Databases Final Project

601.315

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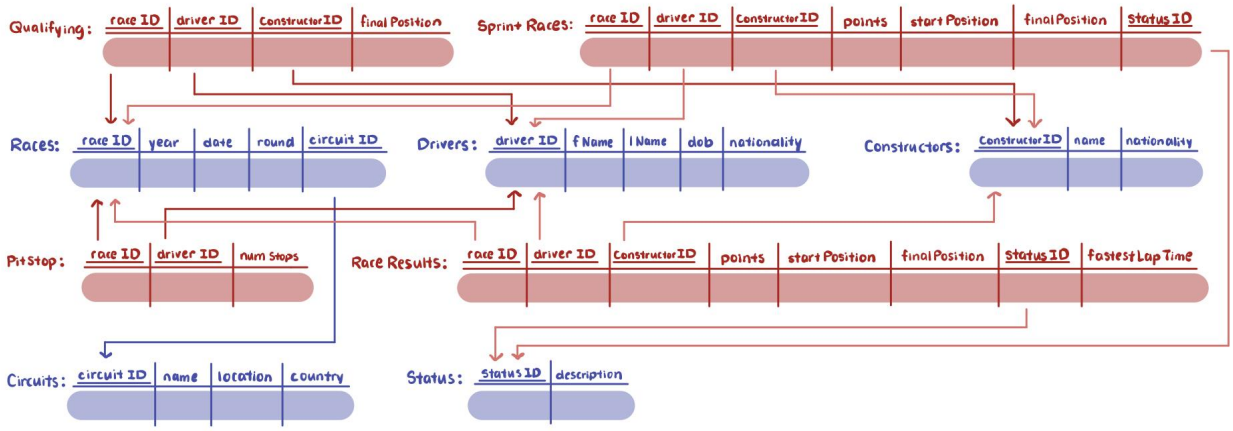
A Formula One database containing drivers, constructors (teams), circuits, races, and various race results. We generate results along the lines of showing the averages for different attributes and the total amount of an attribute.

Website https://www.ugrad.cs.jhu.edu/~szhan141/
Code https://github.com/cliu168/Christine_Liu_Stephen_Zhang_601.315_Final_Project

Sample Queries

1. Return nationalities and driver count. Order by descending number of drivers.
2. Return the first name and last name of all drivers of a specific nationality.
3. Return countries and circuit count. Order by descending number of circuits.
4. Return the name and location of all circuits in a specific country.
5. Return the first name and last name of all drivers who have won a race.
6. Return the first name and last name of all drivers who have gotten pole from qualifying.
7. Return the first name and last name of all drivers who have won a sprint race.
8. Return the average number points for a specific circuit of each driver and the respective driver's first name and last name. Order by descending number of points.
9. Return the average number of points per season of each driver and the respective driver's first name and last name. Order by descending number of points.
10. Return the average number points for a specific circuit of each constructor and the respective constructor's name. Order by descending number of points.
11. Return the average number of points per season of each constructor and the respective constructor's name. Order by descending number of points.
12. Return driver first name and last names, and their respective number of wins in a specific circuit. Order by descending number of wins.
13. Return driver first name and last names, and their respective fastest lap time in a specific circuit. Order by ascending all time fastest lap time.
14. Return the name and location of all circuits and it's all time total race accidents/collisions. Order by descending accidents.
15. Return the name and location of all circuits and its average accidents/collisions per race. Order by descending average accidents.
16. Return first name and last name of all drivers who have ever had an accident/collision in a specific circuit.
17. Return the first name and last name of all drivers, and their all time number of races with issues (status not equal to one). Order by descending number of races with issues.
18. Return average number of pit stops of all drivers that have won at a specific circuit. Order by ascending pit stops.
19. Return nationalities and all its drivers' average number of points per season. Order by descending points.
20. Return year of birth and all its drivers' average number of points per season. Order by descending points.

