Documentation for F1 Lap Time Analysis Program

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Overview

This program processes lap time data for Formula 1 drivers and outputs detailed performance metrics. It reads the drivers details from a file , processes a multiple lap times files and computes metrics such as the best , average and over all fastest lap.

Features

1. Driver Information: It reads the drivers details from a CSV file.

2. Lap Time Data: Analyzes multiple lap time files and calculates the best lap time , average lap time and overall lap time per drivers and per time respectively.

3. Output: the output is detailed within the formatted table of driver performances, highlighting the overall fastest lap.

4. Error handling: logs and skips the invalid data, and handles the missing files and invalid input as well.

Requirements:

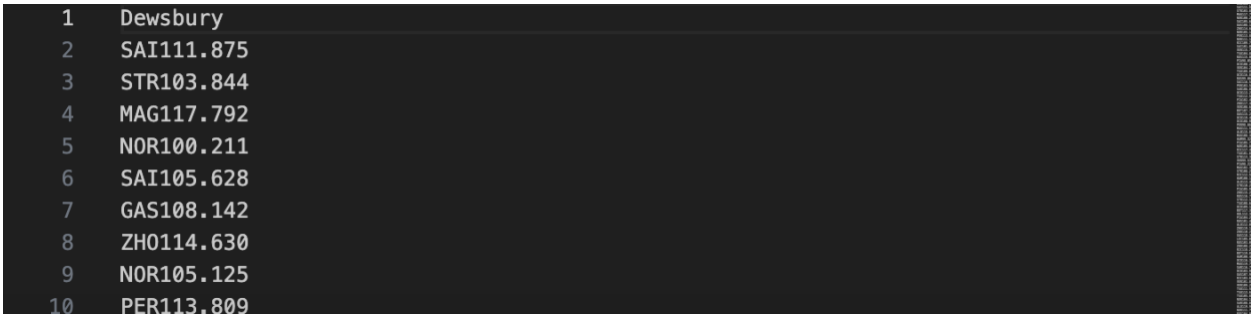
CSV file containing driver details in the format (drivers_file)

drivers.csv > data

```
1,VER,Max Verstappen,Red Bull Racing
2,SAR,Logan Sargeant,Williams
3,RIC,Daniel Ricciad,RB
4,NOR,Lando Norris,McLaren
10,GAS,Pierre Gasly,Alpine
11,PER,Sergio Perez,Red Bull Racing$#
14,ALO,Fernando Alonso,Aston Martin Racing
16,LEC,Charles Leclerc,Ferrari
18,STR,Lance Stroll,Aston Martin Racing
20,MAG,Kevin Magnussen,Haas
22,TSU,Yuki Tsunoda,RB
23,ALB,Alex Albon,Williams
24,ZHO,Zhou Guanyu,Kick Sauber
27,HUL,Niko Hulkenberg,Haas
31,OCO,Esteban Ocon,Alpine
44,HAM,Lewis Hamilton,Mercedes
55,SAI,Carlos Sainz,Ferrari
63,RUS,George Russell,Mercedes
77,BOT,Valtteri Bottas,Kick Sauber
81,PIA,Oscar Piastri,McLaren
```

Lap time files (lap_time_file)

Example:



Running the program:

1. To run the program the following command is used :

   python f1_lap_analysis.py drivers.csv lap_time_1.txt lap_time_2.txt lap_time_3.txt

   (for individual lap time the command will be*" python f1_lap_analysis.py drivers.csv lap_time_1.txt"* and so on for other two)

The structure of the program :

Functions:

load_drivers (file_name)

- Purpose: Reads the drivers file and loads data into a dictionary.
- Parameters: file_name (str) - Path to the drivers file.
- Returns: Dictionary with driver codes as keys and details (ID, Name, Team) as values.
- Error Handling: Prints an error if the file is not found or another issue occurs.

process_lap_times (file_names, drivers)

- Purpose: Processes lap time files, calculates metrics, and displays the results.

- Parameters:
    - file_names (list): List of lap time file paths.
    - drivers (dict): Dictionary of driver data loaded by load_drivers.

- Functionality:

