scuderia AlphaTauri	53	1:15:45.001
10	Oscar Piastri McLaren F1 Team	53	1:15:46.101

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Formula 1

Home

Standings

Results

Drivers

Constructors

F1 Results

Select Year

2023

Select Track

Melbourne

STATISTICS

ADD RESULT

REMOVE RESULT

Pos	Driver	Car	Laps	Time
1	Lewis Hamilton	Mercedes-AMG Petronas F1 Team	53	1:11:56.136
2	Max Verstappen	Red Bull Racing	53	1:12:02.736
3	Charles Leclerc	Scuderia Ferrari	53	1:12:56.310
4	Daniel Ricciardo	Scuderia AlphaTauri	53	1:13:32.436
5	Lando Norris	McLaren F1 Team	53	1:14:34.126
6	George Russell	Mercedes-AMG Petronas F1 Team	53	1:15:32.436
7	Sergio Perez	Red Bull Racing	53	1:15:42.555
8	Carlos Sainz	Scuderia Ferrari	53	1:15:44.111
9	Pierre Gasly	Scuderia AlphaTauri	53	1:15:45.001
10	Oscar Piastri	McLaren F1 Team	53	1:15:46.101

g. Aggregation with Group By

SQL Query - can be found in server->repository->constructorsRepository.js, Line 62-64

```
aggregation-with-groupby.sql

SELECT DISTINCT dw.CName AS Constructor_Name,
                COUNT(dw.RaceID) AS Total_Races
FROM Drivers_WorksFor_Participate dw
GROUP BY dw.CName;
```

Formula 1				Home	Standings	Results	Drivers	Constructors
F1 Constructors								
Select Year 2023	Select Constructor All	FEATURES						
Name	Team Principal	Championships	Total Races					
McLaren F1 Team	Zak Brown	8	4					
Red Bull Racing	Christian Horner	6	4					
Scuderia Ferrari	Mattia Binotto	16	4					
Scuderia AlphaTauri	Laurent Mekies	0	4					
Mercedes-AMG Petronas F1 Team	Toto Wolff	9	4					

