Tyre Data Analysis

Goal: analyze all races, lap times (via results/fastest laps), pit stops, and all tyre manufacturers.

Import data and Modules

```
conda install psycopg2
```

```
2 channel Terms of Service accepted
Channels:
 - defaults
Platform: linux-64
Collecting package metadata (repodata.json): done
Solving environment: done


==> WARNING: A newer version of conda exists. <==
    current version: 25.5.1
    latest version: 25.11.0

Please update conda by running

    $ conda update -n base -c defaults conda



# All requested packages already installed.


Note: you may need to restart the kernel to use updated packages.
```

```
from numpy.ma.extras import unique
import matplotlib.pyplot as plt


import pandas as pd
import seaborn as sns

path = 'resources/pickled_tables/'
extension = '.plk'

tire_data_table = "tyre_manufacturer"
tyre_data_file = path + tire_data_table + extension
tire_data = pd.read_pickle(tyre_data_file)

print(f"Loaded data shape: {tire_data.shape}")
tire_data.head()
```

```
Loaded data shape: (9, 13)

            id         name      country_id
best_starting_grid_position  \
0         avon         Avon  united-kingdom
2
1  bridgestone  Bridgestone           japan
1
2  continental  Continental         germany
1
3       dunlop       Dunlop  united-kingdom
1
4    englebert    Englebert         belgium
1

   best_race_result  total_race_entries  total_race_starts
total_race_wins  \
0                 5                  32                 28
0
1                 1                 244                244
175
2                 1                  13                 13
10
3                 1                 177                175
84
4                 1                  60                 60
8

   total_race_laps  total_podiums  total_podium_races
total_pole_positions  \
0             2961              0                   0
0
1           173435            482                 209
168
2             2232             18                  11
8
3            84697            241                 104
77
4            11015             40                  26
11

   total_fastest_laps
0                   0
1                 170
2                   9
3                  83
4                  12

tire_data.head(100)
```

```
            id         name                country_id  \
0         avon         Avon            united-kingdom
1  bridgestone  Bridgestone                     japan
2  continental  Continental                   germany
3       dunlop       Dunlop            united-kingdom
4    englebert    Englebert                   belgium
5    firestone    Firestone  united-states-of-america
6     goodyear     Goodyear  united-states-of-america
7     michelin     Michelin                    france
8      pirelli      Pirelli                     italy

   best_starting_grid_position  best_race_result
total_race_entries  \
0                            2                 5                  32

1                            1                 1                 244

2                            1                 1                  13

3                            1                 1                 177

4                            1                 1                  60

5                            1                 1                 122

6                            1                 1                 493

7                            1                 1                 217

8                            1                 1                 509


   total_race_starts  total_race_wins  total_race_laps  total_podiums
\
0                 28                0             2961              0

1                244              175           173435            482

2                 13               10             2232             18

3                175               84            84697            241

4                 60                8            11015             40

5                122               48            96610            138

6                493              368           376316           1139

7                215              102            99137            317

8                504              348           398748           1053
```

```
   total_podium_races  total_pole_positions  total_fastest_laps
0                   0                     0                   0
1                 209                   168                 170
2                  11                     8                   9
3                 104                    77                  83
4                  26                    11                  12
5                  77                    59                  52
6                 459                   358                 364
7                 179                   111                 108
8                 374                   351                 361
```

Show basic stats

```
print(f"Number of tyre manufacturers: {len(tire_data)}")
```

```
Number of tyre manufacturers: 9
```

Sort by total wins to see the best manufacturers

```
sorted_by_wins = tire_data.sort_values('total_race_wins',
ascending=False)
print("\nTyre Manufacturers sorted by total wins:")
print(sorted_by_wins[['name', 'total_race_wins',
'total_race_entries']].head(10))
```

```
Tyre Manufacturers sorted by total wins:
          name  total_race_wins  total_race_entries
6     Goodyear              368                 493
8      Pirelli              348                 509
1  Bridgestone              175                 244
7     Michelin              102                 217
3       Dunlop               84                 177
5    Firestone               48                 122
2  Continental               10                  13
4    Englebert                8                  60
0         Avon                0                  32
```

