COURSEWORK (PART ABCDE)

SOFTWARE DEVELOPMENT

- **Module Name**: Software Development
- **Module Leader**: Prof. Guhanathan Poravi
- **Level/ Year**: Level 4/ First Year/ Sem 1
- **Name**: Sunath Sandul Jayalath
- **Student ID**: 20240646
- **UOW ID**: w2120070
- **Assignment due date**: 24th of December 2024

CLASSES & FUNCTIONS

Classes

1. Histogram

- Purpose: Creates a histogram visualization for vehicle frequency per hour.
- Key Methods:
  - __init__(self, traffic_data, date): Initializes the histogram application with traffic data and date.
  - setup_window(self): Sets up the Tkinter window and canvas for the histogram.
  - draw_histogram(self): Draws histogram bars for two junctions.
  - add_legend(self): Adds a legend and title to the histogram.
  - run(self): Starts the Tkinter main loop to display the histogram.

2. MultiCSVProcessor

- Purpose: Manages the processing of multiple CSV files.
- Key Methods:
  - __init__(self): Initializes the processor for handling CSV files.
  - load_csv_file(self, file_path): Loads and processes a CSV file, then visualizes its data.
  - clear_previous_data(self): Clears data from the previous run.
  - handle_user_interaction(self): Handles user input for loading multiple datasets.
  - process_files(self): Main loop for processing multiple files until the user quits.

Functions

Input Validation

1. validate_date_input():
   - Prompts the user to input a date in DD MM YYYY format.
   - Validates the input for data type, range, and file existence.

2. file_exists(file_name):
   - Checks if a given file exists in the directory.

3. validate_continue_input():
   - Prompts the user to decide whether to load another dataset.
   - Validates 'Y' or 'N' inputs and returns True or False.

Data Processing

4. process_csv_data(file_path):
   Processes the CSV data for the selected date and extracts metrics such as:
   - Total vehicles
   - Trucks
   - Electric vehicles
   - Two-wheeled vehicles
   - Rain hours, peak traffic, and more.

5. display_outcomes(vehicle_counts, formatted_peak_hours, max_traffic):
   - Displays calculated metrics in a clear and formatted way.

6. save_results_to_file(vehicle_counts, formatted_peak_hours, file_name, max_traffic):
   - Saves processed results into a text file named results.txt.

