

The story of Formula One

Data Visualizations

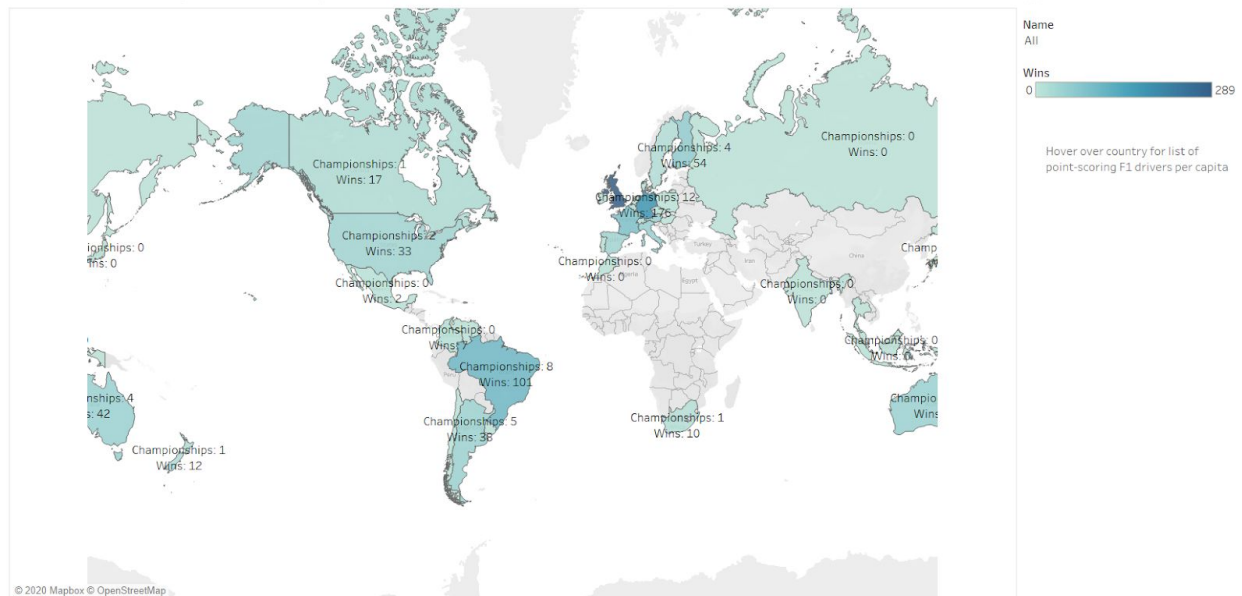
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Subtopic 1: History