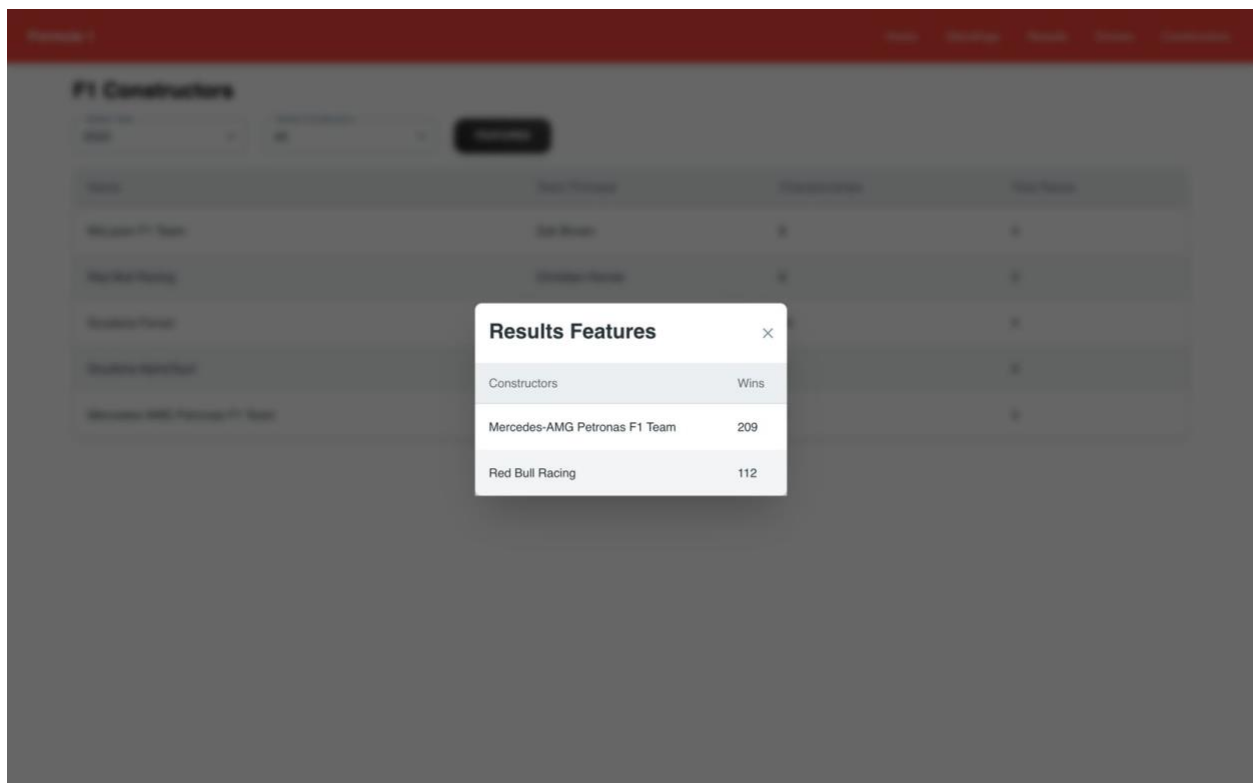
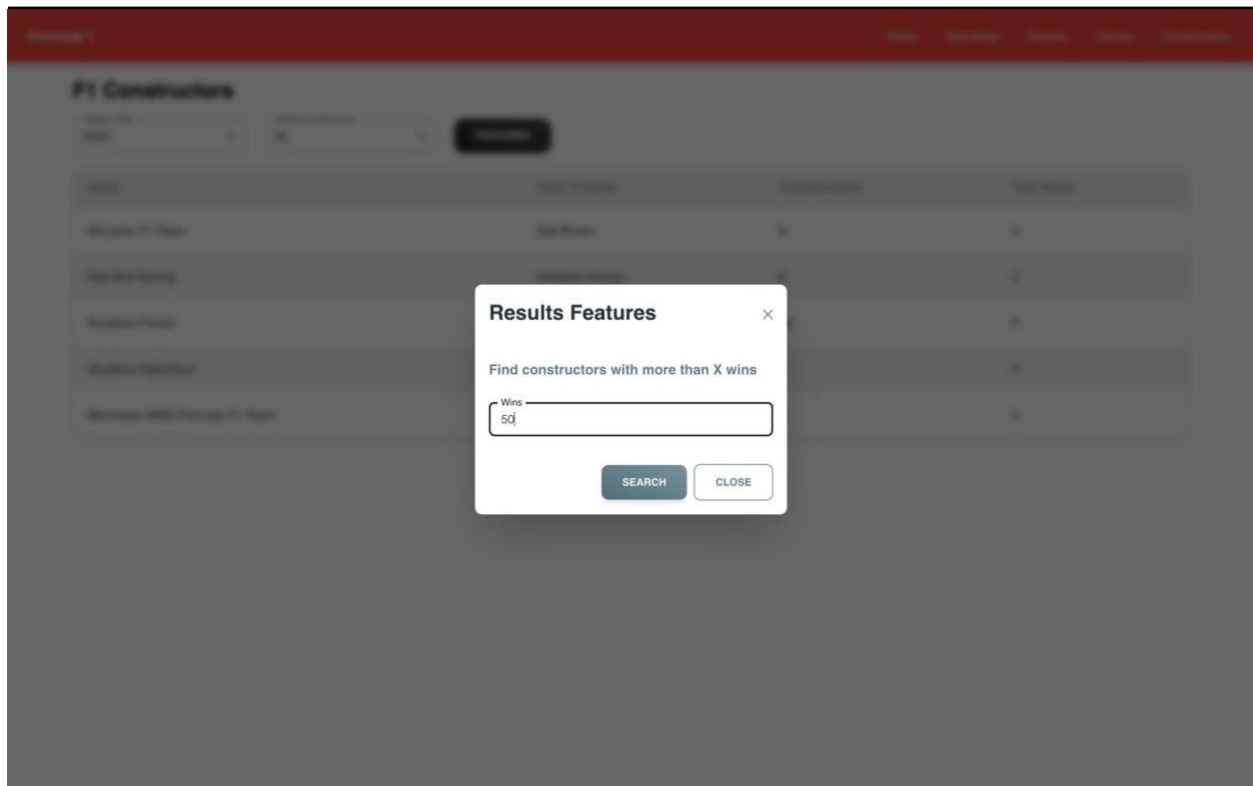
h. Aggregation with Having