Relational Model



SQL Implementation

```sql
create table Circuits (
	circuitID		INTEGER NOT NULL, -- 1
	name			VARCHAR(100), -- Yarowsky Circuit
	location		VARCHAR(100), -- Maryland
	country			VARCHAR(100), -- USA
	PRIMARY KEY (circuitID)
);


create table Constructors (
	constructorID		INTEGER NOT NULL, -- 1
	name			VARCHAR(100), -- Yarowsky Team
	nationality		VARCHAR(100), -- American
	PRIMARY KEY (constructorID)
);

create table Drivers (
	driverID		INTEGER NOT NULL, -- 1
	fName			VARCHAR(100), -- David
	lName			VARCHAR(100), -- Yarowsky
	dob			DATE, -- 1982-10-01
	nationality		VARCHAR(100), -- American
	PRIMARY KEY (driverID)
);

create table Status (
	statusID		INTEGER NOT NULL, -- 1
	description		VARCHAR(100), -- Finished
	PRIMARY KEY (statusID)
);

create table Races (
	raceID			INTEGER NOT NULL, -- 1
	year			INTEGER, -- 2022
	round			INTEGER, -- 1
	circuitID		INTEGER, -- 1
	date			DATE, -- 2022-12-17
	PRIMARY KEY (raceID)
);
```

```sql
create table RaceResults (
	raceID			INTEGER NOT NULL, -- 1
	driverID		INTEGER NOT NULL, -- 1
	constructorID		INTEGER NOT NULL, -- 1
	startPosition		INTEGER, -- 1
	finalPosition		INTEGER, -- 1
	points			INTEGER, -- 22
	fastestLapTime		TIME, -- 01:34.2
	statusID		INTEGER NOT NULL, -- 1
	FOREIGN KEY (raceID) REFERENCES Races(raceID),
	FOREIGN KEY (driverID) REFERENCES Drivers(driverID),
	FOREIGN KEY (constructorID) REFERENCES Constructors(constructorID),
	FOREIGN KEY (statusID) REFERENCES Status(statusID)
);

create table Qualifying (
	raceID			INTEGER NOT NULL, -- 1
	driverID		INTEGER NOT NULL, -- 1
	constructorID		INTEGER NOT NULL, -- 1
	finalPosition		INTEGER, -- 1
	FOREIGN KEY (raceID) REFERENCES Races(raceID),
	FOREIGN KEY (driverID) REFERENCES Drivers(driverID),
	FOREIGN KEY (constructorID) REFERENCES Constructors(constructorID)
);

create table SprintRaces (
	raceID			INTEGER NOT NULL, -- 1
	driverID		INTEGER NOT NULL, -- 1
	constructorID		INTEGER NOT NULL, -- 1
	startPosition		INTEGER, -- 1
	finalPosition		INTEGER, -- 1
	points			INTEGER, -- 3
	statusID		INTEGER, -- 1
	FOREIGN KEY (raceID) REFERENCES Races(raceID),
	FOREIGN KEY (driverID) REFERENCES Drivers(driverID),
	FOREIGN KEY (constructorID) REFERENCES Constructors(constructorID)

);

create table PitStops (
	raceID			INTEGER NOT NULL, -- 1
	driverID		INTEGER NOT NULL, -- 1
	numPitStops  INTEGER, -- 0
	FOREIGN KEY (raceID) REFERENCES Races(raceID),
	FOREIGN KEY (driverID) REFERENCES Drivers(driverID)
);
```

Load Database
Data is extracted from:
https://www.kaggle.com/datasets/thedevastator/formula-one-racing-a-comprehensive-data-analysis.
We modified the .csv files to follow our database implementation.
Then the website https://sqlizer.io/ was used to convert our edited .csv files into sql format to be loaded into the database.

Software
mysql on dbase.cs.jhu.edu

Views
One view we create is that for every pair of races and drivers there will be a row that consists of the driver, circuit, constructor, year and points to help with calculating point averages.
Another view we create is that for every circuit there will be a count of accidents and total races to help with calculating accident averages.
The last view we create is a collection of races with the circuit and driver that won, to help with some queries that want to look at winners at a specific circuit.