Countries ranked by best F1 driver performance

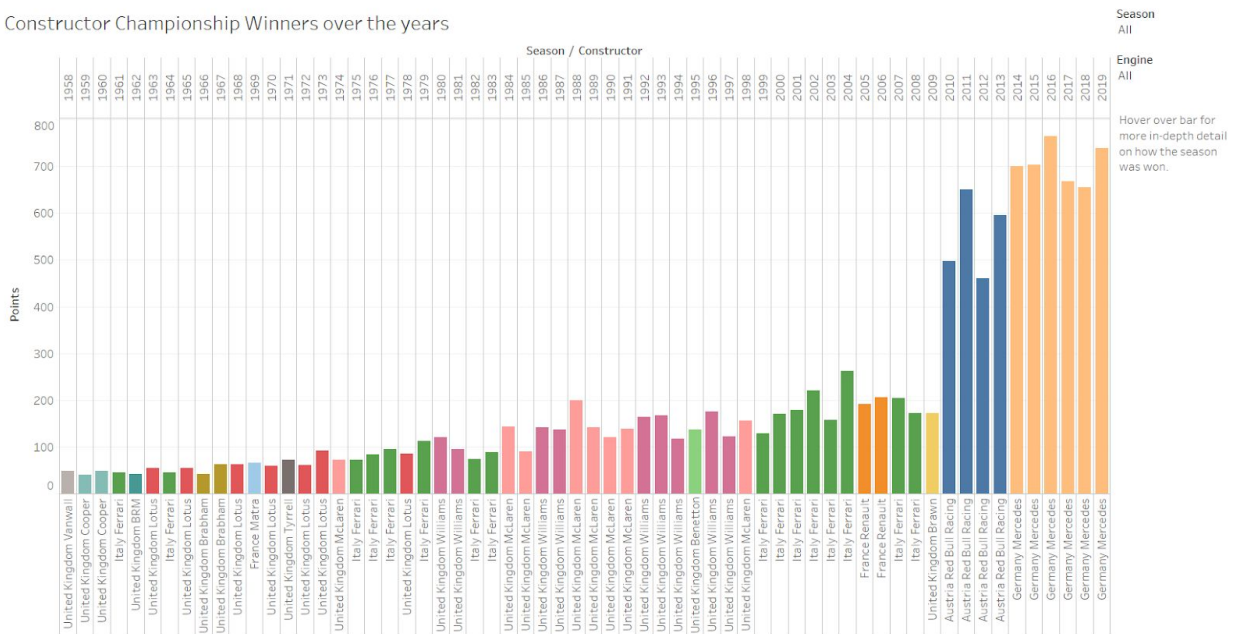


As for the first data visualization that has been explored for the sake of further uncovering the elaborate history of F1 a world map was made which represents which country has ‘produced the most successful’ F1 drivers. With the drivers-market being one of the key-factors of F1’s history this representation has the option to both show the country’s that performed best and also the individual stats of the drivers themselves.

These driver-specific statistics can be found when hovering over or selecting a country. Upon these actions a tooltip will be displayed that features all the race-winning drivers per capita and the number of races they then in turn did win.

For the driver stats the following database was used:
https://drive.google.com/file/d/1gPzCZo6S2j5-qCzM_NXdLMXSy7Nn7OdU/view?usp=sharing [1.1]

Constructor Championship Winners over the years



Next up, after having taken a look at the individual drivers’ performance F1 is and will stay a teamsport. Therefore a concept known as the “Constructor Championship”. The constructors championship is the underlying battle between the different teams that take part in F1. With the team that has collected the most points from races winning the title (usually) at the end of the season.

The way the data is represented can be interpreted that the order of teams is not important. More-so it is the way the order of the teams is displayed when presenting the data based per season. As has been done in the following representation. The first season of F1 is presented on the far left (1950) and the latest season (2019) on the far right. As can be seen by the height of the graphs is the amount of points a team has scored in that specific season which made them secure the title.

When hovering over or selecting a season/year you can get some more in-detail information on the team that won in that specific year. With the tooltip then showing information on the engine that the team used, together with the drivers for that current season.

For the Constructor championship stats the following database was used:

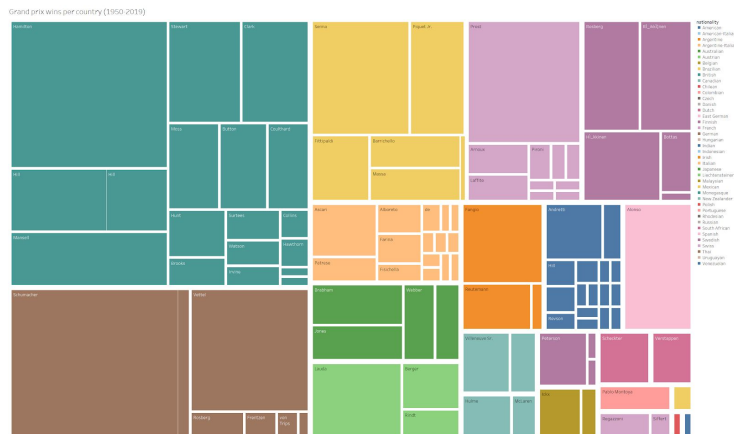
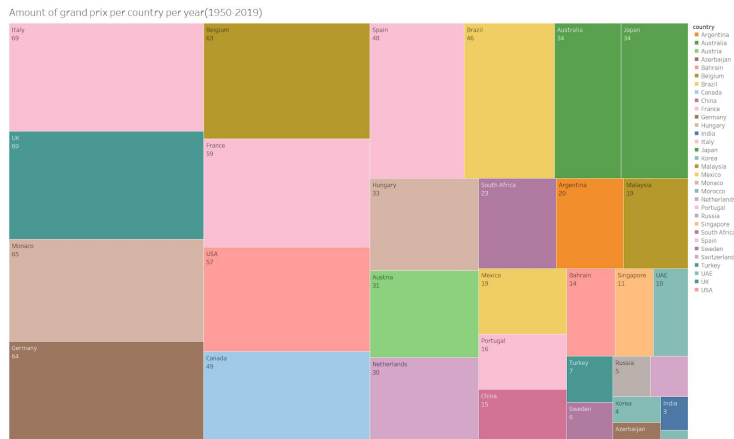
<https://drive.google.com/file/d/1LrWo2H632Fcq5AbkFtjx0FEKTmsK6jmy/view?usp=sharing> [1.2]

