final-project-f1-data-analysis-1

October 7, 2023

[1]:

```
import pandas as pd
import matplotlib
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import plotly.graph_objects as go
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.impute import SimpleImputer
from sklearn.tree import DecisionTreeClassifier
```

[2]:

```
circuits = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪circuits.csv')
laptimes = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪lap_times.csv')
pitstops = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪pit_stops.csv')
seasons = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪seasons.csv' )
status = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪status.csv')
constructor_standings = pd.read_csv('/kaggle/input/
 ↪formula-1-world-championship-1950-2020/constructor_standings.csv')
constructors = pd.read_csv('/kaggle/input/
 ↪formula-1-world-championship-1950-2020/constructors.csv')
driver_standings = pd.read_csv('/kaggle/input/
 ↪formula-1-world-championship-1950-2020/driver_standings.csv')
drivers = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪drivers.csv')
races = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/races.
 ↪csv')
constructor_results = pd.read_csv('/kaggle/input/
 ↪formula-1-world-championship-1950-2020/constructor_results.csv')
results = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪results.csv')
```

```
qualifying = pd.read_csv('/kaggle/input/formula-1-world-championship-1950-2020/
 ↪qualifying.csv')
pd.get_option("display.max_columns",None)
```

[2]: 20

[ ]:

```
[ ]:
```

[3]:

```
drivers.head()
#dob=doğum tarihleri
```

[3]:

```
   driverId   driverRef number code  forename     surname         dob  \
0         1    hamilton     44  HAM     Lewis    Hamilton  1985-01-07
1         2    heidfeld     \N  HEI      Nick    Heidfeld  1977-05-10
2         3     rosberg      6  ROS      Nico     Rosberg  1985-06-27
3         4      alonso     14  ALO  Fernando      Alonso  1981-07-29
4         5  kovalainen     \N  KOV    Heikki  Kovalainen  1981-10-19

  nationality                                             url
0     British     http://en.wikipedia.org/wiki/Lewis_Hamilton
1      German      http://en.wikipedia.org/wiki/Nick_Heidfeld
2      German       http://en.wikipedia.org/wiki/Nico_Rosberg
3     Spanish    http://en.wikipedia.org/wiki/Fernando_Alonso
4     Finnish  http://en.wikipedia.org/wiki/Heikki_Kovalainen
```

[4]:

```
races.head()
```

[4]:

```
   raceId  year  round  circuitId                   name        date  \
0       1  2009      1          1  Australian Grand Prix  2009-03-29
1       2  2009      2          2   Malaysian Grand Prix  2009-04-05
2       3  2009      3         17     Chinese Grand Prix  2009-04-19
3       4  2009      4          3     Bahrain Grand Prix  2009-04-26
4       5  2009      5          4     Spanish Grand Prix  2009-05-10

       time                                                url fp1_date  \
0  06:00:00  http://en.wikipedia.org/wiki/2009_Australian_G…       \N
1  09:00:00  http://en.wikipedia.org/wiki/2009_Malaysian_Gr…       \N
2  07:00:00  http://en.wikipedia.org/wiki/2009_Chinese_Gran…       \N
3  12:00:00  http://en.wikipedia.org/wiki/2009_Bahrain_Gran…       \N
4  12:00:00  http://en.wikipedia.org/wiki/2009_Spanish_Gran…       \N

  fp1_time fp2_date fp2_time fp3_date fp3_time quali_date quali_time  \
0       \N       \N       \N       \N       \N         \N         \N
1       \N       \N       \N       \N       \N         \N         \N
2       \N       \N       \N       \N       \N         \N         \N
3       \N       \N       \N       \N       \N         \N         \N
4       \N       \N       \N       \N       \N         \N         \N
```

```
  sprint_date sprint_time
0          \N          \N
1          \N          \N
2          \N          \N
3          \N          \N
4          \N          \N
```

```
[5]: driver_standings.head()
```

```
[5]:    driverStandingsId  raceId  driverId  points  position positionText  wins
     0                  1      18         1    10.0         1            1     1
     1                  2      18         2     8.0         2            2     0
     2                  3      18         3     6.0         3            3     0
     3                  4      18         4     5.0         4            4     0
     4                  5      18         5     4.0         5            5     0
```

```
[6]: circuits.isnull().sum()
     circuits['circuitId'].dtype
     circuits.dtypes
```

```
[6]: circuitId       int64
     circuitRef     object
     name           object
     location       object
     country        object
     lat           float64
     lng           float64
     alt            object
     url            object
     dtype: object
```

```
[7]: laptimes.head()
```

```
[7]:    raceId  driverId  lap  position      time  milliseconds
     0     841        20    1         1  1:38.109         98109
     1     841        20    2         1  1:33.006         93006
     2     841        20    3         1  1:32.713         92713
     3     841        20    4         1  1:32.803         92803
     4     841        20    5         1  1:32.342         92342
```

```
[8]: pitstops.head()
```

```
[8]:    raceId  driverId  stop  lap      time duration  milliseconds
     0     841       153     1    1  17:05:23   26.898         26898
     1     841        30     1    1  17:05:52   25.021         25021
     2     841        17     1   11  17:20:48   23.426         23426
```

```
3     841          4      1    12  17:22:34   23.251          23251
4     841         13      1    13  17:24:10   23.842          23842
```

[9]:
```
seasons.head()
```

[9]:
```
   year                                                url
0  2009  http://en.wikipedia.org/wiki/2009_Formula_One_…
1  2008  http://en.wikipedia.org/wiki/2008_Formula_One_…
2  2007  http://en.wikipedia.org/wiki/2007_Formula_One_…
3  2006  http://en.wikipedia.org/wiki/2006_Formula_One_…
4  2005  http://en.wikipedia.org/wiki/2005_Formula_One_…
```

[10]:
```
status.head()
```

[10]:
```
   statusId        status
0         1      Finished
1         2  Disqualified
2         3      Accident
3         4     Collision
4         5        Engine
```

[11]:
```
constructor_standings.head()
```

[11]:
```
   constructorStandingsId  raceId  constructorId  points  position  \
0                       1      18              1    14.0         1
1                       2      18              2     8.0         3
2                       3      18              3     9.0         2
3                       4      18              4     5.0         4
4                       5      18              5     2.0         5

  positionText  wins
0            1     1
1            3     0
2            2     0
3            4     0
4            5     0
```

[12]:
```
constructors.head()
```

[12]:
```
   constructorId constructorRef        name nationality  \
0              1        mclaren     McLaren     British
1              2     bmw_sauber  BMW Sauber      German
2              3       williams    Williams     British
3              4        renault     Renault      French
4              5     toro_rosso  Toro Rosso     Italian

                                                 url
```

```
0                http://en.wikipedia.org/wiki/McLaren
1             http://en.wikipedia.org/wiki/BMW_Sauber
2  http://en.wikipedia.org/wiki/Williams_Grand_Pr…
3  http://en.wikipedia.org/wiki/Renault_in_Formul…
4   http://en.wikipedia.org/wiki/Scuderia_Toro_Rosso
```

```
[13]: driver_standings.head()
```

```
[13]:    driverStandingsId  raceId  driverId  points  position positionText  wins
      0                  1      18         1    10.0         1            1     1
      1                  2      18         2     8.0         2            2     0
      2                  3      18         3     6.0         3            3     0
      3                  4      18         4     5.0         4            4     0
      4                  5      18         5     4.0         5            5     0
```

```
[14]: drivers.head()
```

```
[14]:    driverId   driverRef number code  forename     surname         dob  \
      0         1    hamilton     44  HAM     Lewis    Hamilton  1985-01-07
      1         2    heidfeld     \N  HEI      Nick    Heidfeld  1977-05-10
      2         3     rosberg      6  ROS      Nico     Rosberg  1985-06-27
      3         4      alonso     14  ALO  Fernando      Alonso  1981-07-29
      4         5  kovalainen     \N  KOV    Heikki  Kovalainen  1981-10-19

        nationality                                             url
      0     British     http://en.wikipedia.org/wiki/Lewis_Hamilton
      1      German      http://en.wikipedia.org/wiki/Nick_Heidfeld
      2      German       http://en.wikipedia.org/wiki/Nico_Rosberg
      3     Spanish    http://en.wikipedia.org/wiki/Fernando_Alonso
      4     Finnish  http://en.wikipedia.org/wiki/Heikki_Kovalainen
```

```
[15]: races.head()
```

```
[15]:    raceId  year  round  circuitId                   name        date  \
      0       1  2009      1          1  Australian Grand Prix  2009-03-29
      1       2  2009      2          2   Malaysian Grand Prix  2009-04-05
      2       3  2009      3         17     Chinese Grand Prix  2009-04-19
      3       4  2009      4          3     Bahrain Grand Prix  2009-04-26
      4       5  2009      5          4     Spanish Grand Prix  2009-05-10

             time                                              url fp1_date  \
      0  06:00:00  http://en.wikipedia.org/wiki/2009_Australian_G…       \N
      1  09:00:00  http://en.wikipedia.org/wiki/2009_Malaysian_Gr…       \N
      2  07:00:00  http://en.wikipedia.org/wiki/2009_Chinese_Gran…       \N
      3  12:00:00  http://en.wikipedia.org/wiki/2009_Bahrain_Gran…       \N
      4  12:00:00  http://en.wikipedia.org/wiki/2009_Spanish_Gran…       \N
```

```
  fp1_time fp2_date fp2_time fp3_date fp3_time quali_date quali_time  \
0       \N       \N       \N       \N       \N         \N         \N
1       \N       \N       \N       \N       \N         \N         \N
2       \N       \N       \N       \N       \N         \N         \N
3       \N       \N       \N       \N       \N         \N         \N
4       \N       \N       \N       \N       \N         \N         \N

  sprint_date sprint_time
0          \N          \N
1          \N          \N
2          \N          \N
3          \N          \N
4          \N          \N
```

[16]:
```
constructor_results.head()
```

[16]:
```
   constructorResultsId  raceId  constructorId  points status
0                     1      18              1    14.0     \N
1                     2      18              2     8.0     \N
2                     3      18              3     9.0     \N
3                     4      18              4     5.0     \N
4                     5      18              5     2.0     \N
```

[17]:
```
qualifying.head()
```

[17]:
```
   qualifyId  raceId  driverId  constructorId  number  position        q1  \
0          1      18         1              1      22         1  1:26.572
1          2      18         9              2       4         2  1:26.103
2          3      18         5              1      23         3  1:25.664
3          4      18        13              6       2         4  1:25.994
4          5      18         2              2       3         5  1:25.960

         q2        q3
0  1:25.187  1:26.714
1  1:25.315  1:26.869
2  1:25.452  1:27.079
3  1:25.691  1:27.178
4  1:25.518  1:27.236
```

[18]:
```
#Burada kullanıcağım csv dosyalarından bazılarını seçtim,şampiyon tahmini␣
 ↪yapacağımdan dolayı results,stats,drivers,races,constructor,driver_standings␣
 ↪dosyalarını kullanıma uygun gördüm.
races
```