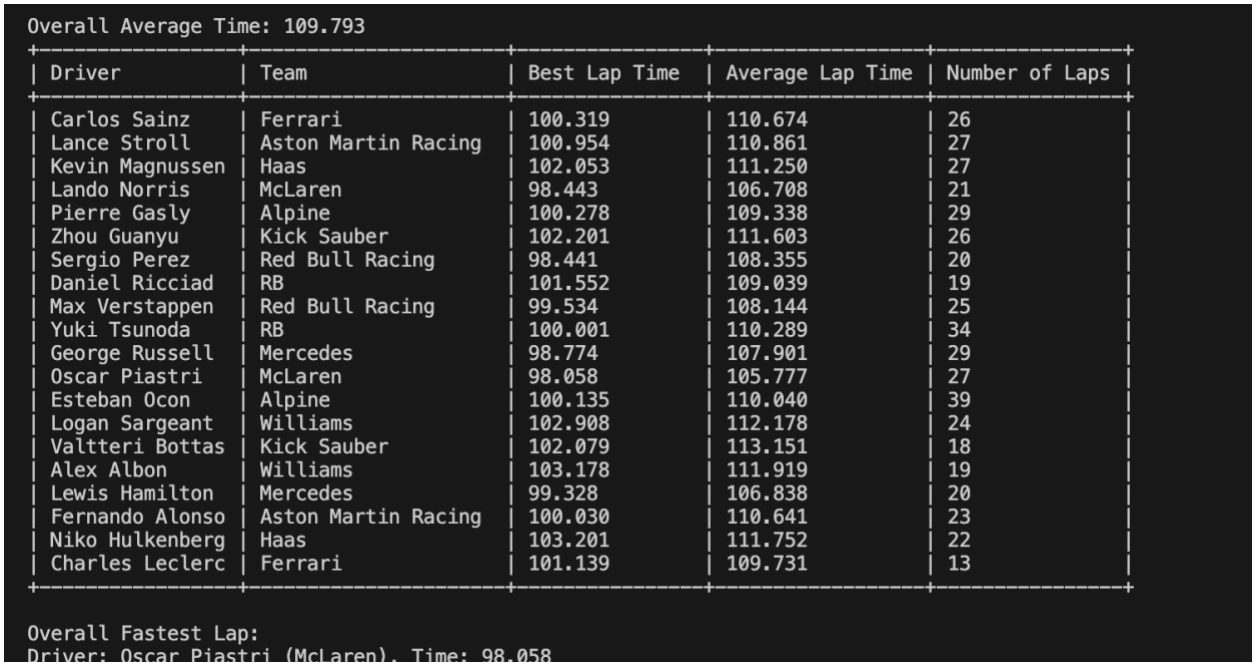
    - Reads lap time files and extracts lap data.
    - Calculates best and average lap times for each driver.
    - Computes the overall average lap time.
    - Identifies the fastest lap across all drivers.
    - Outputs a formatted table and the fastest lap details.

- Error Handling:
    - Logs and skips invalid lines or lap times.
    - Handles missing files gracefully.

Main Script:

- Parses command-line arguments for the drivers file and lap time files.
- Calls load_drivers to load driver data.
- Calls process_lap_times to process the lap time data and display results.
- Validates that sufficient arguments are provided.

Output example:



```
Overall Average Time: 109.793
+------------------+----------------------+---------------+------------------+----------------+
| Driver           | Team                 | Best Lap Time | Average Lap Time | Number of Laps |
+------------------+----------------------+---------------+------------------+----------------+
| Carlos Sainz     | Ferrari              | 100.319       | 110.674          | 26             |
| Lance Stroll     | Aston Martin Racing  | 100.954       | 110.861          | 27             |
| Kevin Magnussen  | Haas                 | 102.053       | 111.250          | 27             |
| Lando Norris     | McLaren              | 98.443        | 106.708          | 21             |
| Pierre Gasly     | Alpine               | 100.278       | 109.338          | 29             |
| Zhou Guanyu      | Kick Sauber          | 102.201       | 111.603          | 26             |
| Sergio Perez     | Red Bull Racing      | 98.441        | 108.355          | 20             |
| Daniel Ricciad   | RB                   | 101.552       | 109.039          | 19             |
| Max Verstappen   | Red Bull Racing      | 99.534        | 108.144          | 25             |
| Yuki Tsunoda     | RB                   | 100.001       | 110.289          | 34             |
| George Russell   | Mercedes             | 98.774        | 107.901          | 29             |
| Oscar Piastri    | McLaren              | 98.058        | 105.777          | 27             |
| Esteban Ocon     | Alpine               | 100.135       | 110.040          | 39             |
| Logan Sargeant   | Williams             | 102.908       | 112.178          | 24             |
| Valtteri Bottas  | Kick Sauber          | 102.079       | 113.151          | 18             |
| Alex Albon       | Williams             | 103.178       | 111.919          | 19             |
| Lewis Hamilton   | Mercedes             | 99.328        | 106.838          | 20             |
| Fernando Alonso  | Aston Martin Racing  | 100.030       | 110.641          | 23             |
| Niko Hulkenberg  | Haas                 | 103.201       | 111.752          | 22             |
| Charles Leclerc  | Ferrari              | 101.139       | 109.731          | 13             |
+------------------+----------------------+---------------+------------------+----------------+

Overall Fastest Lap:
Driver: Oscar Piastri (McLaren), Time: 98.058
```

Conclusion

This program provides an efficient way to analyze F1 driver lap times. With its detailed output and robust error handling, it is a valuable tool for race performance analysis.