Calculate win percentage

```
tire_data['win_percentage'] = (tire_data['total_race_wins'] /
tire_data['total_race_entries'] * 100)
sorted_by_win_percentage = tire_data.sort_values('win_percentage',
ascending=False)
print("\nTyre Manufacturers sorted by win percentage:")
print(sorted_by_win_percentage[['name', 'win_percentage',
'total_race_wins', 'total_race_entries']].head(10))
```

```
Tyre Manufacturers sorted by win percentage:
          name  win_percentage  total_race_wins  total_race_entries
2  Continental       76.923077               10                  13
6     Goodyear       74.645030              368                 493
1  Bridgestone       71.721311              175                 244
8      Pirelli       68.369352              348                 509
3       Dunlop       47.457627               84                 177
7     Michelin       47.004608              102                 217
5    Firestone       39.344262               48                 122
4    Englebert       13.333333                8                  60
0         Avon        0.000000                0                  32
```

Sort by total races

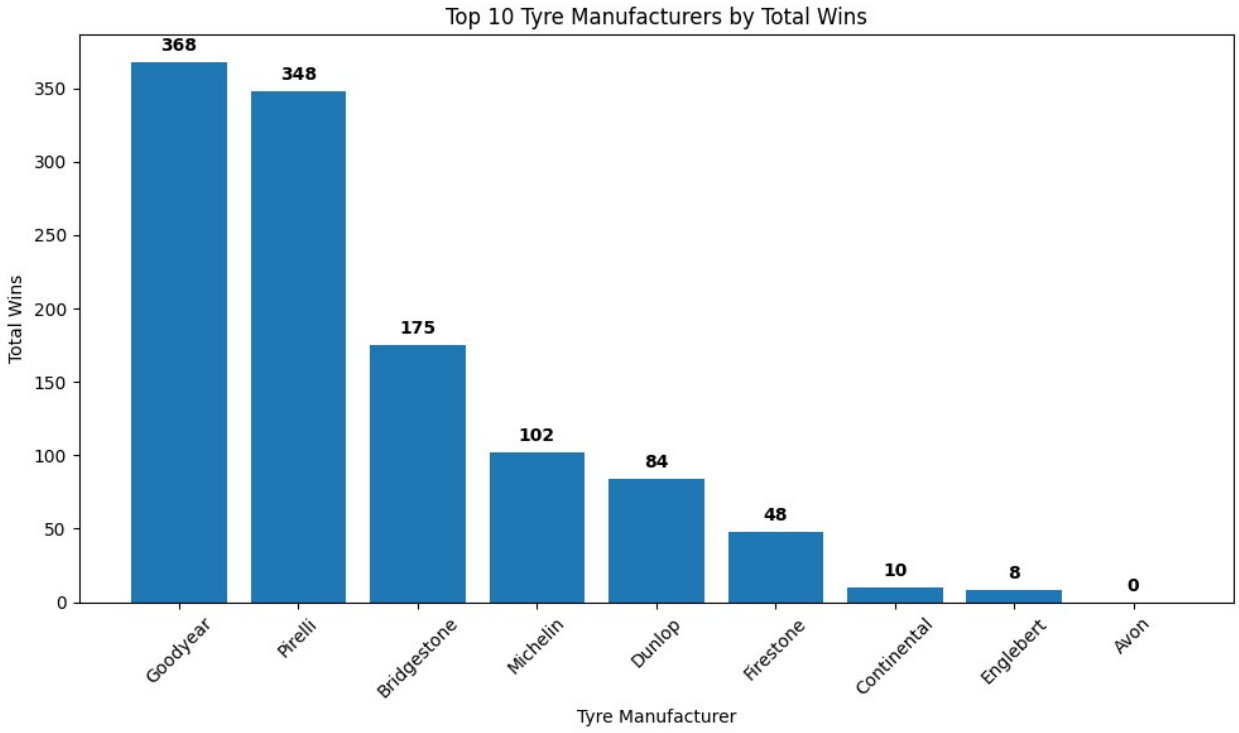
```
sorted_by_races = tire_data.sort_values('total_race_entries',
ascending=False)
print("\nTyre Manufacturers sorted by total race entries:")
print(sorted_by_races[['name', 'total_race_entries',
'total_race_wins']].head(10))
```

```
Tyre Manufacturers sorted by total race entries:
          name  total_race_entries  total_race_wins
8      Pirelli                 509              348
6     Goodyear                 493              368
1  Bridgestone                 244              175
7     Michelin                 217              102
3       Dunlop                 177               84
5    Firestone                 122               48
4    Englebert                  60                8
0         Avon                  32                0
2  Continental                  13               10
```