PSEUDOCODE

```
#TaskA

#TaskB

#TaskC

#TaskD

#TaskE


BEGIN


  FUNCTION validate_date_input()
    WHILE True DO
      TRY
        PROMPT user for day, month, year
        CONVERT inputs to integers


        IF day is not in range 1 to 31 THEN
          PRINT error message for day
          CONTINUE


        IF month is not in range 1 to 12 THEN
          PRINT error message for month
          CONTINUE


        IF year is not in range 2000 to 2024 THEN
          PRINT error message for year
```

```
            CONTINUE

        FORMAT date string as DDMMYYYY
        SET file_name to "traffic_data" + date_str + ".csv"

        IF file_exists(file_name) THEN
          RETURN file_name
        ELSE
          PRINT file not found message
          CONTINUE

      EXCEPT ValueError
        PRINT invalid input message
        CONTINUE
  END WHILE
END FUNCTION

FUNCTION file_exists(file_name)
  TRY
    OPEN file_name for reading
    RETURN True
  EXCEPT FileNotFoundError
    RETURN False
  END TRY
END FUNCTION
```

```
FUNCTION validate_continue_input()
  WHILE True DO
    PROMPT user for input (Y/N)
    IF input is 'Y' THEN
      RETURN True
    ELSE IF input is 'N' THEN
      RETURN False
    ELSE
      PRINT invalid input message
    END IF
  END WHILE
END FUNCTION

FUNCTION process_csv_data(file_path)
  INITIALIZE vehicle_counts dictionary with metrics
  INITIALIZE hanley_highway_counts and bike_hour_counts dictionaries

  TRY
    OPEN file_path for reading
    READ lines from file

    SET header to first line of the file

    FOR each line in lines DO
      SPLIT line into row data
      CREATE data dictionary from header and row
```

```
            INCREMENT vehicle_counts based on data conditions
            COUNT vehicles by type, speed, and junction

        CALCULATE percentages and averages
        FIND peak traffic hours

        RETURN vehicle_counts, formatted_peak_hours, max_traffic
    EXCEPT FileNotFoundError
        PRINT file not found message
        RETURN None, None
    END TRY
END FUNCTION

FUNCTION display_outcomes(vehicle_counts, formatted_peak_hours, max_traffic)
    PRINT formatted outcomes based on vehicle_counts
END FUNCTION

FUNCTION save_results_to_file(vehicle_counts, formatted_peak_hours, file_name,
max_traffic)
    TRY
        OPEN "results.txt" for appending
        WRITE formatted results to file
        PRINT results saved message
    EXCEPT Exception as e
        PRINT error message
```

```
    END TRY
END FUNCTION

CLASS HistogramApp
    FUNCTION __init__(traffic_data, date)
        INITIALIZE attributes
        CREATE main window
        CALL setup_window
        CALL draw_histogram
        CALL add_legend
    END FUNCTION

    FUNCTION setup_window()
        INITIALIZE canvas dimensions
        CREATE canvas
    END FUNCTION

    FUNCTION draw_histogram()
        CALCULATE max_value for scaling
        FOR each hour from 0 to 23 DO
            DRAW bars for Elm Avenue and Hanley Highway
            ADD hour labels
    END FUNCTION

    FUNCTION add_legend()
        CREATE legend for histogram
```

```
    ADD title to histogram
  END FUNCTION

  FUNCTION run()
    START Tkinter main loop
  END FUNCTION
END CLASS

CLASS MultiCSVProcessor
  FUNCTION __init__()
    INITIALIZE current_data
  END FUNCTION

  FUNCTION load_csv_file(file_path)
    PRINT loading file message
    CALL process_csv_data
    IF data is valid THEN
      CALL display_outcomes
      CALL save_results_to_file
      COLLECT hourly data for histogram
      CREATE HistogramApp instance and run it
    END IF
  END FUNCTION

  FUNCTION clear_previous_data()
    CLEAR current_data
```

```
        PRINT cleared data message
    END FUNCTION

    FUNCTION handle_user_interaction()
      WHILE True DO
        CALL validate_date_input
        CALL clear_previous_data
        CALL load_csv_file with file_name

        IF user does not want to continue THEN
          PRINT exit message
          BREAK
      END WHILE
    END FUNCTION

    FUNCTION process_files()
      PRINT welcome message
      CALL handle_user_interaction
    END FUNCTION
  END CLASS

  IF __name__ == "__main__" THEN
    CREATE MultiCSVProcessor instance
    CALL process_files
  END IF
END
```

TEST PLAN

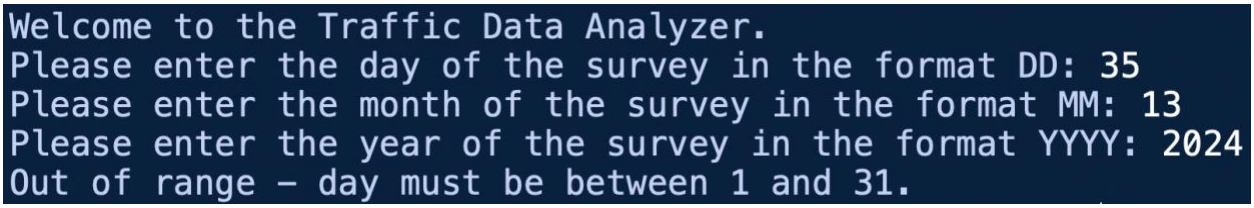
1. Test cases for input validations (validate_date_input)