Grand Prix Wins per Country” + “Amount of Grand Prix per Country per Year

Also here, we see that a small number of countries dominate over the other countries[1.4]. With just the United Kingdom and Germany (2 countries) having almost a third of all the Grand Prix wins. Also, these countries raise the most influential drivers (look at Hamilton and Schumacher).

With Italy and The United Kingdom having the most number of Grand Prix organized, the amount of countries dominating this part of the F1 is relatively small[1.5]. With new countries hosting an F1 race in their own country, this division will possible be spread more and more over the years[1.5b][1.5c].

Which is funny when comparing these graphs, is that the most successful countries, of course, organize the most races, except for Monaco. With just a few wins, Monaco is the biggest (UK) organizer of the F1 throughout the years.





Lastly F1 is famously known for the incredible physics numbers that are being produced during races. Be it the engine power, the technological innovations or in the case for the final visualization, the downforce. A video represents the increase of downforce over the years in comparison to the previous year. So not a representation of the ability of an F1 car to drive upside down (which they are very well capable off) but rather the change over the year formatted in a way that is looked into by the majority of the F1 community.

Over the years that F1 has been raced the factor that has been developed the most is the downforce produced by cars. Not only have teams been trying to increase this downforce to the max of their ability but rather trying to find the best balance between speed and grip on a circuit, thus balancing the downforce of a car.

For the Downforce stats the following database was used, which was created by analysis of speeds during races and mostly in corners, plus picture analysis of the aero-surfaces that are responsible for downforce and then combining these sets of data in the formula for downforce which takes ground-effect into consideration. This due to the fact that there are no numbers available online for the downforce produced by cars:

<https://drive.google.com/file/d/1RrbFUuhIIInWyviWvy6ve5WFF6NjKUgR/view?usp=sharing> [1.3]

Subtopic 2: Technology

Considering these evolutions within the Formula One History, we cannot leave out of account the center of this sport. The major innovations and improvements in/around the formula one cars. In the course of history many teams have both entered and left this championship, each with their own contributions to the Formula One we know today. Within this chapter we will be focussing on the teams that have contributed to Formula One recently, looking at the statistics, we are particularly interested in the growth of Red Bull Racing. How did a relatively new team make it so high in the rankings? What were the grounding factors that affected the results of this team the most? And what changes have they had to become a serious match for seasoned teams like Ferrari and Mercedes?

Regardless of all these unanswered questions we will first start with a basic statement about these cars; Formula one cars differ on many aspects from normal cars, the bodywork, the aerodynamics, space, wheels, positioning, engine differ in such extent that they cannot be compared to the performances of normal, every day, vehicles. These cars are built with the only purpose of being faster, more efficient and reliable within the most extreme circumstances.