SQL Query - can be found in server-> results->repository->**constructorsRepository.js**, Line 36-39

```
aggregation-with-having.sql

SELECT CName, SUM(Wins) AS TotalWins
FROM Drivers_WorksFor_Participate
GROUP BY CName
HAVING SUM(Wins) >= :minTotalWins;
```

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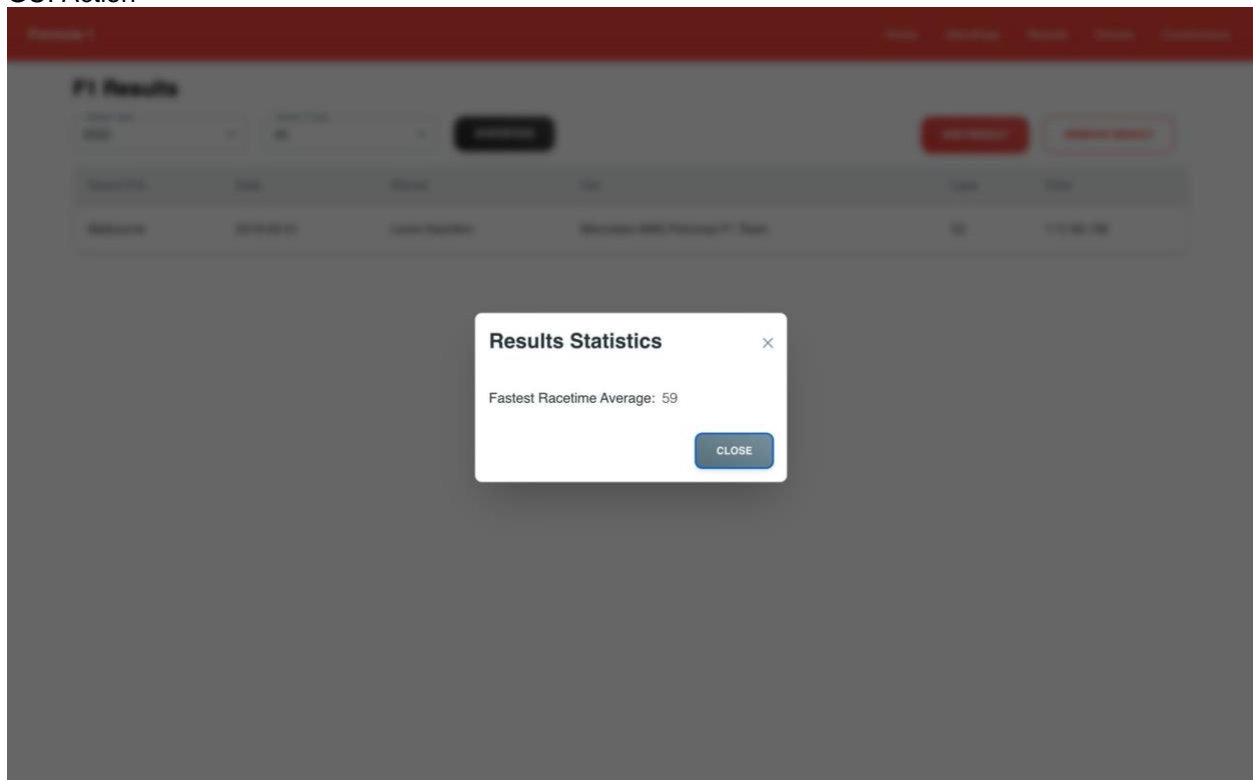
i. Nested Aggregation with Group By

SQL Query - can be found in server-> results->repository->**driversRepository.js**, Line 35-42

```
nested-aggregation-with-gro

SELECT MAX(AvgLapTimeInSeconds) AS Max_Average_LapTime
FROM (
    SELECT AVG(TO_NUMBER(SUBSTR(LapTimes, 1, 2)) * 60 +
        TO_NUMBER(SUBSTR(LapTimes, 4, 2)) +
        TO_NUMBER(SUBSTR(LapTimes, 7, 2)))
    AS AvgLapTimeInSeconds
FROM Qualifying
GROUP BY RaceID, DriverName);
```