Test case id	Input	Expected output	Actual output	Description	Status
1	Day = 35	Out of range, should be in 1-31	Out of range, should be in 1 and 31	Testing if user input can get as a day (1-31)	pass
2	Day: 31 Month: 06 Year: 2024	Out of range - month must be between 1 and 12.	Out of range - month must be between 1 and 12.	Testing if the month	pass
3	Date: 17 Month: 06 Year:2024	Error: File 'traffic_data17062024.csv' not found	Error: File 'traffic_data17062024.csv' not found	If the related csv file in the folder	pass
4	Day: 21 Month: April Year: 2024	Invalid input. Please enter integers for day, month, and year.	Invalid input. Please enter integers for day, month, and year.	Testing if user input is integer	pass

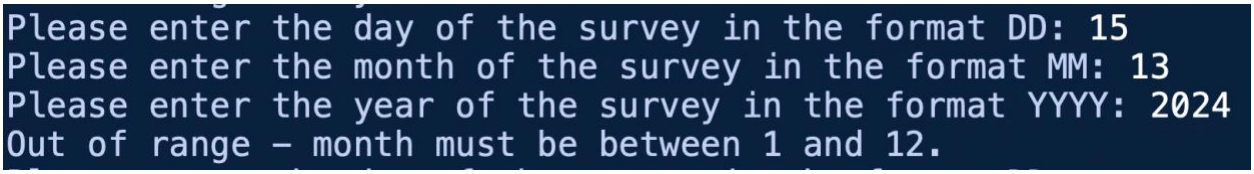
2. Continue input validation (validate_ continue_ input)

Test Case ID	Input	Expected output	Actual output	Description	Status
1	Y	You choose to load other data set	You choose to load other data set	Testing if user need to add another dataset	pass
2	N	You choose to quit other data set	You choose to quit other data set	Testing if user need to quit	pass
3	L	Invalid input. Please enter 'Y' or 'N'.	Invalid input. Please enter 'Y' or 'N'.	Testing if user doesn't input "y" or "n"	pass

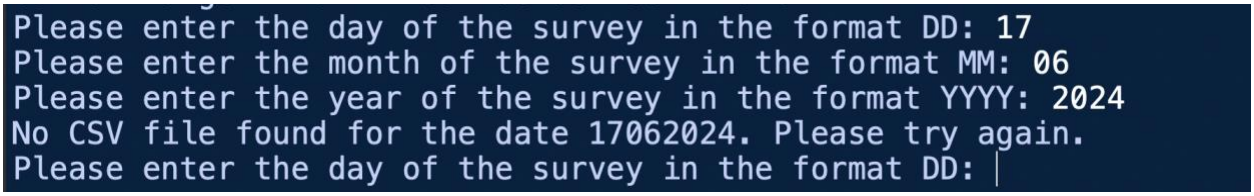
1.1	Day = 35	Out of range, should be in 1-31	Out of range, should be in 1-31	Testing if user input can get as a day(1-31)	pass



1.2	Day: 15 Month: 06 Year: 2024	There are only 30 days in this month	There are only 30 days in this month	Testing if the month has only 30 days	Pass



1.3	Date: 17 Month: 06 Year:2024	Error: File 'traffic_data17062024.csv' not found	Error: File 'traffic_data17062024.csv' not found	If the related csv file in the folder	pass



1.4	Day: 21 Month: April Year: 2024	Invalid input. Please enter integers for day, month, and year.	Invalid input. Please enter integers for day, month, and year.	Testing if user input is integer	pass

```
Please enter the day of the survey in the format DD: 21
Please enter the month of the survey in the format MM: April
Invalid input. Please enter integers for day, month, and year.
Please enter the day of the survey in the format DD:
```