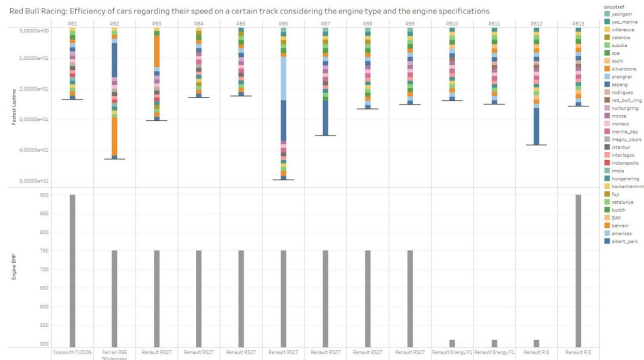
Given these statements we tackle the first question of how a relatively new team makes it into the higher segment of the overall rankings? For this we will focus on the power of the Red Bull car (RBx) and compare this to the efficiency of other teams. [Visualisation 1; See table below]

After having explained how the engine efficiency has affected the overall result of this team, we will tackle comparison of these car's results in speed and lap times to other teams and also discuss how these engines have influenced the rankings for each individual driver of Red Bull over the previous years and highlight the results of their most current drivers Max Verstappen and Daniel Ricciardo. [Visualisation 2]

As we have to be aware, efficient engine use is not the golden ticket to a win. It certainly does influence the overall results of the team, nevertheless, we cannot disregard one other important aspect of these races; The strategy and the pitstops. As this last one can really define a race, we will now focus on the efficiency of pitstops during races, taking into consideration the duration of the pitstops, the time of the day the race takes place and the position of Red Bull with respect to the other top 3 teams as regards pitstop efficiency. [Visualisation 3]

Visualisation 1: Efficiency of RBx considering the engine power and the amount of fastest laps over the years [2005-2017]

Dataset used:
 [1] *enginedata.xlsx*
 [2] *fastestlap_percar_perryear_pertrack.xlsx*
 Contacted the Team Principal of Red Bull Racing by phone; subtracted a reliable datasource from this and added all these datasets to a database. This database can be found in the database-environment created for the course DDA.



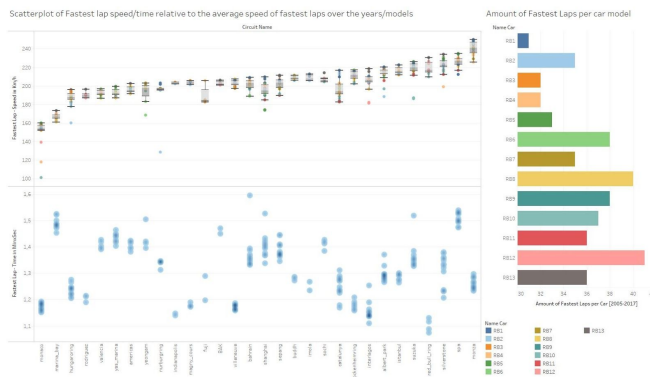
In the following visualisation we have stated the engine power and compared this to the average lap time per car over an entire season.

Considering this visualisation we can easily conclude that the RB10 had the most efficient engine.

Despite the low engine power of 510 Bhp, it was still able to perform at its finest, resulting in low lap times and many maximal speed records.

Visualisation 2: The Maximal speed across the maximal lap times per circuit per car

Dataset used:
 [1] *fastestlap_percoureur_perrace.xlsx*
 [2] *velocity_car_of_fastest_lap_RedBull.xlsx*

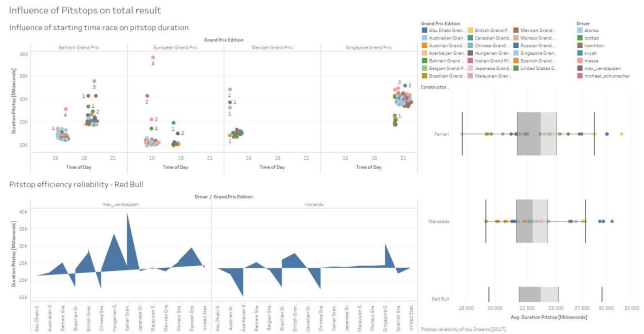


In this visualization I have emphasized the effect of these engines/cars on the overall result per year per track.