Simple Visualization 1: Total Wins Comparison

```
# Set figure size (similar to Ch9 plotting examples)
plt.figure(figsize=(10, 6))

# Get top 10 using nlargest() method from Chapter 8 slides
top_10_wins = sorted_by_wins.nlargest(10, 'total_race_wins')

# Create bar plot (similar to Ch8 plotting examples)
bars = plt.bar(top_10_wins['name'], top_10_wins['total_race_wins'])

# Set titles and labels (similar to Ch9 plot customization)
plt.title('Top 10 Tyre Manufacturers by Total Wins')
plt.xlabel('Tyre Manufacturer')
```

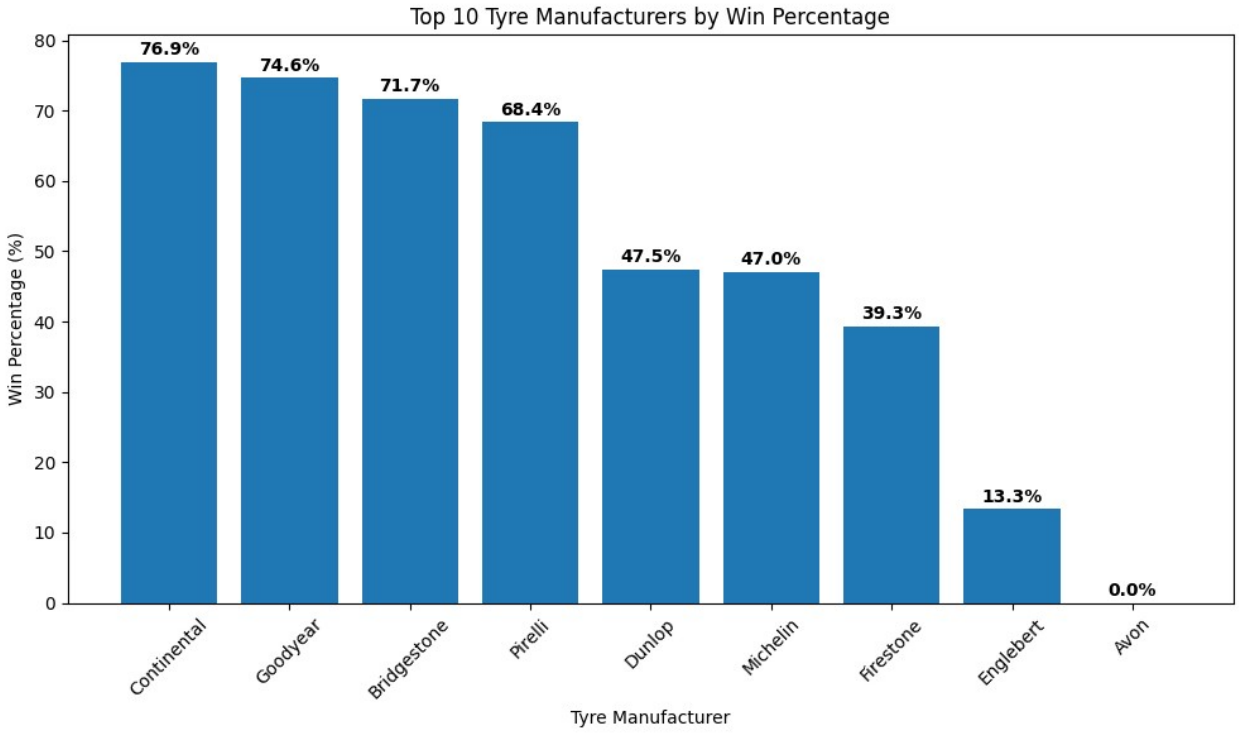
```
plt.ylabel('Total Wins')
plt.xticks(rotation=45)  # Rotate x-axis labels like in Ch9 examples

# Add value labels on bars (enhanced version with formatting)
for bar in bars:
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2., height + 5,
             f'{int(height):,}',  # Format with commas for thousands
             ha='center', va='bottom', fontweight='bold')

# Adjust layout and show (standard pattern from slides)
plt.tight_layout()
plt.show()
```