2.1	Y	You choose to load other data set	You choose to load other data set	Testing if user need to add another dataset	pass

```
The total number of vehicles recorded for this date is 101
The total number of trucks recorded for this date is 11
The total number of electric vehicles for this date is 29
The total number of two-wheeled vehicles for this date is 29
The total number of buses leaving Elm Avenue/Rabbit Road heading North is 0
The total number of vehicles through both junctions not turning left or right is 38
The percentage of vehicles recorded that are trucks for this date is 11%
Average number of bikes per hour this date is 1
The total number of vehicles recorded as over the speed limit for this date is 20
The total number of vehicles recorded through Elm Avenue/Rabbit Road junction is 52
The total number of vehicles recorded through Hanley Highway: 49
6% of vehicles recorded through Elm Avenue/Rabbit Road are scooters
The highest number of vehicles in an hour on Hanley Highway/Westway is: 5
Total number of rain hours: 9
The most vehicles through on Hanley Highway/Westway were recorded between 01:00 and 2:00
Results saved to results.txt
Do you want to load another dataset? (Y/N): Y
Please enter the day of the survey in the format DD:
```

2.2	N	You choose to quit other data set	You choose to quit other data set	Testing if user need to quit	pass

```
The total number of vehicles recorded for this date is 1334
The total number of trucks recorded for this date is 138
The total number of electric vehicles for this date is 442
The total number of two-wheeled vehicles for this date is 503
The total number of buses leaving Elm Avenue/Rabbit Road heading North is 0
The total number of vehicles through both junctions not turning left or right is 494
The percentage of vehicles recorded that are trucks for this date is 10%
Average number of bikes per hour this date is 20
The total number of vehicles recorded as over the speed limit for this date is 250
The total number of vehicles recorded through Elm Avenue/Rabbit Road junction is 651
The total number of vehicles recorded through Hanley Highway: 683
10% of vehicles recorded through Elm Avenue/Rabbit Road are scooters
The highest number of vehicles in an hour on Hanley Highway/Westway is: 71
Total number of rain hours: 389
The most vehicles through on Hanley Highway/Westway were recorded between 18:00 and 19:00
Results saved to results.txt
Do you want to load another dataset? (Y/N): N
Exiting program. Thank you!
```

2.3	L	Invalid input. Please enter 'Y' or 'N'.	Invalid input. Please enter 'Y' or 'N'.	Testing if user doesn’t input “y” or “n”	pass

```
The total number of vehicles recorded for this date is 101
The total number of trucks recorded for this date is 11
The total number of electric vehicles for this date is 29
The total number of two-wheeled vehicles for this date is 29
The total number of buses leaving Elm Avenue/Rabbit Road heading North is 0
The total number of vehicles through both junctions not turning left or right is 38
The percentage of vehicles recorded that are trucks for this date is 11%
Average number of bikes per hour this date is 1
The total number of vehicles recorded as over the speed limit for this date is 20
The total number of vehicles recorded through Elm Avenue/Rabbit Road junction is 52
The total number of vehicles recorded through Hanley Highway: 49
6% of vehicles recorded through Elm Avenue/Rabbit Road are scooters
The highest number of vehicles in an hour on Hanley Highway/Westway is: 5
Total number of rain hours: 9
The most vehicles through on Hanley Highway/Westway were recorded between 01:00 and 2:00
Results saved to results.txt
Do you want to load another dataset? (Y/N): L
Invalid input. Please enter 'Y' or 'N'.
Do you want to load another dataset? (Y/N):
```

TEXT FILE RESULTS

results.txt — Edited

```
Data file selected is traffic_data16062024.csv
The total number of vehicles recorded for this date is 101
The total number of trucks recorded for this date is 11
The total number of electric vehicles for this date is 29
The total number of two-wheeled vehicles for this date is 29
The total number of buses leaving Elm Avenue/Rabbit Road heading North is 0
The total number of vehicles through both junctions not turning left or right is 38
The percentage of vehicles recorded that are trucks for this date is 11%
Average number of bikes per hour this date is 1
The total number of vehicles recorded as over the speed limit for this date is 20
The total number of vehicles recorded through Elm Avenue/Rabbit Road junction is 52
The total number of vehicles recorded through Hanley Highway: 49
6% of vehicles recorded through Elm Avenue/Rabbit Road are scooters
The highest number of vehicles in an hour on Hanley Highway/Westway is: 5
Total number of rain hours: 9
The most vehicles through on Hanley Highway/Westway were recorded between 01:00 and 2:00

*********************************************
```