User's guide
The user can run our code by visiting: https://www.ugrad.cs.jhu.edu/~szhan141/.
Each query is contained within a box, choose an option in the dropdown menu if it is present, and click the submit button to run. Give the results some time to load.

Specialized Topics
particularly advanced GUI form interface and/or report generation
See the strengths listed below.

Strengths
- The website is neatly organized, indicating what the results of each query will look like.
- Ranked queries include column graphs to visualize the top 10 items to the user.
- To limit user error, a dropdown menu exists for queries that require input. It allows the user to know what options they can search for and removes the possibility of typos.

Limitations & Possible Improvements
- Some queries (8, 10, 16, 18) may take a few seconds to load due to large amount of data to join on, if it takes over a minute it will be stopped with an internal server error.
- The PitStops table and RaceResults table for the fastestLapTime attribute are missing data for many races, resulting in empty results (13, 18) when it should not be the case. To help fix this issue more data can be found to fill in.
- For our graphs we could not display characters with accent marks. To get around this issue, we replaced them with the same character but without the accent mark. This could be improved by finding a way to display the graphs while maintaining the original characters that were present in the database.

References

We received help from the teaching assistant Jessie Luo on how to display the graphs. From looking at Jessie's code, we were able to explore and learn more on the documentation of the CanvasJS library that was used to create the graphs.

Output

8. Find the average number of points of each driver in a circuit

How many points did each driver get in the specified circuit? Display the driver's first name, last name, and average points. Order by descending number of points.

Circuit: AVUS

Submit

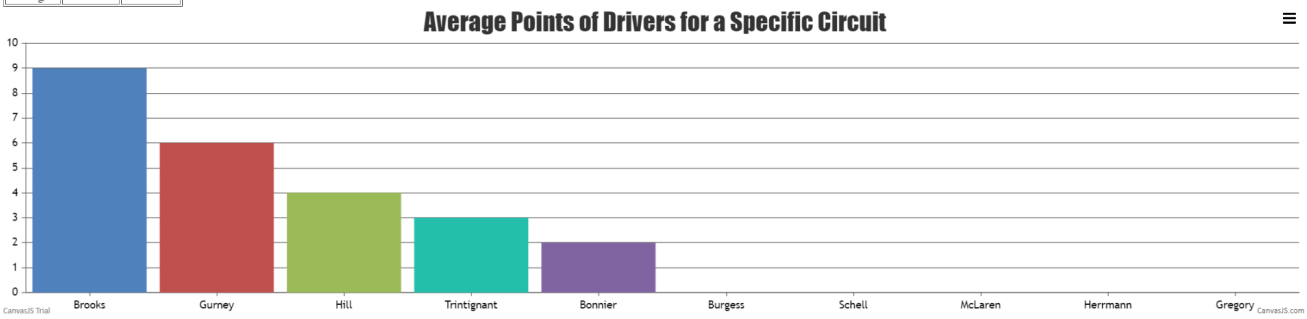
10. Find the average number of points each constructor gets in a specific circuit

Which constructor obtains the highest average number of points in a specific circuit? Order them in descending order of average number of points.

Circuit: Las Vegas Street Circuit

Submit

FirstName	LastName	AveragePts
Tony	Brooks	9.00
Dan	Gurney	6.00
Phil	Hill	4.00
Maurice	Trintignant	3.00
Jo	Bonnier	2.00
Ian	Burgess	0.00
Harry	Schell	0.00
Bruce	McLaren	0.00
Hans	Herrmann	0.00
Masten	Gregory	0.00
Jack	Brabham	0.00
Graham	Hill	0.00
Innes	Ireland	0.00
Cliff	Allison	0.00
Stirling	Moss	0.00



Name	AveragePts
Williams	3.00
Renault	2.25
Tyrrell	2.25
McLaren	1.50
Ligier	1.25
Alfa Romeo	1.00
Team Lotus	0.75
Brabham	0.50
Ferrari	0.00
Theodore	0.00
Ensign	0.00
ATS	0.00
Fittipaldi	0.00
Arrows	0.00
Toleman	0.00
March	0.00
Osella	0.00