Taking into account the maximal speed and the minimal lap times over the different tracks, we can easily draw conclusions wherein we define the most ideal engine per track

Visualisation 3: The efficiency of pitstops regarding the effect the duration has on the result of a race

Datasets used:
 [1] *RedBull_pitstop_efficiency.xlsx*
 [2] *Pitstop_duration_perteam_perdriver.xlsx*



Within this visualization we see the overall efficiency of pitstops during the different times of the day. We can conclude if a race starts later in the evening, the average pitstops are less efficient and the duration therefore is higher compared to pitstops that take place during the day.

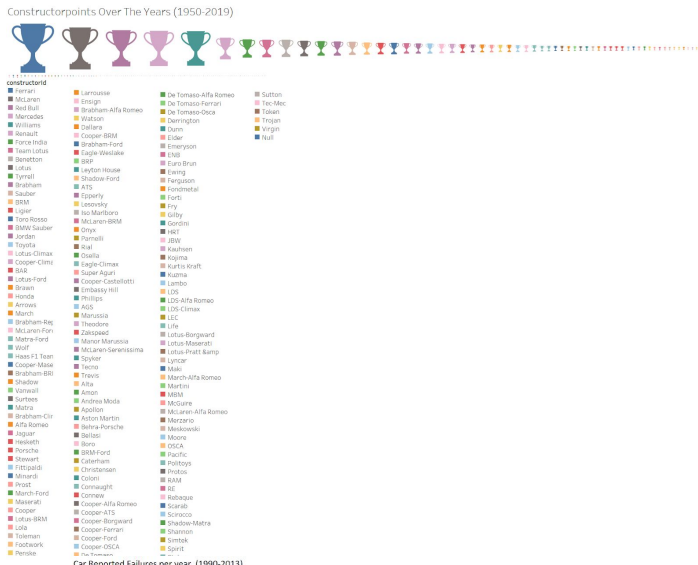
Not only the times of the day are important, we can also see that due to the pressure of the performance of the main driver Max Verstappen, there is more fluctuation with his pitstops and therefore the average duration of the pitstops of Max are higher compared to the pitstops of Ricciardo.

Also we have visualised the efficiency of Red Bull over the years compared to the average pitstops of the other top 3 teams over the years.

Subtopic 3: Performances

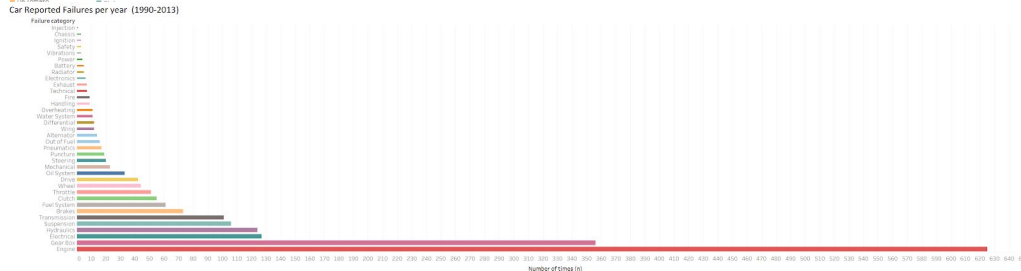
Constructor Results

In this visualization, the number of constructor points gathered per team in the period 1950-2019 is visualized[3.1]. A small group of constructors is dominating the other teams. Also, we see that the older teams are still the biggest (Ferrari, McLaren), but that the newer, more promising teams of the moment, are slowly overtaking them (Red Bull, Mercedes)[3.1b]. Furthermore, a lot of teams did not even get any constructor points.

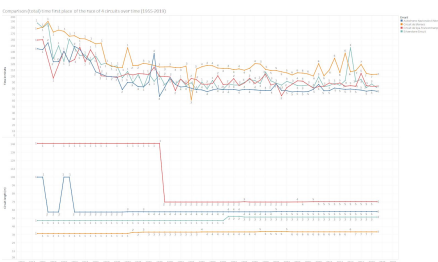


Car reported failures per year

In this graph, the causes of car failure are reported over a few years (1990-2013)[3.2]. Which stands out of this graph is that the main “Trouble makers” for the F1 engines are the engine and gearbox. With more than half of the causes caused by these parts of the car, it is clear which part of the car needs some extra attention.