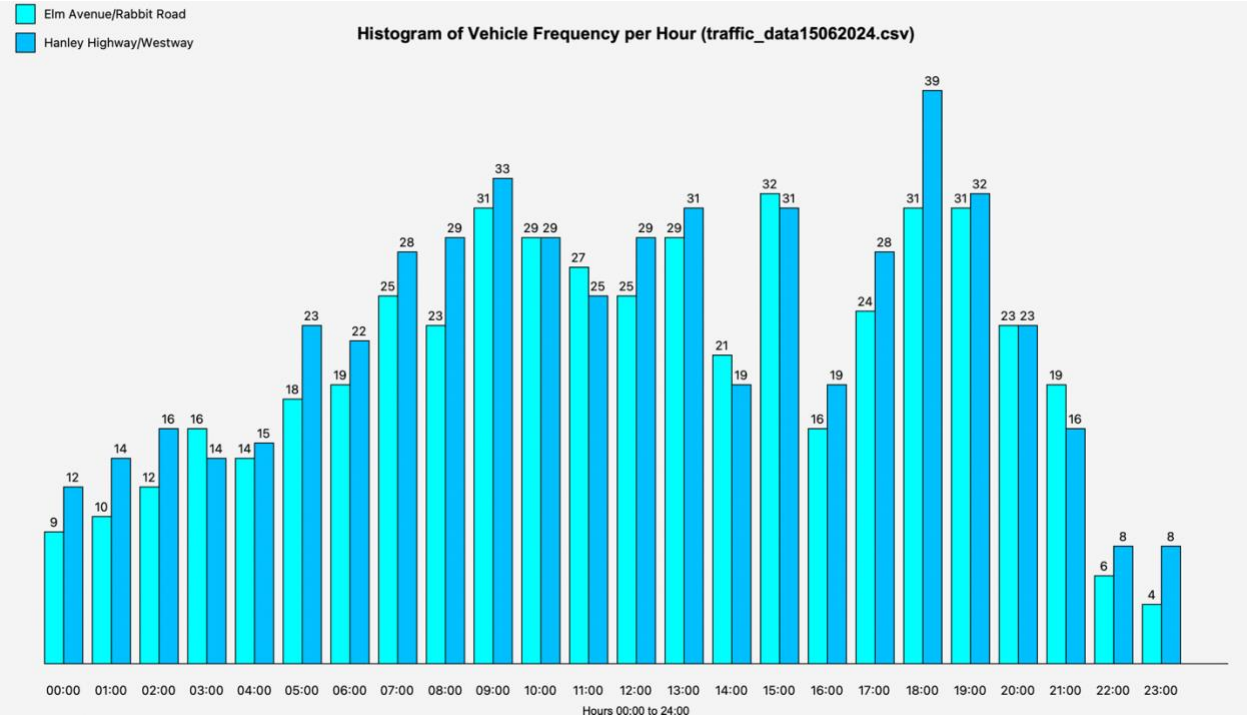
results.txt — Edited

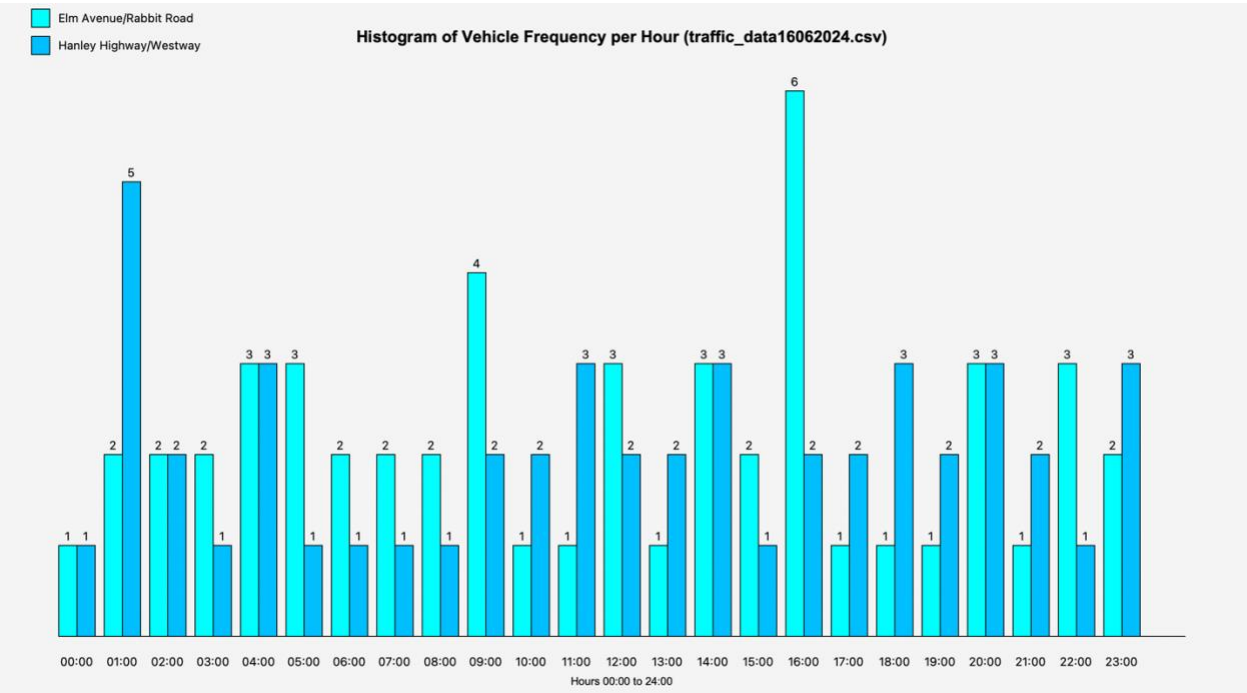
```
6% of vehicles recorded through Elm Avenue/Rabbit Road are scooters
The highest number of vehicles in an hour on Hanley Highway/Westway is: 5
Total number of rain hours: 9
The most vehicles through on Hanley Highway/Westway were recorded between 01:00 and 2:00

*********************************************

Data file selected is traffic_data21062024.csv
The total number of vehicles recorded for this date is 1334
The total number of trucks recorded for this date is 138
The total number of electric vehicles for this date is 442
The total number of two-wheeled vehicles for this date is 503
The total number of buses leaving Elm Avenue/Rabbit Road heading North is 0
The total number of vehicles through both junctions not turning left or right is 494
The percentage of vehicles recorded that are trucks for this date is 10%
Average number of bikes per hour this date is 20
The total number of vehicles recorded as over the speed limit for this date is 250
The total number of vehicles recorded through Elm Avenue/Rabbit Road junction is 651
The total number of vehicles recorded through Hanley Highway: 683
10% of vehicles recorded through Elm Avenue/Rabbit Road are scooters
The highest number of vehicles in an hour on Hanley Highway/Westway is: 71
Total number of rain hours: 389
The most vehicles through on Hanley Highway/Westway were recorded between 18:00 and 19:00

*********************************************
```