[18]:
```
      raceId  year  round  circuitId                    name        date  \
0          1  2009      1          1   Australian Grand Prix  2009-03-29
1          2  2009      2          2    Malaysian Grand Prix  2009-04-05
```

```
2          3  2009      3          17        Chinese Grand Prix  2009-04-19
3          4  2009      4           3        Bahrain Grand Prix  2009-04-26
4          5  2009      5           4        Spanish Grand Prix  2009-05-10
…      …   …    …        …                       …         …
1096    1116  2023      18         69  United States Grand Prix  2023-10-22
1097    1117  2023      19         32    Mexico City Grand Prix  2023-10-29
1098    1118  2023      20         18      São Paulo Grand Prix  2023-11-05
1099    1119  2023      21         80      Las Vegas Grand Prix  2023-11-19
1100    1120  2023      22         24      Abu Dhabi Grand Prix  2023-11-26

          time                                                url    fp1_date  \
0     06:00:00  http://en.wikipedia.org/wiki/2009_Australian_G…          \N
1     09:00:00  http://en.wikipedia.org/wiki/2009_Malaysian_Gr…          \N
2     07:00:00  http://en.wikipedia.org/wiki/2009_Chinese_Gran…          \N
3     12:00:00  http://en.wikipedia.org/wiki/2009_Bahrain_Gran…          \N
4     12:00:00  http://en.wikipedia.org/wiki/2009_Spanish_Gran…          \N
…        …                                                …         …
1096  19:00:00  https://en.wikipedia.org/wiki/2023_United_Stat…  2023-10-20
1097  20:00:00  https://en.wikipedia.org/wiki/2023_Mexico_City…  2023-10-27
1098  17:00:00  https://en.wikipedia.org/wiki/2023_S%C3%A3o_Pa…  2023-11-03
1099  06:00:00  https://en.wikipedia.org/wiki/2023_Las_Vegas_G…  2023-11-17
1100  13:00:00  https://en.wikipedia.org/wiki/2023_Abu_Dhabi_G…  2023-11-24

      fp1_time    fp2_date  fp2_time    fp3_date  fp3_time  quali_date  \
0           \N          \N        \N          \N        \N          \N
1           \N          \N        \N          \N        \N          \N
2           \N          \N        \N          \N        \N          \N
3           \N          \N        \N          \N        \N          \N
4           \N          \N        \N          \N        \N          \N
…        …         …       …         …       …         …
1096  17:30:00  2023-10-21  18:00:00          \N        \N  2023-10-20
1097  18:30:00  2023-10-27  22:00:00  2023-10-28  17:30:00  2023-10-28
1098  14:30:00  2023-11-04  14:30:00          \N        \N  2023-11-03
1099  04:30:00  2023-11-17  08:00:00  2023-11-18  04:30:00  2023-11-18
1100  09:30:00  2023-11-24  13:00:00  2023-11-25  10:30:00  2023-11-25

     quali_time sprint_date sprint_time
0            \N          \N          \N
1            \N          \N          \N
2            \N          \N          \N
3            \N          \N          \N
4            \N          \N          \N
…         …         …         …
1096   21:00:00  2023-10-21    22:00:00
1097   21:00:00          \N          \N
1098   18:00:00  2023-11-04    18:30:00
1099   08:00:00          \N          \N
```

```
1100   14:00:00          \N          \N

[1101 rows x 18 columns]
```

```
[19]: results
```

```
[19]:
       resultId  raceId  driverId  constructorId number  grid position  \
0             1      18         1              1     22     1        1
1             2      18         2              2      3     5        2
2             3      18         3              3      7     7        3
3             4      18         4              4      5    11        4
4             5      18         5              1     23     3        5
…         …     …       …            …    …   …      …
26075     26081    1110       817            213      3    19       16
26076     26082    1110       858              3      2    18       17
26077     26083    1110       807            210     27     0       18
26078     26084    1110       832              6     55     4       \N
26079     26085    1110       857              1     81     5       \N

      positionText  positionOrder  points  laps         time milliseconds  \
0                1              1    10.0    58  1:34:50.616      5690616
1                2              2     8.0    58       +5.478      5696094
2                3              3     6.0    58       +8.163      5698779
3                4              4     5.0    58      +17.181      5707797
4                5              5     4.0    58      +18.014      5708630
…            …            …     …   …          …          …
26075           16             16     0.0    44    +1:43.071      5053521
26076           17             17     0.0    44    +1:44.476      5054926
26077           18             18     0.0    44    +1:50.450      5060900
26078            R             19     0.0    23           \N           \N
26079            R             20     0.0     0           \N           \N

      fastestLap rank fastestLapTime fastestLapSpeed  statusId
0             39    2       1:27.452         218.300         1
1             41    3       1:27.739         217.586         1
2             41    5       1:28.090         216.719         1
3             58    7       1:28.603         215.464         1
4             43    1       1:27.418         218.385         1
…          …  …            …             …       …
26075         25   15       1:50.994         227.169         1
26076         37    9       1:50.486         228.213         1
26077         26    4       1:49.907         229.415         1
26078          9   19       1:53.138         222.864       130
26079         \N    0             \N              \N       130

[26080 rows x 18 columns]
```

[20]:
```
#Burada incelerken url kısmının gereksiz olduğunu görebiliyoruz o yüzden␣
 ↪ilerleyen zamanda bu kısmı dropluycaz.
constructors
```

[20]:
```
     constructorId constructorRef            name nationality  \
0                1        mclaren         McLaren     British
1                2     bmw_sauber      BMW Sauber      German
2                3       williams        Williams     British
3                4        renault         Renault      French
4                5     toro_rosso      Toro Rosso     Italian
..             …              …             …         …
206            209          manor  Manor Marussia     British
207            210           haas    Haas F1 Team    American
208            211   racing_point    Racing Point     British
209            213     alphatauri      AlphaTauri     Italian
210            214         alpine  Alpine F1 Team      French

                                                   url
0                   http://en.wikipedia.org/wiki/McLaren
1                http://en.wikipedia.org/wiki/BMW_Sauber
2    http://en.wikipedia.org/wiki/Williams_Grand_Pr…
3    http://en.wikipedia.org/wiki/Renault_in_Formul…
4     http://en.wikipedia.org/wiki/Scuderia_Toro_Rosso
..                                                 …
206       http://en.wikipedia.org/wiki/Manor_Motorsport
207           http://en.wikipedia.org/wiki/Haas_F1_Team
208   http://en.wikipedia.org/wiki/Racing_Point_F1_Team
209    http://en.wikipedia.org/wiki/Scuderia_AlphaTauri
210         http://en.wikipedia.org/wiki/Alpine_F1_Team

[211 rows x 5 columns]
```

[21]:
```
drivers
```

[21]:
```
     driverId        driverRef number code  forename     surname         dob  \
0           1         hamilton     44  HAM     Lewis    Hamilton  1985-01-07
1           2         heidfeld     \N  HEI      Nick    Heidfeld  1977-05-10
2           3          rosberg      6  ROS      Nico     Rosberg  1985-06-27
3           4           alonso     14  ALO  Fernando      Alonso  1981-07-29
4           5       kovalainen     \N  KOV    Heikki  Kovalainen  1981-10-19
..        …              …    …  …       …         …         …
852       854  mick_schumacher     47  MSC      Mick  Schumacher  1999-03-22
853       855             zhou     24  ZHO    Guanyu        Zhou  1999-05-30
854       856          de_vries     21  DEV      Nyck    de Vries  1995-02-06
855       857          piastri     81  PIA     Oscar     Piastri  2001-04-06
856       858         sargeant      2  SAR     Logan    Sargeant  2000-12-31
```

```
    nationality                                             url
0       British     http://en.wikipedia.org/wiki/Lewis_Hamilton
1        German      http://en.wikipedia.org/wiki/Nick_Heidfeld
2        German       http://en.wikipedia.org/wiki/Nico_Rosberg
3       Spanish    http://en.wikipedia.org/wiki/Fernando_Alonso
4       Finnish  http://en.wikipedia.org/wiki/Heikki_Kovalainen
..          …                                             …
852      German    http://en.wikipedia.org/wiki/Mick_Schumacher
853     Chinese        http://en.wikipedia.org/wiki/Zhou_Guanyu
854       Dutch      http://en.wikipedia.org/wiki/Nyck_de_Vries
855  Australian      http://en.wikipedia.org/wiki/Oscar_Piastri
856    American     http://en.wikipedia.org/wiki/Logan_Sargeant

[857 rows x 9 columns]
```

[22]:

```
status
```

[22]:

```
     statusId          status
0           1        Finished
1           2    Disqualified
2           3        Accident
3           4       Collision
4           5          Engine
..        …             …
134       137          Damage
135       138          Debris
136       139         Illness
137       140       Undertray
138       141  Cooling system

[139 rows x 2 columns]
```

[23]:

```
driver_standings
```

[23]:

```
       driverStandingsId  raceId  driverId  points  position positionText  \
0                      1      18         1    10.0         1            1
1                      2      18         2     8.0         2            2
2                      3      18         3     6.0         3            3
3                      4      18         4     5.0         4            4
4                      5      18         5     4.0         5            5
…                  …     …       …     …       …          …
34119              72183    1110       846    69.0         8            8
34120              72184    1110       839    35.0        10           10
34121              72185    1110       844    99.0         5            5
34122              72186    1110       857    34.0        11           11
34123              72187    1110       817     0.0        21           21
```

```
       wins
0         1
1         0
2         0
3         0
4         0
…     …
34119     0
34120     0
34121     0
34122     0
34123     0

[34124 rows x 7 columns]
```

[24]:

```
#Merge ederken kullanıcaklarımı ve onları df içerisindeki tabloda neye göre␣
 ↪sıralıycağımı belirleyerek ona göre merge işlemini gerçekleştirdim.

df = pd.merge(results,races[['raceId','year','name','round','date']],on =␣
 ↪'raceId',how = 'left')
df=pd.
 ↪merge(df,drivers[['driverId','driverRef','forename','surname','nationality','dob']],on='dri
df=pd.
 ↪merge(df,constructors[['constructorId','name','nationality']],on='constructorId',how='left'
df=pd.merge(df,status[['statusId','status']],on='statusId',how='left')
#Bu satırı yazma sebebim bütün sütunları görebilmek
pd.get_option("display.max_columns",None)
df
```