GUI Action



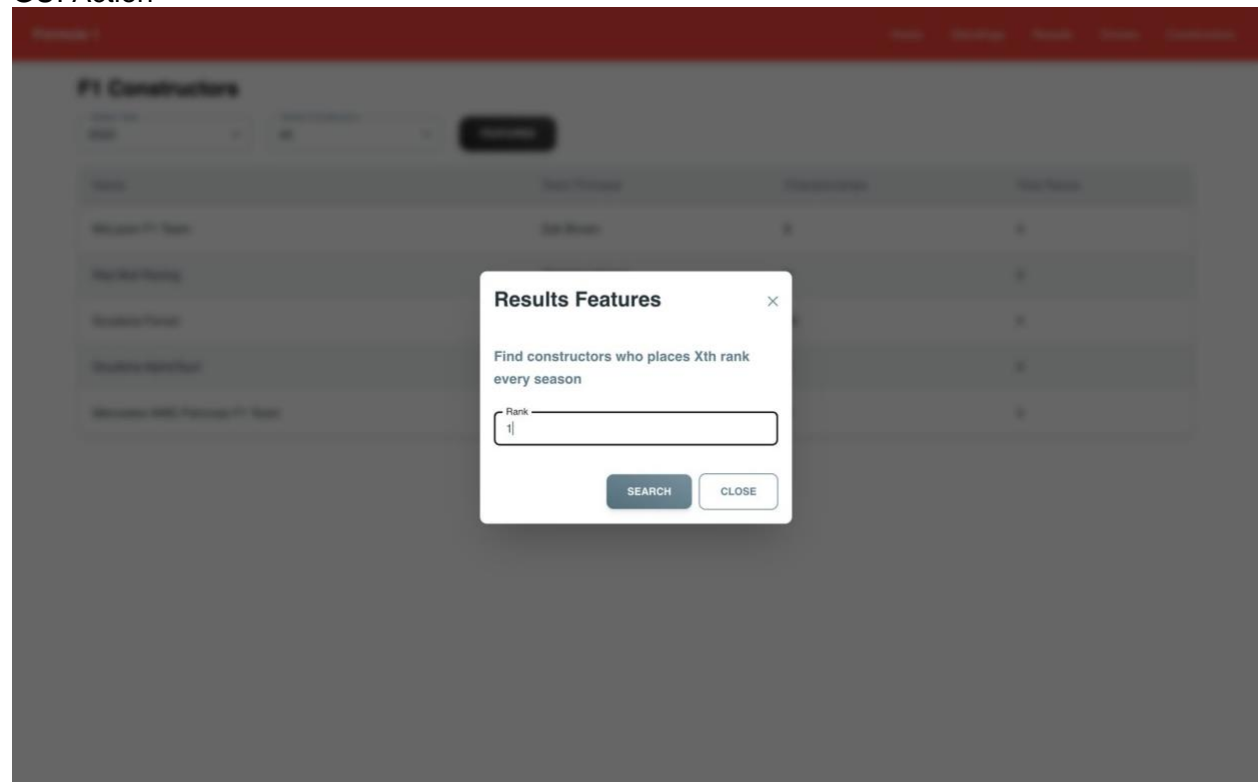
j. Division

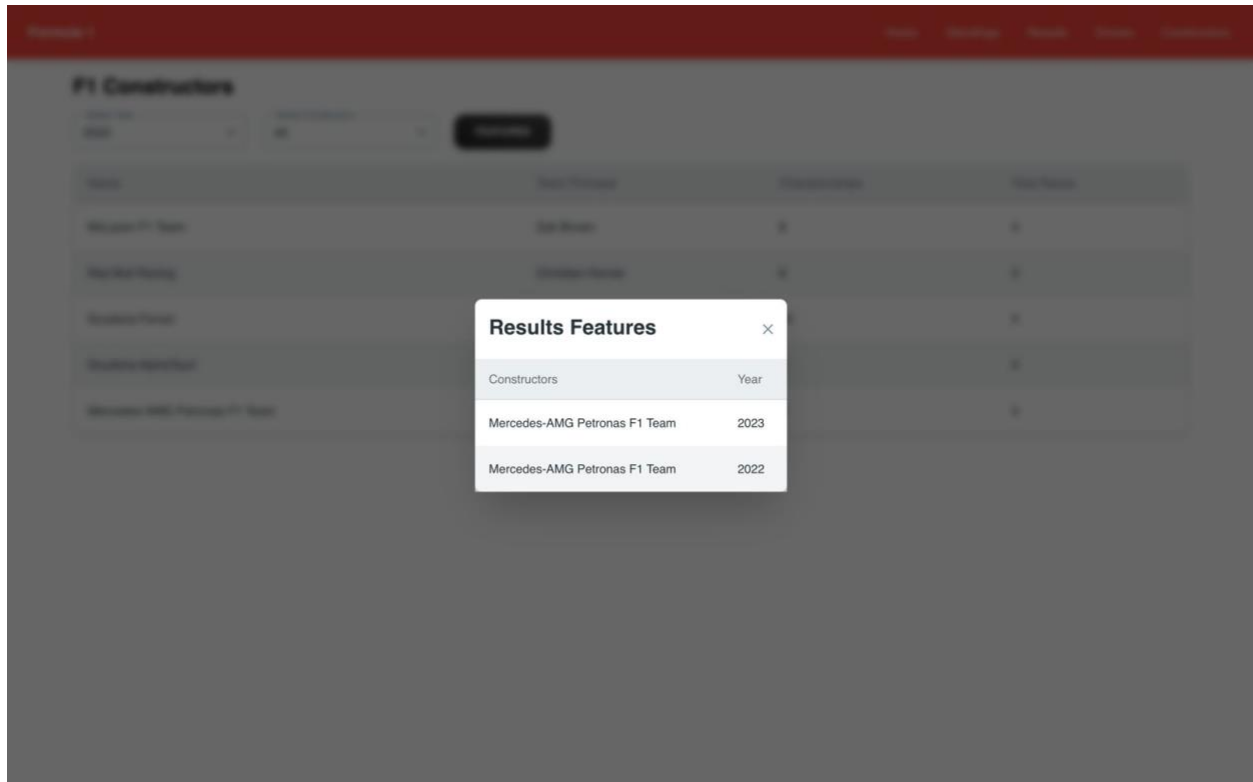
SQL Query - can be found in server-> results->repository-> **constructorsRepository.js**, Line 83-93

```
division.sql

SELECT c.Name
FROM Constructors c
WHERE EXISTS (
  SELECT SeasonID
  FROM Seasons
  WHERE EXISTS (
    SELECT *
    FROM Constructor_Rank_Standings_Withholds crsw
    WHERE Seasons.SeasonID = crsw.SeasonID
      AND c.Name = crsw.Constructor
      AND crsw.Rank =: rank));
```

GUI Action





The screenshot shows a web application for F1 Constructors. At the top, there is a dark red navigation bar with links for Home, Standings, Results, Teams, and Constructors. Below the navigation bar, the main heading is 'F1 Constructors'. Under this heading, there are two input fields: 'Team Name' with the value 'Mercedes' and 'Year' with the value '2023', followed by a 'Results' button. Below the inputs is a table with the following columns: 'Team', 'Team Points', 'Constructors', and 'Year Points'. The table contains several rows, including 'Mercedes F1 Team', 'Red Bull Racing', 'Ferrari', 'Aston Martin', and 'Mercedes-AMG Petronas F1 Team'. A modal window titled 'Results Features' is open in the center of the screen. It has a close button (X) in the top right corner. The modal contains a table with two columns: 'Constructors' and 'Year'. The table lists 'Mercedes-AMG Petronas F1 Team' for the years '2023' and '2022'.

Team	Team Points	Constructors	Year Points
Mercedes F1 Team	519	Mercedes	519
Red Bull Racing	519	Red Bull	519
Ferrari	519	Ferrari	519
Aston Martin	519	Aston Martin	519
Mercedes-AMG Petronas F1 Team	519	Mercedes-AMG Petronas F1 Team	519

Constructors	Year
Mercedes-AMG Petronas F1 Team	2023
Mercedes-AMG Petronas F1 Team	2022