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Task A. Input Validation: Pseudocode

Start

Function validate_dates()

WHILE True

TRY

Get user input for day in DD format

Convert day into integer

IF day < 1 or day > 31 THEN

Display “Out of range - values must be in the range 1 to 31.”

Continue the loop

Get user input for month in MM format

Convert month into integer

IF month < 1 or month > 12 THEN

Display “Out of range-values must be in the range 1 to 12.”

Continue the loop

Get user input for year in YYYY format

Convert year into integer

IF year < 2000 or year > 2024 THEN

Display “Out of range-values must be in the range 2000 to 2024.”

Continue the loop

IF month is January, March, May, July, August, October, or December

Set month days to 31

ELSE IF month is April, June, September, or November

Set month days to 30

ELSE IF month is February:

IF year is divisible by 4 and (not divisible by 100 or divisible by 400)

```

        Set month days to 29
    ELSE:
        Set month days to 28

Determine month days based on month
IF day > month days THEN
    PRINT "invalid day: In {year}, month {month} has only {month_days} days"
    Continue the loop
    Return formatted date as "DDMMYYYY"
Except ValueError
    Display "Integer required."

Function validate_continue_input()
WHILE True
    Get user input for choice as ("Do you want to select another data file for a different date?
(Y/N):")
    IF choice is Y or y or N or n THEN
        Return choice
    Display "Please enter 'Y' or 'N'."

```

Task B. Outcomes: Pseudocode

```

Function process_csv_data(file_path)
TRY
    Open file path in read mode as file
    Initialize reader as a csv reader for file
    Skip the header row by next(reader)
    Initialize totals and counts

```

Set total vehicle to 0
Set total trucks to 0
Set total electric vehicles to 0
Set total two wheeled vehicles to 0
Set total busses heading north to 0
Set total vehicles not turning to 0
Set total bicycles to 0
Set total vehicles over speed to 0
Set total elm avenue vehicles to 0
Set total hanley highway vehicles to 0
Set elm avenue scooters to 0
Set hours of rain to 0
Set hourly data as an empty dictionary
Set peak hours as an empty list
Set rainy hours as an empty list
Set bicycle hours as an empty list

Set data found to False

For each row in file

IF row is not empty

Set data found to True

Extract junction name, date, time of day, hour, travel direction in, travel direction out,
weather condition, junction speed limit, vehicle speed, vehicle type, electric hybrid

Increment total vehicles

IF vehicle type is Truck THEN Increment total trucks

IF electric hybrid is true THEN Increment total electric vehicles

IF vehicle type is Bicycle, Motorcycle, or Scooter THEN Increment total two wheeled vehicles

IF junction name is Elm Avenue and travel direction out is N and vehicle type is Buss THEN Increment total busses heading north

IF travel direction in equals travel direction out THEN Increment total vehicles not turning

IF vehicle speed > junction speed limit THEN Increment total vehicles over speed

IF vehicle type is Scooter and junction name is Elm Avenue THEN Increment elm avenue scooters

IF junction name is Elm Avenue THEN Increment total Elm avenue vehicles

IF junction name is Hanley Highway THEN Increment total Hanley highway vehicles

IF vehicle type is Bicycle THEN Increment total bicycles

IF vehicle type is Bicycle AND hour not in bicycle hours THEN Add hour to bicycle hours

IF weather condition is Light Rain or Heavy Rain THEN Add hour to rainy hours if not already present

IF junction name is Hanley Highway THEN Update hourly data for the hour

IF data found is false

Display ("No vehicles recorded for this date")

Return empty list

Calculate rainy hours

Calculate trucks percentage

Calculate average bicycles per hour

Calculate scooter percentage of Elm Avenue

Calculate peak hour vehicle total in Hanley Highway

Determine peak traffic hours for Hanley Highway

Construct results into a list of formatted strings

Return results

Except FileNotFoundError

Display "error '{file_path}' not found"

Return empty list

Function display_outcomes(outcomes)

For each outcome in outcomes DO

Display outcome

Task C. Save Results as a Text File: Pseudocode

Function save_results_to_file(outcomes, file_name="results.txt")

Open file name in append mode

For each outcome in outcomes DO

Write outcome to file

Function process_histogram_data(file_path)

Initialize histogram data as dictionary

Elm Avenue/Rabbit Road: Dictionary with keys 00 to 23 all set to 0

Hanely Highway/Westway: Dictionary with keys 00 to 23 all set to 0

TRY

Open file at file_path for reading as fie

Create csv.reader(file) to read fie

Call next(reader) (skip the header line)

For each row in reader

IF row is not empty THEN

Set junction to row[0]

Set time to row[2]

Set hour to formatted hour from time (HH format)

IF junction in histogram data THEN

Increment histogram data[junction][hour] by 1

Return histogram data

Except Exception

Print “Error processing histogram data”

Return None

Task D. Histogram Display

Class HistogramApp

Function __init__(self,traffic_data,date)

Set self.traffic_data to traffic_data

Set self.date to date

Create tkinter window as self.root

Set self.canvas to None

Function setup_window

Set window title to “Histogram”

Create canvas with width 1000,height 600,background color light gray

Pack canvas

Function draw_histogram

Set canvas dimensions and parameters for drawing the histogram

Define colors as a dictionary

Add title to canvas

Define start_x, start_y, end_x, end_y

Draw x-axis and add labels for hour

Add x-axis title on canvas

Calculate the maximum value for scaling

Draw bars for each location at each hour using traffic_data

Add labels above each bar showing the value

Function add_legend

- Create legend for the two locations

- Draw colored rectangle for each location

- Add location name next to rectangle

- Increment legend_y

Function run(self)