[24]:

```
       resultId  raceId  driverId  constructorId number  grid position  \
0             1      18         1              1     22      1        1
1             2      18         2              2      3      5        2
2             3      18         3              3      7      7        3
3             4      18         4              4      5     11        4
4             5      18         5              1     23      3        5
…         …     …       …            …    …   …      …
26075     26081    1110       817            213      3    19       16
26076     26082    1110       858              3      2    18       17
26077     26083    1110       807            210     27     0       18
26078     26084    1110       832              6     55     4       \N
26079     26085    1110       857              1     81     5       \N

      positionText  positionOrder  points  …  round         date  driverRef  \
0                1              1    10.0  …      1  2008-03-16   hamilton
1                2              2     8.0  …      1  2008-03-16   heidfeld
2                3              3     6.0  …      1  2008-03-16    rosberg
3                4              4     5.0  …      1  2008-03-16     alonso
```

```
4                 5              5     4.0  …       1  2008-03-16  kovalainen
…              …              …      …  …    …      …         …
26075            16             16     0.0  …      12  2023-07-30   ricciardo
26076            17             17     0.0  …      12  2023-07-30    sargeant
26077            18             18     0.0  …      12  2023-07-30  hulkenberg
26078             R             19     0.0  …      12  2023-07-30       sainz
26079             R             20     0.0  …      12  2023-07-30     piastri

       forename     surname nationality_x         dob        name_y  \
0         Lewis    Hamilton       British  1985-01-07       McLaren
1          Nick    Heidfeld        German  1977-05-10    BMW Sauber
2          Nico     Rosberg        German  1985-06-27      Williams
3      Fernando      Alonso       Spanish  1981-07-29       Renault
4        Heikki  Kovalainen       Finnish  1981-10-19       McLaren
…           …           …           …          …           …
26075    Daniel   Ricciardo    Australian  1989-07-01    AlphaTauri
26076     Logan    Sargeant      American  2000-12-31      Williams
26077      Nico  Hülkenberg        German  1987-08-19  Haas F1 Team
26078    Carlos       Sainz       Spanish  1994-09-01       Ferrari
26079     Oscar     Piastri    Australian  2001-04-06       McLaren

       nationality_y            status
0            British          Finished
1             German          Finished
2            British          Finished
3             French          Finished
4            British          Finished
…                …                …
26075        Italian          Finished
26076        British          Finished
26077       American          Finished
26078        Italian  Collision damage
26079        British  Collision damage

[26080 rows x 30 columns]
```

[25]:
```
#Gereksiz sütunları kaldırdık
df.
 ↪drop(['number','position','positionText','statusId','resultId','driverId','constructorId'],
 ↪=1,inplace = True)
```

[26]:
```
df
```

[26]:
```
       raceId  grid  positionOrder  points  laps         time milliseconds  \
0          18     1              1    10.0    58  1:34:50.616      5690616
1          18     5              2     8.0    58       +5.478      5696094
2          18     7              3     6.0    58       +8.163      5698779
```

```
3          18    11              4     5.0    58      +17.181      5707797
4          18     3              5     4.0    58      +18.014      5708630
…       …   …            …     …   …          …          …
26075    1110    19             16     0.0    44    +1:43.071      5053521
26076    1110    18             17     0.0    44    +1:44.476      5054926
26077    1110     0             18     0.0    44    +1:50.450      5060900
26078    1110     4             19     0.0    23           \N           \N
26079    1110     5             20     0.0     0           \N           \N

      fastestLap rank fastestLapTime  … round        date   driverRef  \
0             39    2       1:27.452  …     1  2008-03-16    hamilton   
1             41    3       1:27.739  …     1  2008-03-16    heidfeld   
2             41    5       1:28.090  …     1  2008-03-16     rosberg   
3             58    7       1:28.603  …     1  2008-03-16      alonso   
4             43    1       1:27.418  …     1  2008-03-16  kovalainen   
…           …  …             …  …   …          …          …
26075         25   15       1:50.994  …    12  2023-07-30   ricciardo   
26076         37    9       1:50.486  …    12  2023-07-30    sargeant   
26077         26    4       1:49.907  …    12  2023-07-30  hulkenberg   
26078          9   19       1:53.138  …    12  2023-07-30       sainz   
26079         \N    0             \N  …    12  2023-07-30     piastri   

       forename     surname nationality_x         dob        name_y  \
0         Lewis    Hamilton       British  1985-01-07       McLaren   
1          Nick    Heidfeld        German  1977-05-10    BMW Sauber   
2          Nico     Rosberg        German  1985-06-27      Williams   
3      Fernando      Alonso       Spanish  1981-07-29       Renault   
4        Heikki  Kovalainen       Finnish  1981-10-19       McLaren   
…         …          …            …          …          …
26075    Daniel   Ricciardo    Australian  1989-07-01    AlphaTauri   
26076     Logan    Sargeant      American  2000-12-31      Williams   
26077      Nico  Hülkenberg        German  1987-08-19  Haas F1 Team   
26078    Carlos       Sainz       Spanish  1994-09-01       Ferrari   
26079     Oscar     Piastri    Australian  2001-04-06       McLaren   

      nationality_y            status
0           British          Finished
1            German          Finished
2           British          Finished
3            French          Finished
4           British          Finished
…             …               …
26075       Italian          Finished
26076       British          Finished
26077      American          Finished
26078       Italian  Collision damage
26079       British  Collision damage
```

```
[26080 rows x 23 columns]
```

[27]:

```
df.rename(columns = {'rank':'fastest_lap_rank','name_x':
↪'gp_name','nationality_x':'driver_nationality',
                    'name_y':'constructor_name','nationality_y':
↪'constructor_nationality','driverRef':'driver'},inplace = True)
df
```

[27]:

```
       raceId  grid  positionOrder  points  laps         time milliseconds  \
0          18     1              1    10.0    58  1:34:50.616      5690616
1          18     5              2     8.0    58       +5.478      5696094
2          18     7              3     6.0    58       +8.163      5698779
3          18    11              4     5.0    58      +17.181      5707797
4          18     3              5     4.0    58      +18.014      5708630
…       …   …            …     …   …          …           …
26075    1110    19             16     0.0    44    +1:43.071      5053521
26076    1110    18             17     0.0    44    +1:44.476      5054926
26077    1110     0             18     0.0    44    +1:50.450      5060900
26078    1110     4             19     0.0    23           \N           \N
26079    1110     5             20     0.0     0           \N           \N

      fastestLap fastest_lap_rank fastestLapTime  … round        date  \
0             39                2       1:27.452  …     1  2008-03-16
1             41                3       1:27.739  …     1  2008-03-16
2             41                5       1:28.090  …     1  2008-03-16
3             58                7       1:28.603  …     1  2008-03-16
4             43                1       1:27.418  …     1  2008-03-16
…          …              …            …  …   …          …
26075         25               15       1:50.994  …    12  2023-07-30
26076         37                9       1:50.486  …    12  2023-07-30
26077         26                4       1:49.907  …    12  2023-07-30
26078          9               19       1:53.138  …    12  2023-07-30
26079         \N                0             \N  …    12  2023-07-30

           driver  forename     surname driver_nationality         dob  \
0        hamilton     Lewis    Hamilton            British  1985-01-07
1        heidfeld      Nick    Heidfeld             German  1977-05-10
2         rosberg      Nico     Rosberg             German  1985-06-27
3          alonso  Fernando      Alonso            Spanish  1981-07-29
4      kovalainen    Heikki  Kovalainen            Finnish  1981-10-19
…           …       …         …                …          …
26075   ricciardo    Daniel   Ricciardo         Australian  1989-07-01
26076    sargeant     Logan    Sargeant           American  2000-12-31
26077  hulkenberg      Nico  Hülkenberg             German  1987-08-19
26078       sainz    Carlos       Sainz            Spanish  1994-09-01
26079     piastri     Oscar     Piastri         Australian  2001-04-06
```

```
      constructor_name constructor_nationality            status
0              McLaren                 British          Finished
1           BMW Sauber                  German          Finished
2             Williams                 British          Finished
3              Renault                  French          Finished
4              McLaren                 British          Finished
…                 …                     …               …
26075       AlphaTauri                 Italian          Finished
26076         Williams                 British          Finished
26077     Haas F1 Team                American          Finished
26078          Ferrari                 Italian  Collision damage
26079          McLaren                 British  Collision damage

[26080 rows x 23 columns]
```

[28]:

```
df['driver_name']=df['forename']+ ' '+ df['surname']
df.drop(['forename','surname'],axis=1,inplace=True)
```

[29]:

```
df
```

[29]:

```
       raceId  grid  positionOrder  points  laps         time milliseconds  \
0          18     1              1    10.0    58  1:34:50.616      5690616
1          18     5              2     8.0    58       +5.478      5696094
2          18     7              3     6.0    58       +8.163      5698779
3          18    11              4     5.0    58      +17.181      5707797
4          18     3              5     4.0    58      +18.014      5708630
…       …   …             …     …   …          …          …
26075    1110    19             16     0.0    44    +1:43.071      5053521
26076    1110    18             17     0.0    44    +1:44.476      5054926
26077    1110     0             18     0.0    44    +1:50.450      5060900
26078    1110     4             19     0.0    23           \N           \N
26079    1110     5             20     0.0     0           \N           \N

      fastestLap fastest_lap_rank fastestLapTime  …                gp_name  \
0             39                2       1:27.452  …  Australian Grand Prix
1             41                3       1:27.739  …  Australian Grand Prix
2             41                5       1:28.090  …  Australian Grand Prix
3             58                7       1:28.603  …  Australian Grand Prix
4             43                1       1:27.418  …  Australian Grand Prix
…           …              …             …  …                   …
26075         25               15       1:50.994  …     Belgian Grand Prix
26076         37                9       1:50.486  …     Belgian Grand Prix
26077         26                4       1:49.907  …     Belgian Grand Prix
26078          9               19       1:53.138  …     Belgian Grand Prix
26079         \N                0             \N  …     Belgian Grand Prix
```

```
       round        date      driver driver_nationality         dob  \
0          1  2008-03-16    hamilton            British  1985-01-07
1          1  2008-03-16    heidfeld             German  1977-05-10
2          1  2008-03-16     rosberg             German  1985-06-27
3          1  2008-03-16      alonso            Spanish  1981-07-29
4          1  2008-03-16  kovalainen            Finnish  1981-10-19
…      …          …          …                …         …
26075     12  2023-07-30   ricciardo         Australian  1989-07-01
26076     12  2023-07-30    sargeant           American  2000-12-31
26077     12  2023-07-30  hulkenberg             German  1987-08-19
26078     12  2023-07-30       sainz            Spanish  1994-09-01
26079     12  2023-07-30     piastri         Australian  2001-04-06

      constructor_name constructor_nationality           status  \
0              McLaren                 British         Finished
1           BMW Sauber                  German         Finished
2             Williams                 British         Finished
3              Renault                  French         Finished
4              McLaren                 British         Finished
…                  …                     …                …
26075       AlphaTauri                 Italian         Finished
26076         Williams                 British         Finished
26077     Haas F1 Team                American         Finished
26078          Ferrari                 Italian  Collision damage
26079          McLaren                 British  Collision damage

             driver_name
0         Lewis Hamilton
1          Nick Heidfeld
2           Nico Rosberg
3        Fernando Alonso
4       Heikki Kovalainen
…                    …
26075   Daniel Ricciardo
26076     Logan Sargeant
26077    Nico Hülkenberg
26078       Carlos Sainz
26079      Oscar Piastri

[26080 rows x 22 columns]
```