Comparison (total) time first place of the race of 4 circuits over time



From 1955 to 2019, the finish time and the distance (with the different stages of the circuits) of 4 different tracks are compared[3.3]. We see a big improvement in the car throughout the years. With the cars going faster and faster we see that the finishing time is almost half in comparison with the first race. Also the amount of decrease rate is slowly stabilizing to a certain value. The F1 Cars could be something around their max performance (yes they can go a little bit faster but not a lot anymore (the difference will not as big as the years above))

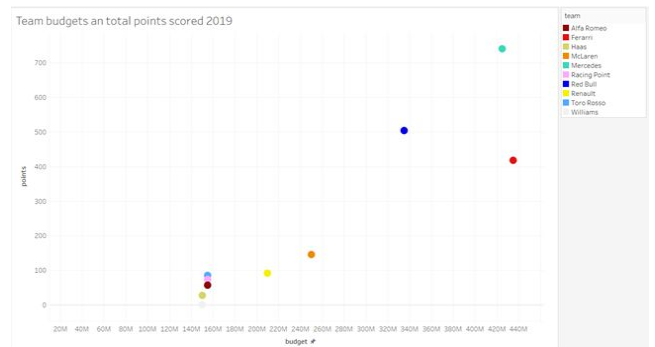
Subtopic 4: Finances

This subtopic will cover some of the financial aspects of formula 1 including the cost of the parts of a formula 1 car, the payouts the teams receive and the budgets the teams have.

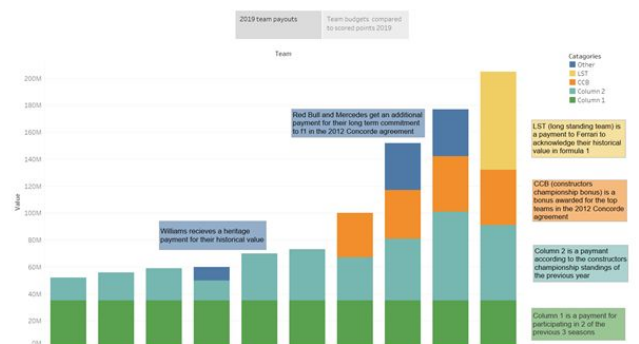
The first visualization is a video of a car being built up, that displays the total price of the parts[4.1] and a list with all the prices individually. This visualization shows how extremely expensive most of the parts are and gives an idea of the magnitude of the budget the teams must have to be able to afford these cars, which are only a small portion of the expenses of a team.



The second visualization shows how the teams receive their payment by the FIA[4.2], the organization that runs formula 1. This graph shows how unfair the payments per team are as a team like Ferrari gets more money from bonuses they receive unconditionally then you are able to get if you have participated for over two years and won the constructors championship. Most of these unfair bonuses were made in the 2012 Concorde agreement made by Bernie Ecclestone to try to get a long term commitment to formula 1 from the top teams. As the team with the highest payout gets paid 4 times the amount of the lowest team these payments result in a larger gap between the top and bottom teams.



The third visualization focuses on the amount of points a team scores[4.3] compared to the budgets[4.4] the teams have. This visualization shows that the teams with a higher budget score significantly more points than the teams with a lower budget. Interesting to see is that a bigger budget does always mean that you will score more points as Ferrari has a little bit more budget than Mercedes but they have far less points.



References

[1.1] : https://drive.google.com/file/d/1gPzCZo6S2j5-qCzM_NXdLMXSy7Nn7OdU/view?usp=sharing

[1.2] : <https://drive.google.com/file/d/1LrWo2H632Fcq5AbkFtjx0FEKTmsK6jmy/view?usp=sharing>

[1.3]:

<https://drive.google.com/file/d/1RrbFUuhIIInWyviWvy6ve5WFF6NjKUgR/view?usp=sharing>

[1.4]:Kaggle.com dataset. tables used:races.csv, seasons.csv . Accessed from: <https://www.kaggle.com/joeycorea/formula1history> , date: 3 june, 2020.