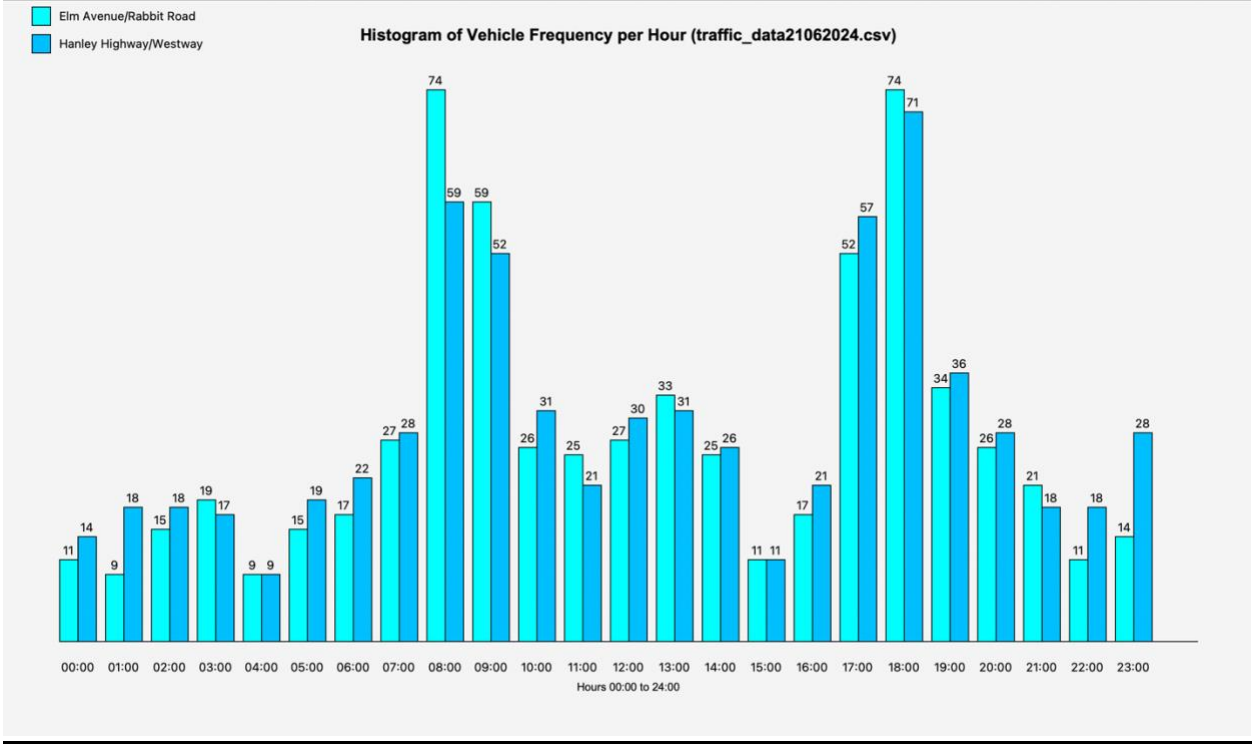
results.txt — Edited

```
Data file selected is traffic_data16062024.csv
The total number of vehicles recorded for this date is 101
The total number of trucks recorded for this date is 11
The total number of electric vehicles for this date is 29
The total number of two-wheeled vehicles for this date is 29
The total number of buses leaving Elm Avenue/Rabbit Road heading North is 0
The total number of vehicles through both junctions not turning left or right is 38
The percentage of vehicles recorded that are trucks for this date is 11%
Average number of bikes per hour this date is 1
The total number of vehicles recorded as over the speed limit for this date is 20
The total number of vehicles recorded through Elm Avenue/Rabbit Road junction is 52
The total number of vehicles recorded through Hanley Highway: 49
6% of vehicles recorded through Elm Avenue/Rabbit Road are scooters
The highest number of vehicles in an hour on Hanley Highway/Westway is: 5
Total number of rain hours: 9
The most vehicles through on Hanley Highway/Westway were recorded between 01:00 and 2:00
```

HISTOGRAM RESULTS






Elm Avenue/Rabbit Road
Hanley Highway/Westway
Histogram of Vehicle Frequency per Hour (traffic_data21062024.csv)
11 14
9 18
15 18
19 17
9 9
15 19
17 22
27 28
74 59
59 52
26 31
25 21
27 30
33 31
25 26
11 11
17 21
52 57
74 71
34 36
26 28
21 18
11 18
14 28
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
Hours 00:00 to 24:00

REFERENCE:

- ChatGPT
- Python Tutorial
- https://www.youtube.com/watch?v=rfscVS0vtbw