[30]:
```
df.head()
```

[30]:
```
   raceId  grid  positionOrder  points  laps         time milliseconds  \
0      18     1              1    10.0    58  1:34:50.616      5690616
1      18     5              2     8.0    58       +5.478      5696094
2      18     7              3     6.0    58       +8.163      5698779
```

```
3      18    11               4     5.0    58      +17.181      5707797
4      18     3               5     4.0    58      +18.014      5708630

  fastestLap fastest_lap_rank fastestLapTime  …                gp_name  \
0         39                2       1:27.452  …  Australian Grand Prix
1         41                3       1:27.739  …  Australian Grand Prix
2         41                5       1:28.090  …  Australian Grand Prix
3         58                7       1:28.603  …  Australian Grand Prix
4         43                1       1:27.418  …  Australian Grand Prix

   round        date      driver driver_nationality         dob  \
0      1  2008-03-16    hamilton            British  1985-01-07
1      1  2008-03-16    heidfeld             German  1977-05-10
2      1  2008-03-16     rosberg             German  1985-06-27
3      1  2008-03-16      alonso            Spanish  1981-07-29
4      1  2008-03-16  kovalainen            Finnish  1981-10-19

  constructor_name constructor_nationality    status       driver_name
0          McLaren                 British  Finished    Lewis Hamilton
1       BMW Sauber                  German  Finished     Nick Heidfeld
2         Williams                 British  Finished      Nico Rosberg
3          Renault                  French  Finished   Fernando Alonso
4          McLaren                 British  Finished  Heikki Kovalainen

[5 rows x 22 columns]
```

[31]:

```
#String yapısını date formatına dönüştürdüm
pd.to_datetime(df.dob)
```

[31]:

```
0       1985-01-07
1       1977-05-10
2       1985-06-27
3       1981-07-29
4       1981-10-19
           …
26075   1989-07-01
26076   2000-12-31
26077   1987-08-19
26078   1994-09-01
26079   2001-04-06
Name: dob, Length: 26080, dtype: datetime64[ns]
```

[32]:

```
df['dob'] = pd.to_datetime(df['dob'])
```

[33]:

```
from datetime import datetime
```

[34]:
```
dates = datetime.today()-df['dob']
age = dates.dt.days/365
```

[35]:
```
#İlerisinde yaşa göre grafik çizdirebilmek için sürücülerin şu an ki tarihe␣
 ↪göre yaş dağılımlarını almak için bazı hesaplamalar yaptım ve 'age' adı␣
 ↪altında yeni bir sütun oluşturdum
df['age'] = round(age)
```

[36]:
```
df
```

[36]:
```
       raceId  grid  positionOrder  points  laps          time milliseconds  \
0          18     1              1    10.0    58   1:34:50.616      5690616
1          18     5              2     8.0    58        +5.478      5696094
2          18     7              3     6.0    58        +8.163      5698779
3          18    11              4     5.0    58       +17.181      5707797
4          18     3              5     4.0    58       +18.014      5708630
…           …     …              …       …     …             …            …
26075    1110    19             16     0.0    44     +1:43.071      5053521
26076    1110    18             17     0.0    44     +1:44.476      5054926
26077    1110     0             18     0.0    44     +1:50.450      5060900
26078    1110     4             19     0.0    23            \N           \N
26079    1110     5             20     0.0     0            \N           \N

      fastestLap fastest_lap_rank fastestLapTime  … round        date  \
0             39                2       1:27.452  …     1  2008-03-16
1             41                3       1:27.739  …     1  2008-03-16
2             41                5       1:28.090  …     1  2008-03-16
3             58                7       1:28.603  …     1  2008-03-16
4             43                1       1:27.418  …     1  2008-03-16
…              …                …              …  …     …           …
26075         25               15       1:50.994  …    12  2023-07-30
26076         37                9       1:50.486  …    12  2023-07-30
26077         26                4       1:49.907  …    12  2023-07-30
26078          9               19       1:53.138  …    12  2023-07-30
26079         \N                0             \N  …    12  2023-07-30

           driver driver_nationality         dob constructor_name  \
0        hamilton            British  1985-01-07          McLaren
1        heidfeld             German  1977-05-10       BMW Sauber
2         rosberg             German  1985-06-27         Williams
3          alonso            Spanish  1981-07-29          Renault
4       kovalainen           Finnish  1981-10-19          McLaren
…               …                  …           …                …
26075   ricciardo         Australian  1989-07-01       AlphaTauri
26076    sargeant           American  2000-12-31         Williams
26077  hulkenberg             German  1987-08-19     Haas F1 Team
26078       sainz            Spanish  1994-09-01          Ferrari
```

```
26079     piastri          Australian 2001-04-06          McLaren

      constructor_nationality            status         driver_name   age
0                     British          Finished      Lewis Hamilton  39.0
1                      German          Finished       Nick Heidfeld  46.0
2                     British          Finished        Nico Rosberg  38.0
3                      French          Finished     Fernando Alonso  42.0
4                     British          Finished   Heikki Kovalainen  42.0
…                           …                 …                 …    …
26075                 Italian          Finished    Daniel Ricciardo  34.0
26076                 British          Finished      Logan Sargeant  23.0
26077                American          Finished      Nico Hülkenberg  36.0
26078                 Italian  Collision damage        Carlos Sainz  29.0
26079                 British  Collision damage       Oscar Piastri  23.0

[26080 rows x 23 columns]
```

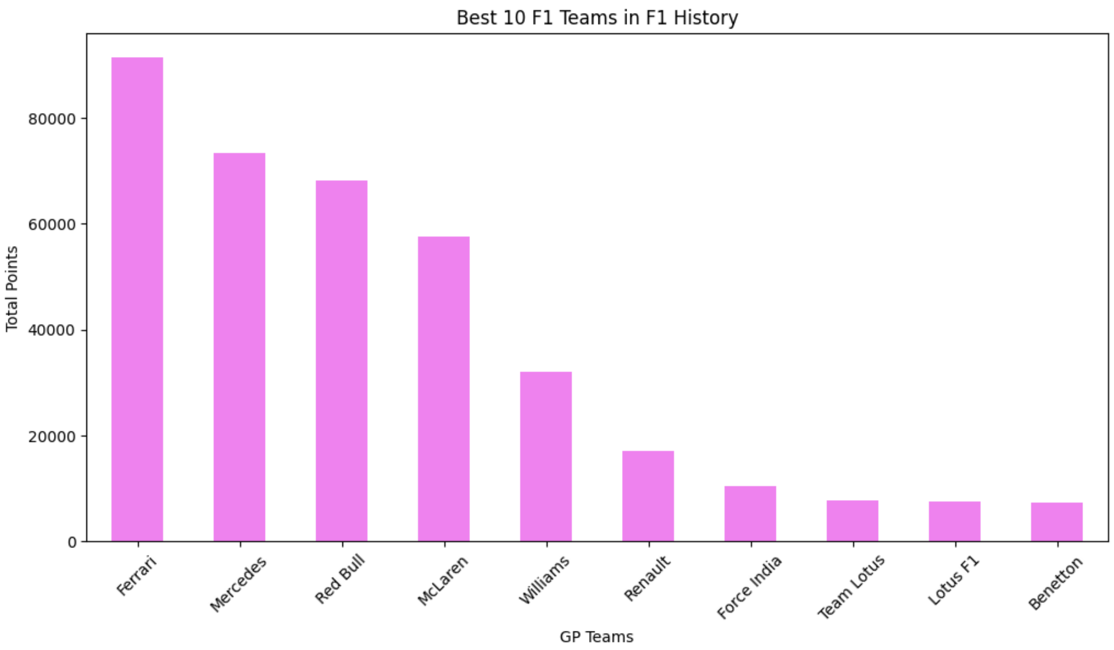
F1 TARİHİNDEKİ EN BAŞARILI 10 TAKIM

[37]:

```
top_constructors = pd.merge(constructor_standings, constructors,␣
 ↪on='constructorId')
top_constructors = top_constructors.groupby('name')['points'].sum()
top_constructors = top_constructors.sort_values(ascending=False).head(10)
```

[38]:

```
plt.figure(figsize=(12, 6))
top_constructors.plot(kind='bar', color='violet')
plt.xlabel('GP Teams')
plt.ylabel('Total Points')
plt.title('Best 10 F1 Teams in F1 History')
plt.xticks(rotation=45)
plt.show()
```



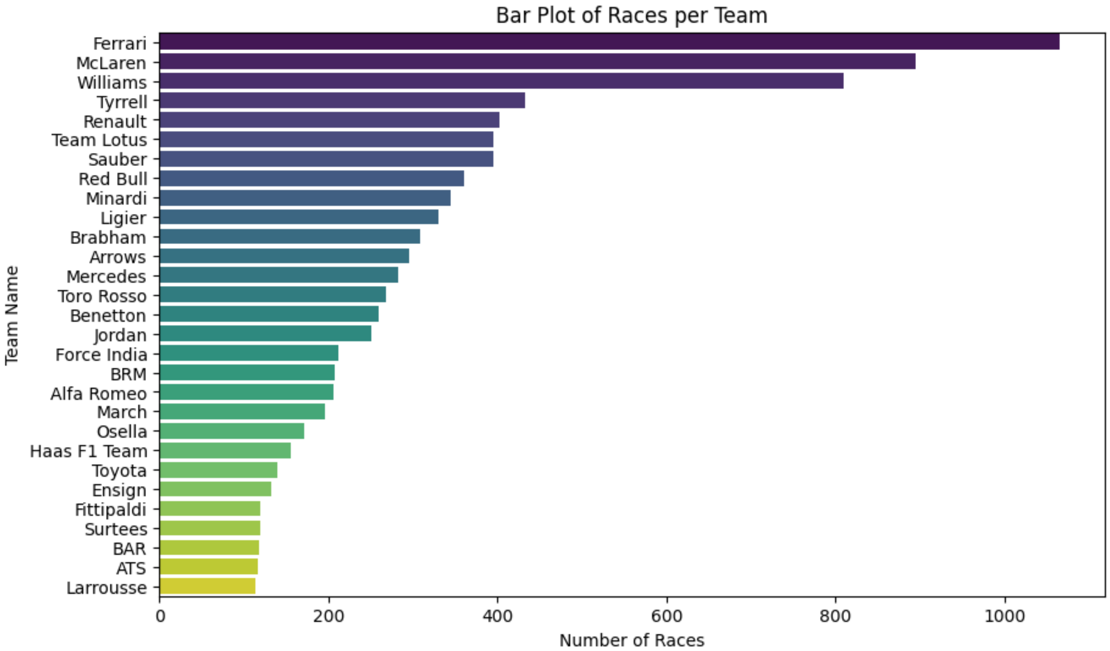
[39]:
```
#Takımların yarış başına düşen puanları
the_best_teams=constructors.merge(results,on = 'constructorId',how = 'left')
the_best_teams = the_best_teams[['name','points','raceId']]
the_best_teams = the_best_teams.groupby('name')['raceId'].nunique().
↪sort_values(ascending = False).reset_index(name = 'races')
the_best_teams = the_best_teams[the_best_teams['races'] >= 100]
the_best_teams
```