[1.4b]:racing-statistics.com. Accessed from:<https://www.racing-statistics.com/en/circuits>, date: 3 june, 2020.

[1.4c] Wikipedia.com. Accessed from: https://en.wikipedia.org/wiki/List_of_Formula_One_circuits, date: 3 june, 2020.

[1.5]:Kaggle.com dataset. tables used:races.csv, driver.csv, results.csv. Accessed from: <https://www.kaggle.com/joeycorea/formula1history> , date: 3 june, 2020.

[3.1]:Kaggle.com dataset. tables used: Accessed from: <https://www.kaggle.com/joeycorea/formula1history> , date: 4 june, 2020.

[3.1b]: Racing-statistics.com. Accessed from: <https://www.racing-statistics.com/en/constructors>, date: 4june, 2020.

[3.2]: StatF1.com dataset. Accessed from: <https://www.statsf1.com/en/moteur-acer.aspx>, date 5 june, 2020.

[3.3]: all articles used for the visualisation are coming from the wiki pages of the circuits. The main sites are:

https://en.wikipedia.org/wiki/Autodromo_Nazionale_di_Monza

https://en.wikipedia.org/wiki/Silverstone_Circuit

https://en.wikipedia.org/wiki/Circuit_de_Monaco

https://en.wikipedia.org/wiki/Circuit_de_Spa-Francorchamps

The total times of the winning cars are from 296 (sub) sites. The basic form of the sites can be found underneath. The year will change in the url between a period of 1955-2019.

https://en.wikipedia.org/wiki/1955_Italian_Grand_Prix

https://en.wikipedia.org/wiki/1955_Monaco_Grand_Prix
https://en.wikipedia.org/wiki/1955_Belgian_Grand_Prix
https://en.wikipedia.org/wiki/1955_British_Grand_Prix

[4.1] Sportekz.com , *F1 Car Cost 2020 Parts Maintenance Expenses*, Accessed from:

<https://www.sportekz.com/f1/formula-1-car-cost/>, date: December 2019

[4.2] Racefans.net, *Team budget analysis*, Accessed from:

<https://www.racefans.net/2019/12/27/the-cost-of-f1-2019-team-budgets-analysed-part-one/> and

<https://www.racefans.net/2020/01/02/the-cost-of-f1-2019-part-two-what-the-top-teams-spent/> date:

December 2019

[4.3] Formula1.com, *2019 Constructor Standings*, Accessed from:

<https://www.formula1.com/en/results.html/2019/team.html>, date: 2019

[4.4] Racefans.net, *Formula 1 teams' prize money payments for 2019 revealed*, accessed from:

<https://www.racefans.net/2019/03/03/formula-1-teams-prize-money-payments-for-2019-revealed/>, date:

march 2019

[5.1]: all articles used for the DHL van visualisation:

https://medium.com/speedbox-is-typing/the-logistics-behind-f1-7537e445de20
https://f1destinations.com/the-logistics-of-formula-1/
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https://www.essentiallysports.com/f1-news-how-are-the-complicated-logistics-of-formula-one-handled/
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https://www.formula1.com/en/toolbar/partners.html
https://en.hondaracingf1.com/insights/the-power-of-logistics.html
https://formulaspy.com/f1/f1-logistics-and-travel-accounts-for-73-of-its-carbon-footprint-66150

[5.2]: For the enormous logistic contribution of DHL:

https://www.youtube.com/watch?v=V1RV_wAFc0k

[5.4]: plain table of CO2 emissions of formula 1 in 2019:

<https://www.gptoday.net/nl/nieuws/f1/252235/f1-stoot-256-551-ton-co2-uit-motoren-verantwoor-delijk-voor-0-7-procent> date: May 24, 2020.

[5.5] Articles used for engine data

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https://en.wikipedia.org/wiki/Ferrari_F2007

https://en.wikipedia.org/wiki/List_of_Ferrari_engines#V8

<https://www.renaultsport.com/About-RS27.html>

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