Simple Visualization 2: Win Percentage

```
# Set figure size (similar to Ch9 plotting examples)
plt.figure(figsize=(10, 6))

# Get top 10 using nlargest() method from Chapter 8 slides
top_10_percentage = sorted_by_win_percentage.nlargest(10,
'win_percentage')

# Create bar plot (similar to Ch8 plotting examples)
bars = plt.bar(top_10_percentage['name'],
```

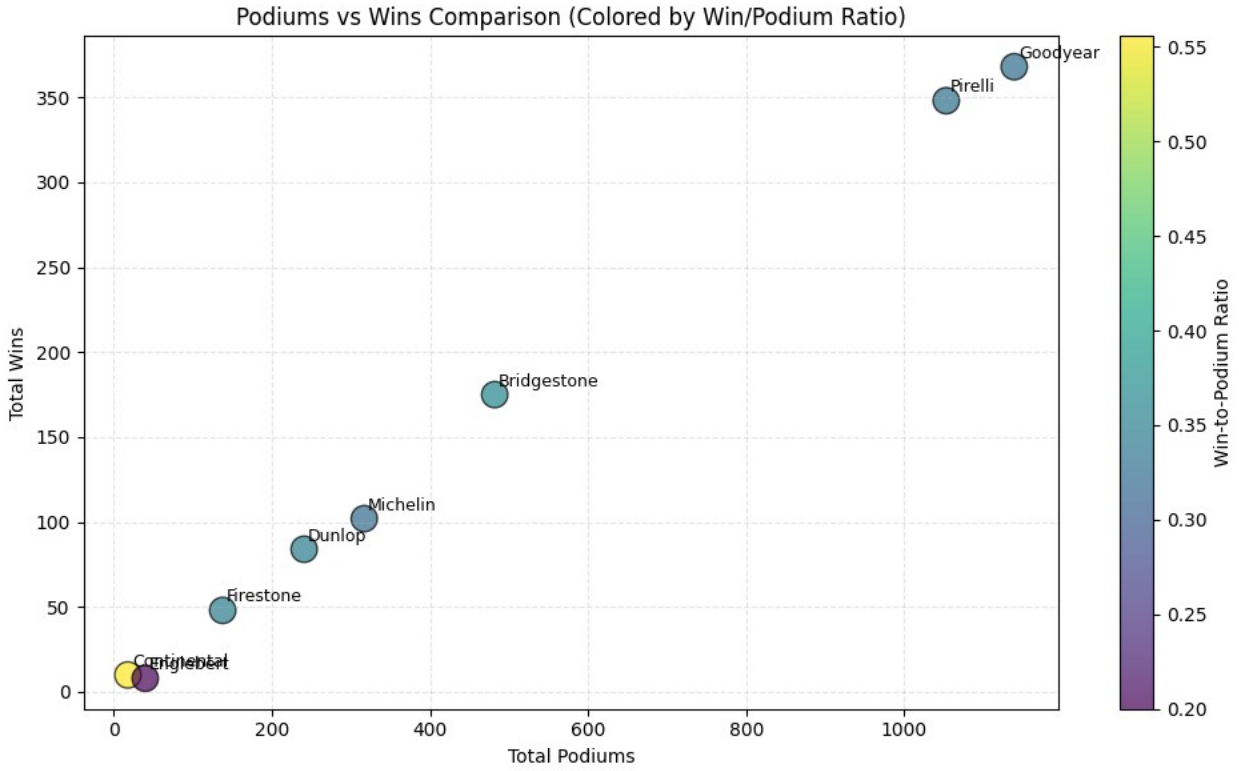
```
top_10_percentage['win_percentage'])

# Set titles and labels (similar to Ch9 plot customization)
plt.title('Top 10 Tyre Manufacturers by Win Percentage')
plt.xlabel('Tyre Manufacturer')
plt.ylabel('Win Percentage (%)')
plt.xticks(rotation=45)  # Rotate x-axis labels like in Ch9 examples

# Add value labels on bars with formatting
for bar in bars:
    height = bar.get_height()
    plt.text(bar.get_x() + bar.get_width()/2., height + 0.5,
             f'{height:.1f}%',  # Format as percentage with 1 decimal
             ha='center', va='bottom', fontweight='bold')

# Adjust layout and show (standard pattern from slides)
plt.tight_layout()
plt.show()
```