[39]:
```
           name  races
0       Ferrari   1066
1       McLaren    895
2      Williams    809
3       Tyrrell    433
4       Renault    403
5    Team Lotus    395
6        Sauber    395
7      Red Bull    360
8       Minardi    345
9        Ligier    330
10      Brabham    308
11       Arrows    296
12     Mercedes    283
13   Toro Rosso    268
14     Benetton    260
15       Jordan    250
16  Force India    212
```

```
17           BRM    208
18     Alfa Romeo    206
19          March    196
20         Osella    171
21   Haas F1 Team    156
22         Toyota    140
23         Ensign    133
24     Fittipaldi    119
25        Surtees    119
26            BAR    118
27            ATS    116
28      Larrousse    114
```

[40]:

```
plt.figure(figsize=(10, 6))
sns.barplot(x='races', y='name', data=the_best_teams, palette='viridis')  #␣
 ↪Veri çerçevesini ve sütunları belirtiyoruz
plt.xlabel('Number of Races')
plt.ylabel('Team Name')
plt.title('Bar Plot of Races per Team')
plt.show()
```



[41]:

```
driver_nationality = df.groupby('driver_nationality')['driver_nationality'].
 ↪count().sort_values(ascending = False).reset_index(name = 'number of␣
 ↪drivers')
```

```
fig = go.Figure(data=[go.Pie(labels=driver_nationality.driver_nationality.
 ↪head(10), values=driver_nationality['number of drivers'])])
fig.update_traces(textfont_size=20,
                  marker=dict(line=dict(color='#000000', width=2)))
fig.update_layout(
    title="Top 10 nationality since 1950")
fig.show()
```

[42]:
```
# En genç 5 sürücüyü buldum ve hepsinin yaşını aldım
youngest_drivers = df.sort_values(by='dob', ascending=False).
 ↪drop_duplicates(subset='driver_name')[:5]
youngest_drivers = youngest_drivers[['driver_name', 'driver_nationality',␣
 ↪'age']]
youngest_drivers = youngest_drivers.reset_index(drop=True)
print(youngest_drivers.to_string(index=False))
```

```
   driver_name driver_nationality  age
 Oscar Piastri         Australian 23.0
Logan Sargeant           American 23.0
  Yuki Tsunoda           Japanese 23.0
  Lando Norris            British 24.0
   Guanyu Zhou            Chinese 24.0
```

[43]:
```
#Burada incelerken gereksiz \N satırlarını farkettim bunları NaN değerine␣
 ↪çevirdim.
df.replace(r'\\N', None, regex=True, inplace=True)
```

[44]:
```
df.columns
```

[44]:
```
Index(['raceId', 'grid', 'positionOrder', 'points', 'laps', 'time',
       'milliseconds', 'fastestLap', 'fastest_lap_rank', 'fastestLapTime',
       'fastestLapSpeed', 'year', 'gp_name', 'round', 'date', 'driver',
       'driver_nationality', 'dob', 'constructor_name',
       'constructor_nationality', 'status', 'driver_name', 'age'],
      dtype='object')
```

[45]:
```
## Burada en genç pilotları incelerken ve en yaşlılara bakarken bir sorun␣
 ↪farkettim.Daha öncesinde 'age',sütunu oluşturduğumda ölen pilotların bilgisi␣
 ↪elimde olmadığı için max yaşları çok fazla çıkıyordu
#Bunların en son yarış yaptıkları tarihlere bakarak yaşlarını güncelledim fakat␣
 ↪emekli olanları ayrıştırmak istemediğim için en son yarışlarını 2015'te
#yapanların yaşlarını 2015 tarihine göre güncelledim

# Sütunları tarih nesnelerine dönüştürüyoruz
df["dob"] = pd.to_datetime(df["dob"])
df["date"] = pd.to_datetime(df["date"])
```

```
last_race_date = df["date"].max()

# Yaş sütunundaki değerleri hesaplayın
df["age"] = (last_race_date - df["dob"]).dt.days / 365.25

# 2015 yılı öncesinde yarışı olmayan kişilerin yaşlarını güncelleyin
df.loc[df["date"] < pd.to_datetime("2015-01-01"), "age"] = (last_race_date -␣
 ↪df["dob"]).dt.days / 365.25
df['age']=round(age)
```

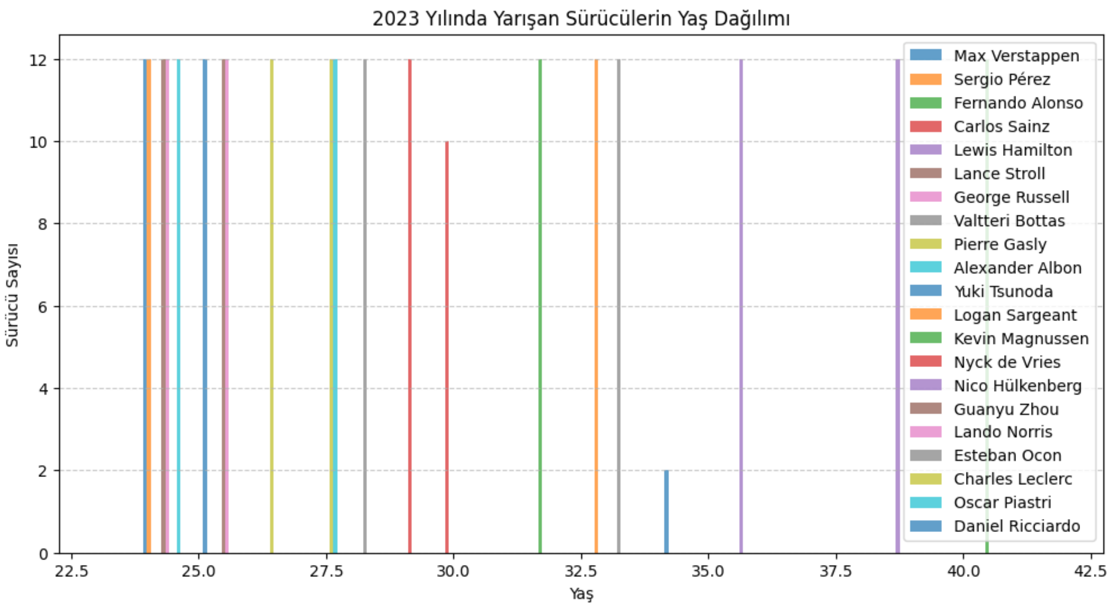
[46]:

```
df['dob'] = pd.to_datetime(df['dob'])
df['date'] = pd.to_datetime(df['date'])

# Her sürücünün sadece bir kez gözüktüğü bir veri çerçevesi oluşturdum
unique_drivers = df.drop_duplicates(subset='driver_name')

# 2023 yılında en son yarışını yapmış olan sürücülerin yaş ortalamasını␣
 ↪hesapladım
latest_race_2023 = unique_drivers[unique_drivers['date'].dt.year == 2023]
average_age_2023 = (latest_race_2023['date'] - latest_race_2023['dob']).dt.days␣
 ↪/ 365.25
print("2023 yılında yarışan sürücülerin yaş ortalaması:", average_age_2023.
 ↪mean())
```

```
2023 yılında yarışan sürücülerin yaş ortalaması: 22.04243668720055
```

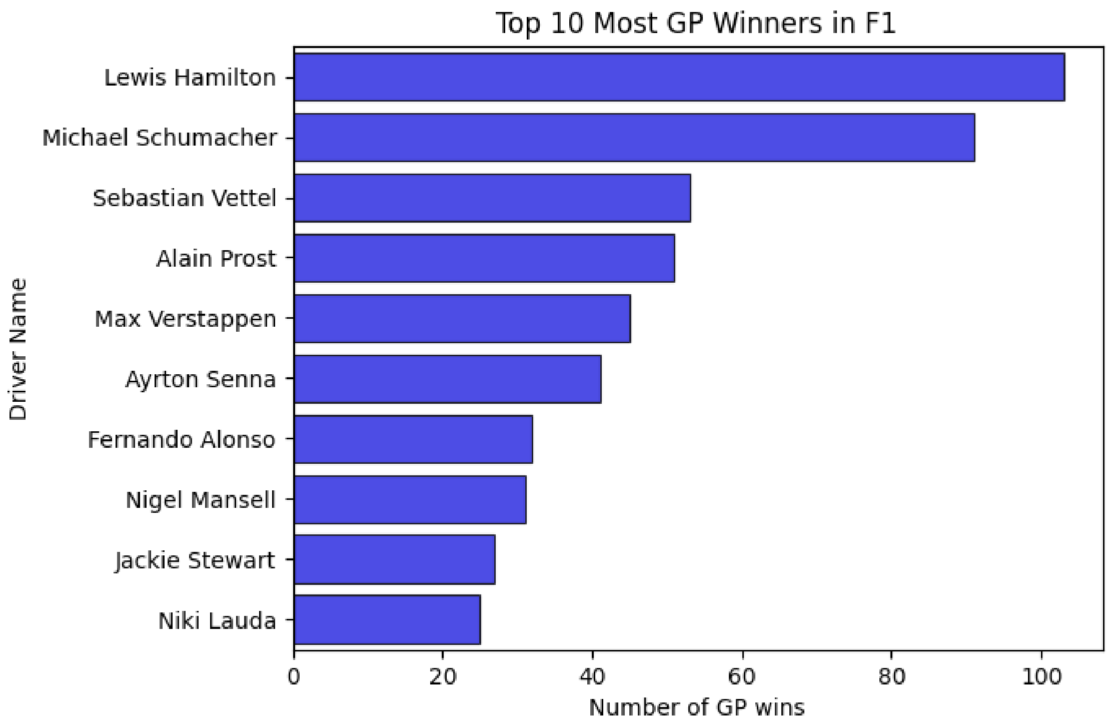
[47]:

```
# 2023 yılında yarışan sürücülerin yaşlarını ve isimlerini aldım
simplified_df = df[df['date'].dt.year == 2023][['driver_name', 'age']]

# Sürücü isimlerini unique yaptım ki tekrarlayan verileri görmeyeyim
unique_drivers = simplified_df['driver_name'].unique()

# Her bir sürücünün yaşını bir listede topladım
ages_by_driver = [simplified_df[simplified_df['driver_name'] == driver]['age'].
 ↪values for driver in unique_drivers]

# Çubuk grafik çizdirdim
plt.figure(figsize=(12, 6))
plt.hist(ages_by_driver, bins=10, alpha=0.7, label=unique_drivers)
plt.xlabel('Yaş')
plt.ylabel('Sürücü Sayısı')
plt.title('2023 Yılında Yarışan Sürücülerin Yaş Dağılımı')
plt.legend()
plt.grid(axis='y', linestyle='--', alpha=0.7)
plt.show()
```



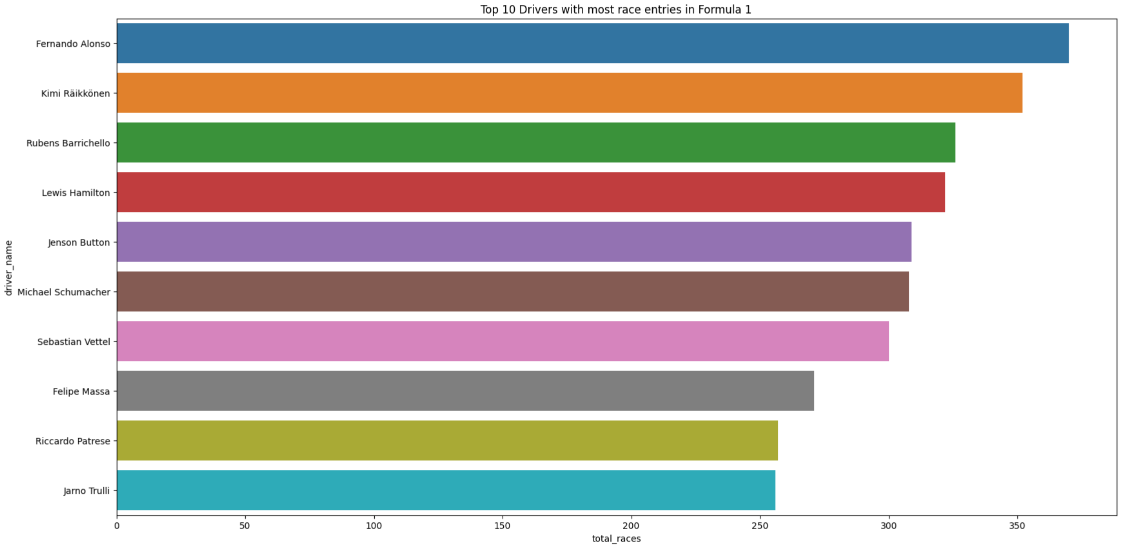
[48]:
```
driver_winner = df.loc[df['positionOrder']==1].
  ↪groupby('driver_name')['positionOrder'].count().sort_values(ascending=False).
  ↪to_frame().reset_index()
top10Drivers =driver_winner.head(10)
sns.
  ↪barplot(data=top10Drivers,y='driver_name',x='positionOrder',color='blue',alpha=0.
  ↪8,linewidth=.8,edgecolor='black')
plt.title('Top 10 Most GP Winners in F1')
plt.ylabel('Driver Name')
plt.xlabel('Number of GP wins')
```

[48]:
```
Text(0.5, 0, 'Number of GP wins')
```



[49]:

```
#En çok yarışan 10 F1 Pilotu
most_races = df.groupby('driver_name')[['raceId']].count().reset_index()
most_races = most_races.sort_values('raceId', ascending= False).head(10)
most_races = most_races.rename(columns ={'raceId': 'total_races'})
plt.figure(figsize = (20,10))
plt.title('Top 10 Drivers with most race entries in Formula 1')
sns.barplot(x = 'total_races' , y = 'driver_name' , data = most_races );
```



[50]:

```
races.value_counts()
counts = races['name'].value_counts()
circuits_pop = pd.DataFrame({'circuitId': counts.index, 'number of times':␣
 ↪counts.values})
circuits_pop
```

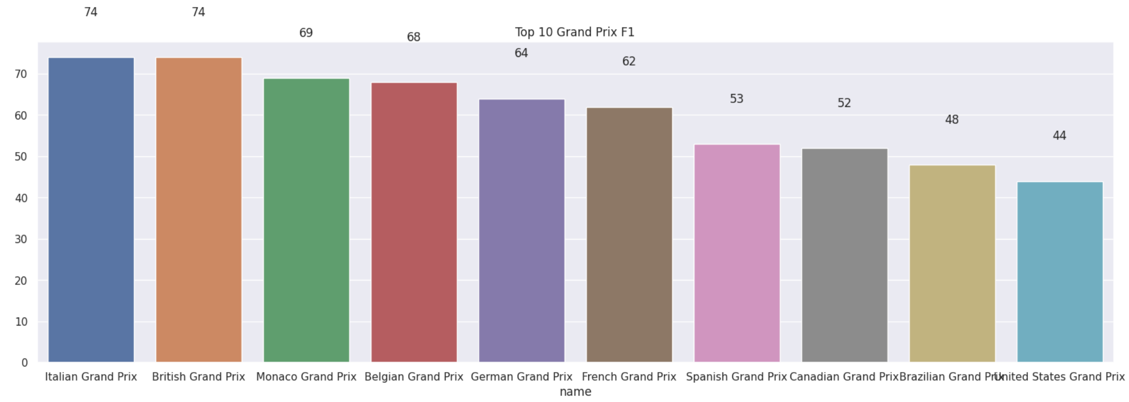
[50]:

```
                        circuitId  number of times
0              Italian Grand Prix               74
1              British Grand Prix               74
2               Monaco Grand Prix               69
3              Belgian Grand Prix               68
4               German Grand Prix               64
5               French Grand Prix               62
6              Spanish Grand Prix               53
7             Canadian Grand Prix               52
8            Brazilian Grand Prix               48
9        United States Grand Prix               44
10           Hungarian Grand Prix               38
11            Japanese Grand Prix               37
12          Australian Grand Prix               37
13            Austrian Grand Prix               36
14               Dutch Grand Prix               33
15          San Marino Grand Prix               26
16            European Grand Prix               23
17       South African Grand Prix               23
18           Argentine Grand Prix               20
19             Mexican Grand Prix               20
20             Bahrain Grand Prix               19
21           Malaysian Grand Prix               19
22          Portuguese Grand Prix               18
23             Chinese Grand Prix               16
24           Abu Dhabi Grand Prix               15
25           Singapore Grand Prix               14
26               Indianapolis 500               11
27             Turkish Grand Prix                9
28             Russian Grand Prix                8
29  United States Grand Prix West                8
30             Detroit Grand Prix                7
31             Swedish Grand Prix                6
32          Azerbaijan Grand Prix                6
33               Swiss Grand Prix                6
34              Korean Grand Prix                4
35       Saudi Arabian Grand Prix                3
36              Indian Grand Prix                3
37         Mexico City Grand Prix                3
```

```
38      Emilia Romagna Grand Prix                3
39      Caesars Palace Grand Prix                2
40                Miami Grand Prix               2
41              Pacific Grand Prix               2
42           Luxembourg Grand Prix               2
43              Styrian Grand Prix               2
44            São Paulo Grand Prix               2
45                Qatar Grand Prix               2
46               Sakhir Grand Prix               1
47             Moroccan Grand Prix               1
48                Eifel Grand Prix               1
49               Tuscan Grand Prix               1
50    70th Anniversary Grand Prix                1
51              Pescara Grand Prix               1
52               Dallas Grand Prix               1
53            Las Vegas Grand Prix               1
```

[51]:

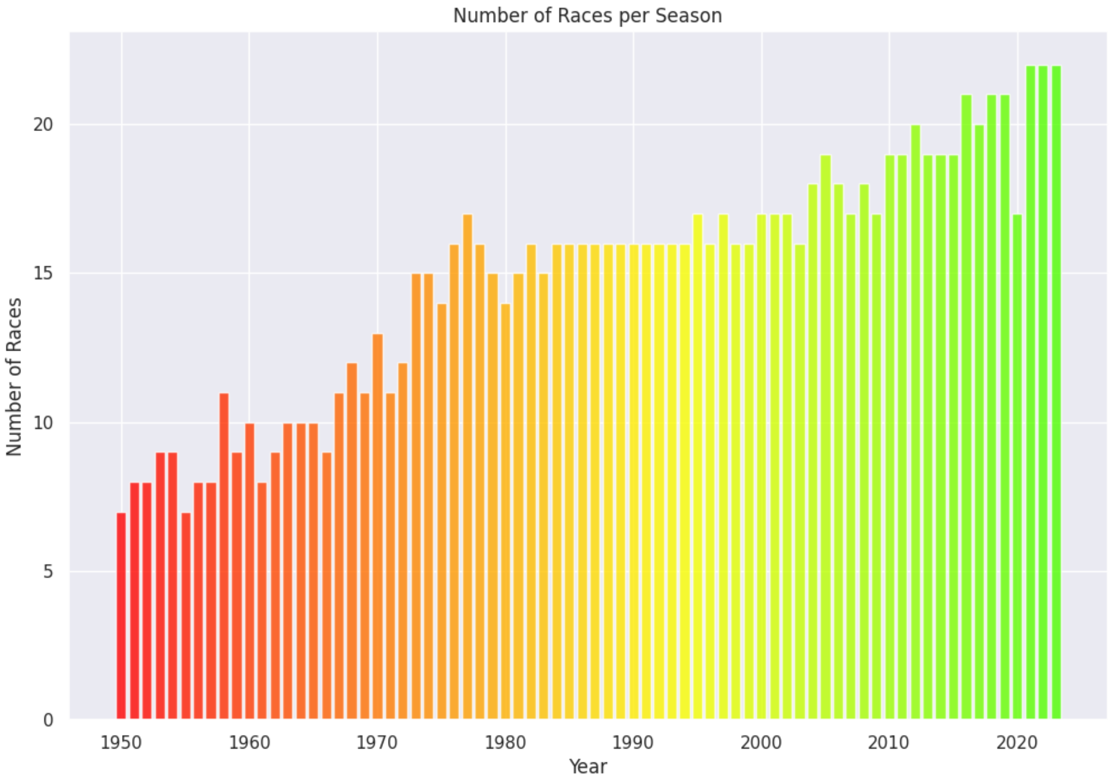
```
top_10_circuits=races['name'].value_counts()[:10]
sns.set(style="darkgrid")
plt.figure(figsize=(20, 6))
ax = sns.barplot(x=top_10_circuits.index, y=top_10_circuits.values)
ax.set_title("Top 10 Grand Prix F1")


for i, v in enumerate(top_10_circuits):
    ax.text(i, v + 10, str(v), ha='center', fontsize=12)


plt.show()
```



[52]:

```
races_per_season = races.groupby('year')['raceId'].nunique()
plt.figure(figsize=(12, 8))
colors = plt.cm.hsv(range(len(races_per_season)))
```

```
plt.bar(races_per_season.index, races_per_season.values, color=colors, alpha=0.
 ↪8)

plt.title('Number of Races per Season')
plt.xlabel('Year')
plt.ylabel('Number of Races')

plt.show()
```