Simple Visualization 3: Podiums vs Wins

```
# Get top 8
top_8 = sorted_by_wins.nlargest(8, 'total_race_wins')

# Calculate win-to-podium ratio for coloring
```

```
top_8['win_podium_ratio'] = top_8['total_race_wins'] /
top_8['total_podiums']

# Create scatter plot with color gradient
plt.figure(figsize=(10, 6))
scatter = plt.scatter(top_8['total_podiums'],
top_8['total_race_wins'],
                      s=200, alpha=0.7,
                      c=top_8['win_podium_ratio'],  # Color by ratio
                      cmap='viridis',
                      edgecolors='black', linewidth=1)

# Add colorbar
plt.colorbar(scatter, label='Win-to-Podium Ratio')

# Add labels for each point
for idx, row in top_8.iterrows():
    plt.text(row['total_podiums'] + 5, row['total_race_wins'] + 5,
             row['name'], fontsize=9, fontweight='medium')

# Set titles and labels
plt.title('Podiums vs Wins Comparison (Colored by Win/Podium Ratio)')
plt.xlabel('Total Podiums')
plt.ylabel('Total Wins')
plt.grid(True, alpha=0.3, linestyle='--')

plt.tight_layout()
plt.show()
```




```python
# Calculate some summary statistics
print("=== Summary Statistics ===")
print(f"Average wins per manufacturer:
{tire_data['total_race_wins'].mean():.1f}")
print(f"Average race entries per manufacturer:
{tire_data['total_race_entries'].mean():.1f}")
print(f"Total wins across all manufacturers:
{tire_data['total_race_wins'].sum()}")
print(f"Total race entries across all manufacturers:
{tire_data['total_race_entries'].sum()}")

# Show manufacturers with perfect or near-perfect records
print("\n=== Manufacturers with High Win Rates ===")
high_win_rate = tire_data[tire_data['win_percentage'] > 50]
print(high_win_rate[['name', 'win_percentage', 'total_race_wins',
'total_race_entries']].sort_values('win_percentage', ascending=False))
```

```
=== Summary Statistics ===
Average wins per manufacturer: 127.0
Average race entries per manufacturer: 207.4
Total wins across all manufacturers: 1143
Total race entries across all manufacturers: 1867

=== Manufacturers with High Win Rates ===
          name  win_percentage  total_race_wins  total_race_entries
2  Continental       76.923077               10                  13
```

```
6     Goodyear       74.645030              368                493
1  Bridgestone       71.721311              175                244
8      Pirelli       68.369352              348                509
```