[53]:
```
import folium
coordinates=[]
for lat,lng in zip(circuits['lat'],circuits['lng']):
    coordinates.append([lat,lng])
maps = folium.Map(zoom_start=2,tiles='Stamen Watercolor')
for i,j in zip(coordinates,circuits.name):
    marker = folium.Marker(
        location=i,
        icon=folium.Icon(icon="car",color='cadetblue',prefix='fa'),
        popup="<strong>{0}</strong>".format(j))
    marker.add_to(maps)
maps
```

```
[53]: <folium.folium.Map at 0x7b4232c90cd0>
```

```
[54]: df_ts=df.copy()
      df_ts=pd.DataFrame(df_ts)
```

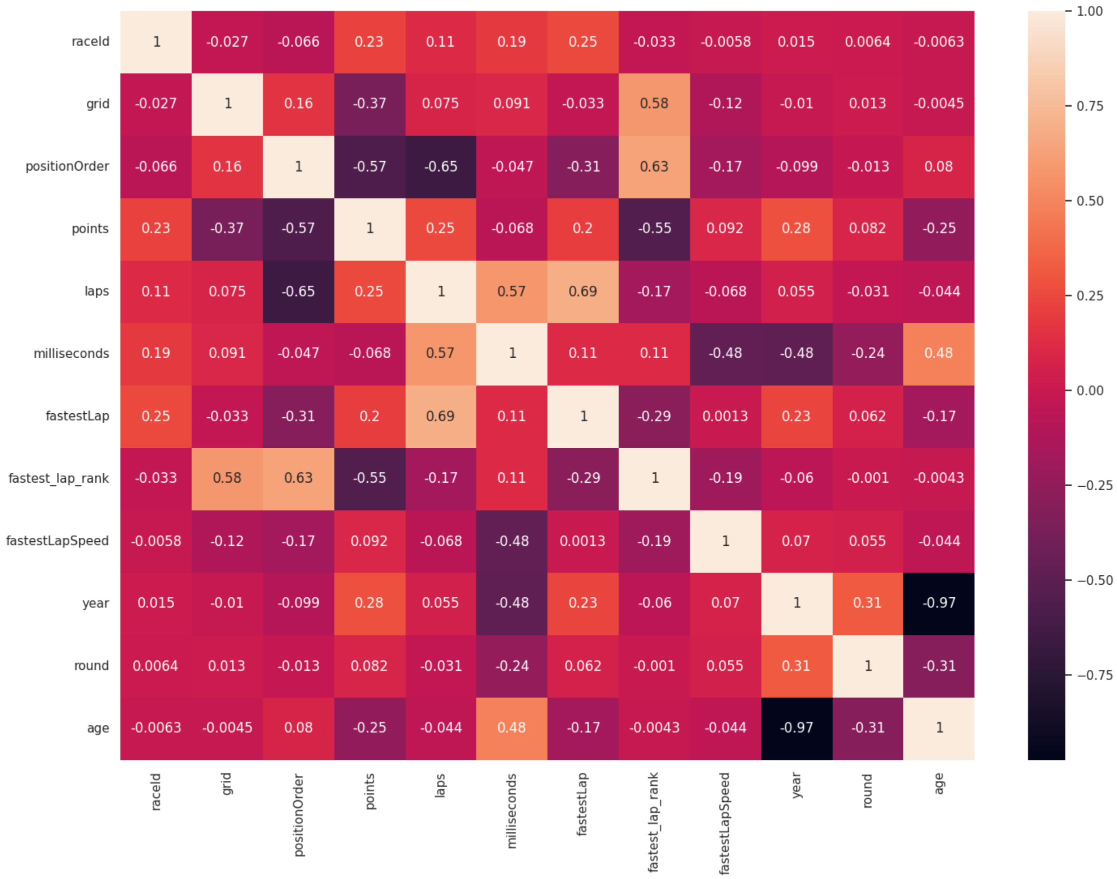
```
[55]: df_ts.drop(columns=['time'], inplace=True)
```

```
[56]: df_ts.drop(columns=['fastestLapTime'],inplace=True)
```

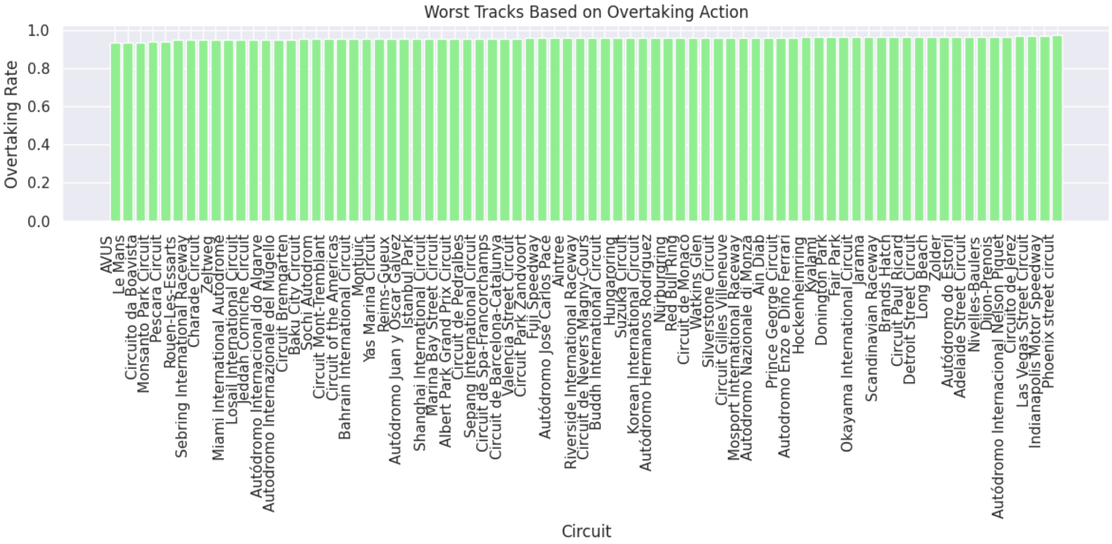
```
[57]: df_ts.columns
```

```
[57]: Index(['raceId', 'grid', 'positionOrder', 'points', 'laps', 'milliseconds',
              'fastestLap', 'fastest_lap_rank', 'fastestLapSpeed', 'year', 'gp_name',
              'round', 'date', 'driver', 'driver_nationality', 'dob',
              'constructor_name', 'constructor_nationality', 'status', 'driver_name',
              'age'],
             dtype='object')
```

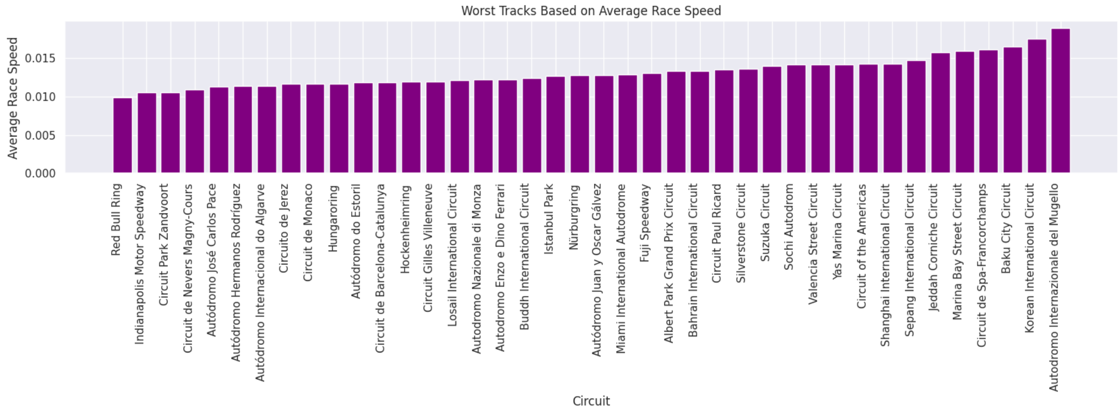
```
[58]: skewness = df_ts.drop(columns=['gp_name', 'constructor_nationality', 'status',␣
        ↪'driver_name', 'driver', 'driver_nationality', 'dob',␣
        ↪'constructor_name','date'])
      plt.figure(figsize=(17, 12))
      sns.heatmap(skewness.corr(), annot=True)
      plt.show()
```



[59]:
```
#Overtaking işlemine göre en kötü pistler
merged_data = pd.merge(races, results, on='raceId')
overtaking_rate = merged_data.groupby('circuitId')['positionOrder'].
  ↪apply(lambda x: (x != 1).sum() / len(x)).reset_index()
overtaking_rate.columns = ['circuitId', 'overtake_rate']
overtaking_rate = pd.merge(overtaking_rate, circuits, on='circuitId')
worst_tracks = overtaking_rate.sort_values(by='overtake_rate', ascending=True)
plt.figure(figsize=(12, 6))
plt.bar(worst_tracks['name'], worst_tracks['overtake_rate'], color='lightgreen')
plt.xlabel('Circuit')
plt.ylabel('Overtaking Rate')
plt.title('Worst Tracks Based on Overtaking Action')
plt.xticks(rotation=90, ha='right')
plt.tight_layout()
plt.show()
```



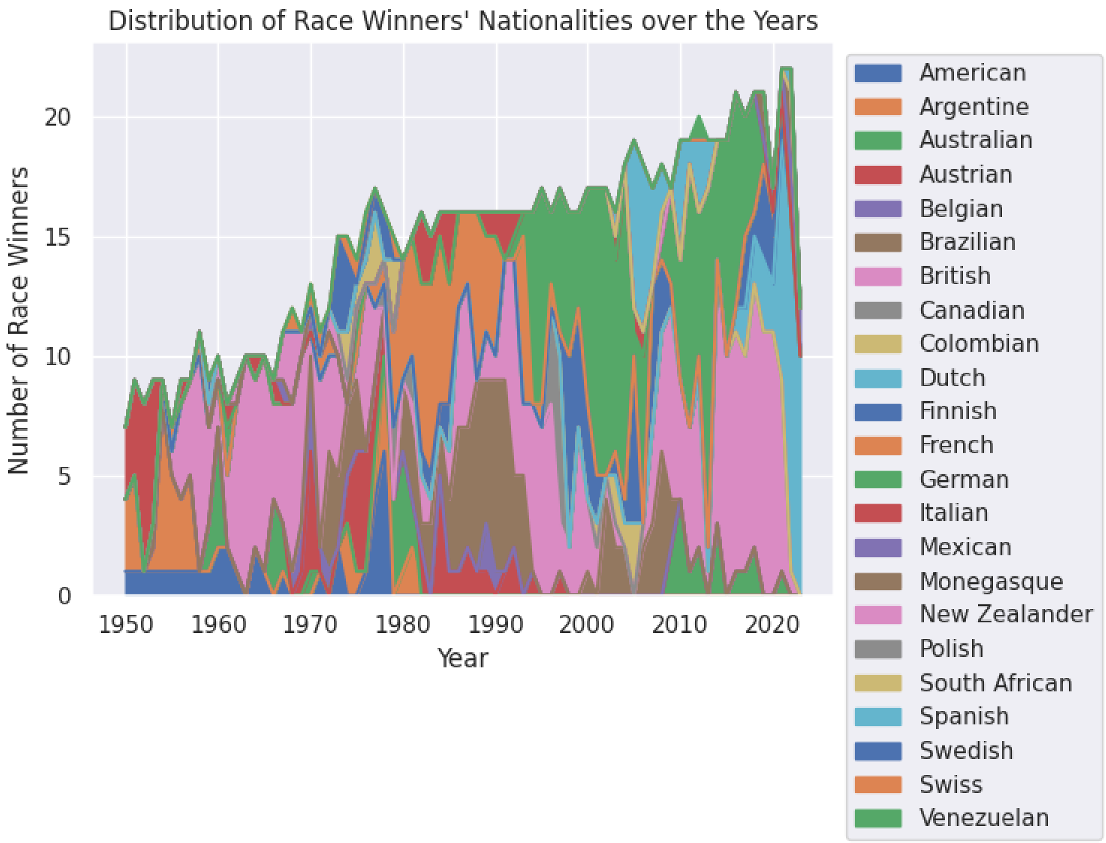
[60]:
```python
#Ortalama Yarış Hızına Göre En Kötü Pistler
merged_data = pd.merge(races, laptimes, on='raceId')
merged_data['average_speed'] = merged_data['milliseconds'] /␣
  ↪merged_data['milliseconds'].max()
average_speed_by_track = merged_data.groupby('circuitId')['average_speed'].
  ↪mean().reset_index()
average_speed_by_track = pd.merge(average_speed_by_track, circuits,␣
  ↪left_on='circuitId', right_on='circuitId')
worst_tracks = average_speed_by_track.sort_values(by='average_speed')
plt.figure(figsize=(16, 6))
plt.bar(worst_tracks['name'], worst_tracks['average_speed'], color='purple')
plt.xlabel('Circuit')
plt.ylabel('Average Race Speed')
plt.title('Worst Tracks Based on Average Race Speed')
plt.xticks(rotation=90, ha='right')
plt.tight_layout()
plt.show()
```



[61]:

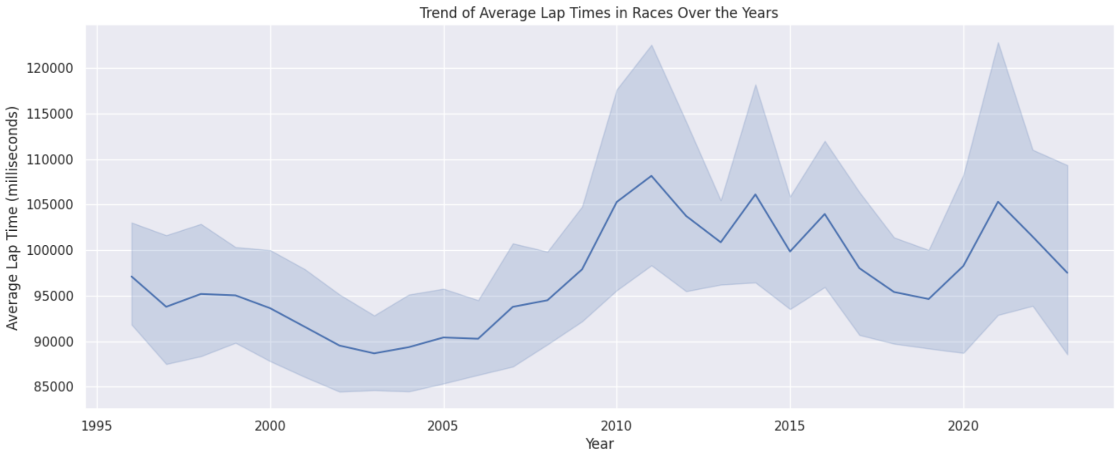
```
#Yarış Galiplerinin Milliyetlerinin Yıllara Göre Dağılımı
merged_data = pd.merge(races, results, on='raceId')
merged_data = pd.merge(merged_data, drivers, on='driverId')
race_winners = merged_data[merged_data['positionOrder'] == 1]
winner_nationalities = race_winners.groupby(['year', 'nationality'])['raceId'].
  ↪count().reset_index()
pivot_data = winner_nationalities.pivot(index='year', columns='nationality',␣
  ↪values='raceId')
pivot_data = pivot_data.fillna(0)
plt.figure(figsize=(16,6))
pivot_data.plot(kind='area', stacked=True)
plt.xlabel('Year')
plt.ylabel('Number of Race Winners')
plt.title('Distribution of Race Winners\' Nationalities over the Years')
plt.legend(loc='upper left', bbox_to_anchor=(1,1))
plt.show()
```

```
<Figure size 1600x600 with 0 Axes>
```



[62]:

```
#Yarışlarda Ortalama Tur Sürelerinin Yıllara Göre Eğilimi
merged_data = pd.merge(races, laptimes, on='raceId')
merged_data = pd.merge(merged_data, drivers, on='driverId')
average_lap_time_by_race = merged_data.groupby(['year',␣
  ↪'raceId'])['milliseconds'].mean().reset_index()
plt.figure(figsize=(16, 6))
sns.lineplot(x='year', y='milliseconds', data=average_lap_time_by_race)
plt.xlabel('Year')
plt.ylabel('Average Lap Time (milliseconds)')
plt.title('Trend of Average Lap Times in Races Over the Years')
plt.show()
```



[63]:

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
```

[64]:

```
df.head()
```

[64]:

```
   raceId  grid  positionOrder  points  laps         time milliseconds  \
0      18     1              1    10.0    58  1:34:50.616      5690616   
1      18     5              2     8.0    58       +5.478      5696094   
2      18     7              3     6.0    58       +8.163      5698779   
3      18    11              4     5.0    58      +17.181      5707797   
4      18     3              5     4.0    58      +18.014      5708630   

  fastestLap fastest_lap_rank fastestLapTime  … round        date  \
0         39                2       1:27.452  …     1 2008-03-16   
1         41                3       1:27.739  …     1 2008-03-16   
2         41                5       1:28.090  …     1 2008-03-16   
3         58                7       1:28.603  …     1 2008-03-16   
4         43                1       1:27.418  …     1 2008-03-16   

       driver  driver_nationality        dob constructor_name  \
0    hamilton             British 1985-01-07          McLaren   
1    heidfeld              German 1977-05-10       BMW Sauber   
2     rosberg              German 1985-06-27         Williams   
3      alonso             Spanish 1981-07-29          Renault   
4  kovalainen             Finnish 1981-10-19          McLaren   

  constructor_nationality    status       driver_name   age
0                 British  Finished    Lewis Hamilton  39.0
1                  German  Finished     Nick Heidfeld  46.0
2                 British  Finished      Nico Rosberg  38.0
3                  French  Finished   Fernando Alonso  42.0
```

```
4                 British  Finished  Heikki Kovalainen  42.0

[5 rows x 23 columns]
```

[65]:

```
df.columns
```

[65]:

```
Index(['raceId', 'grid', 'positionOrder', 'points', 'laps', 'time',
       'milliseconds', 'fastestLap', 'fastest_lap_rank', 'fastestLapTime',
       'fastestLapSpeed', 'year', 'gp_name', 'round', 'date', 'driver',
       'driver_nationality', 'dob', 'constructor_name',
       'constructor_nationality', 'status', 'driver_name', 'age'],
      dtype='object')
```

[66]:

```
df_2022 = df[df['year'] == 2022].copy()

# 'fastestLapTime' sütununu dakika cinsine dönüştürdüm
def convert_lap_time(time_str):
    if isinstance(time_str, str):
        minutes, seconds = map(float, time_str.split(":"))
        return minutes + seconds / 60.0
    else:
        return time_str

df_2022["fastestLapTime"] = df_2022["fastestLapTime"].apply(convert_lap_time)

# 'fastestLapTime' sütunundaki tüm değerleri float tipine dönüştürdüm
df_2022["fastestLapTime"] = pd.to_numeric(df_2022["fastestLapTime"])
```

[67]:

```
# Tahmin için kullanılacak özellikler
X = df_2022[["raceId", "grid", "points", "laps", "fastestLap",␣
 ↪"fastestLapTime"]]

# Sürücü adı
driver_names = df_2022["driver_name"]

# Yanıt etiketi
y = df_2022["positionOrder"]

# Yanıt etiketlerini kodladım
encoder = LabelEncoder()
y = encoder.fit_transform(y)

# Veri kümesini eğitim ve test kümelerine ayırdım
X_train, X_test, y_train, y_test, driver_names_train, driver_names_test =␣
 ↪train_test_split(X, y, driver_names, test_size=0.3, random_state=17)

# Eksik veriler olduğundan dolayı bununla doldurup tahminlerde bulundum
```

```python
imputer = SimpleImputer()

# Verilerdeki NaN değerlerini tahmin ettirdim
imputed_data = imputer.fit_transform(X_train)
imputed_test_data = imputer.transform(X_test)

# Karar ağacı sınıflandırıcı oluşturdum
classifier = DecisionTreeClassifier(max_depth=6)

# Karar ağacı sınıflandırıcıyı eğitilmiş verilerle eğittim
classifier.fit(imputed_data, y_train)

# Karar ağacı sınıflandırıcıyı test verileriyle test ettim
y_pred = classifier.predict(imputed_test_data)

# Tahmin sonuçlarını ve gerçek sonuçları içeren bir DataFrame oluşturdum
results_df = pd.DataFrame({"Tahmin Değeri:": encoder.inverse_transform(y_pred),␣
 ↪"Gerçek Değeri:": encoder.inverse_transform(y_test)})

# Şampiyon adayını buldum
champion_candidates = results_df[results_df["Tahmin Değeri:"] == 1]["Gerçek␣
 ↪Değeri:"]
if not champion_candidates.empty:
    champion_candidate_index = champion_candidates.index[0]  # İlk şampiyon␣
 ↪adayının indeksini aldım
    champion_candidate = driver_names_test.iloc[champion_candidate_index]  #␣
 ↪Sürücü adını indekse göre aldım
    print("Şampiyon Olabilecek Sürücü:", champion_candidate)
else:
    print("Şampiyon Olabilecek Sürücü Bulunamadı")
print(results_df)
```

```
Şampiyon Olabilecek Sürücü: Max Verstappen
     Tahmin Değeri:  Gerçek Değeri:
0                19              17
1                 1               1
2                 1               2
3                 6               6
4                10              10
..              …             …
127              11              19
128              19              14
129              18              11
130              19              16
131               5               5

[132 rows x 2 columns]
```

[ ]:

```
```