- Call setup_window()

- Call draw_histogram()

- Call add_legend()

- Start tkinter main loop

Task E. Handle multiple CSV files

Class MultiCSVProcessor

Function __init__(self)

- Set self.current_data to None

Function load_csv_file(self, file_path)

- TRY

- Set self.current_data to process_csv_data(file_path)

- Return True

- EXCEPT Exception as e

- Print "Error processing file: " + e

- Return False

Function clear_previous_data(self)

- Set self.current_data to None

Function handle_user_interaction(self)

- Set date input to validate_dates()

```

    Set filename to "traffic data +date input+ .csv"
    IF self.load_csv_file(file_name_)
        Call display_outcomes(self.current_data)
        Call save_results_to_file(self.current_data)

    Set histogram_data to process_histogram_data(file_name)
    IF histogram_data is not None THEN
        Set formatted_date to format date for display
        Create HistogramApp with histogram_data
        Call app.run()

    Return validate_continue_input
Function process_files(self)
    WHILE True
        Call clear_previous_data()
        Set choice to handle_user_interaction()

        IF choice is "N" THEN
            Print "Exiting Program."
            Break
        Print "Loading another dataset"

Function main()
    Create MultiCSVProcessor as processor
    Call processor.process_files()

IF __name__ == "__main__"
    Call main()

```

Test cases

Task A. Input Validation: Test Cases

Test case	Input	Expected output	Result
Valid date	Date - 15, Month - 06, Year - 2024	Program should run without errors	Pass
Invalid date	Date 40	Display “out of range” and ask the date again	Pass
Invalid month	Month 20	Display “out of range” and ask the month again	Pass
Invalid year	Year 1990	Display “out of range” and ask the year again	Pass
Non integer value	Date s	Display “Integer required”	Pass
Leap year validation	Date - 29, month- 2, year - 2023	Display “Invalid day: In 2023 , month 2 has only 28 days” and ask for the date again	pass

Table 1-Task A - Input Validation: Test Cases

```
===== RESTART: C:\Users\sapoo\Downloads\pro cw\2.py =====
Please enter the day of the survey in the format DD: 15
Please enter the month of the survey in the format MM: 06
Please enter the year of the survey in the format YYYY: 2024
*****
data file selected is traffic_data15062024.csv
*****
The total number of vehicles recorded for this date is 1037
The total number of trucks recorded for this date is 109
The total number of electric vehicles for this date is 368
The total number of two-wheeled vehicles for this date is 401
The total number of Busses leaving Elm Avenue/Rabbit Road heading north is 15
The total number of vehicles through both junctions not turning left or right is 363
The percentage of total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for this date is 7
The total number of vehicles recorded as over the speed limit for this date is 205
The total number of vehicles recorded through Elm avenue/Rabbit Road junction is date is 494
The total number of vehicles recorded through Hanley Highway/Westway junction is 543
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 11%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 39
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 0
Do you want to select another data file for a different date? (Y/N):
```

Figure 1- valid date

```
Please enter the day of the survey in the format DD: 40
Out of range - values must be in the range 1 to 31.
Please enter the day of the survey in the format DD: |
```

Figure 2-Invalid date

```
Please enter the day of the survey in the format DD: 12
Please enter the month of the survey in the format MM: 20
Out of range -values must be in range 1 to 12.
Please enter the day of the survey in the format DD: |
```

Figure 3-Invalid month

```
Please enter the day of the survey in the format DD: 12
Please enter the month of the survey in the format MM: 05
Please enter the year of the survey in the format YYYY: 1990
Out of range-values must be in range 2000 to 2024.
Please enter the day of the survey in the format DD: |
```

Figure 4-Invalid month

```
Please enter the day of the survey in the format DD: s
Integer required.
Please enter the day of the survey in the format DD:
```

Figure 5-Non integer value

```
Please enter the day of the survey in the format DD: 29
Please enter the month of the survey in the format MM: 02
Please enter the year of the survey in the format YYYY: 2023
Invalid day: In 2023 , month 2 has only 28 days
Please enter the day of the survey in the format DD:
```

Figure 6-Leap year validation

Task B. Outcomes: Test Cases

Test case	input	Expected output	Result
Valid inputs 15 th	Date-15,month-06,year-2024	Processed the csv file, correct calculations for all required metrics and display the outcome	pass
Valid inputs 16 th	Date-16,month-06,year-2024	Processed the csv file, correct calculations for all required metrics and display the outcome	Pass
Valid inputs 21 th	Date-21,month-06,year-2024	Processed the csv file, correct calculations for all required metrics and display the outcome	pass

Table 2- Task B- Outcomes: Test Cases

```

Please enter the day of the survey in the format DD: 15
Please enter the month of the survey in the format MM: 06
Please enter the year of the survey in the format YYYY: 2024
*****
data file selected is traffic_data15062024.csv
*****
The total number of vehicles recorded for this date is 1037
The total number of trucks recorded for this date is 109
The total number of electric vehicles for this date is 368
The total number of two-wheeled vehicles for this date is 401
The total number of Busses leaving Elm Avenue/Rabbit Road heading north is 15
The total number of vehicles through both junctions not turning left or right is 363
The percentage of total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for this date is 7
The total number of vehicles recorded as over the speed limit for this date is 205
The total number of vehicles recorded through Elm avenue/Rabbit Road junction is date is 494
The total number of vehicles recorded through Hanley Highway/Westway junction is 543
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 11%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 39
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 0
Do you want to select another data file for a different date? (Y/N): |

```

Figure 7-Valid inputs 15th

```

Please enter the day of the survey in the format DD: 16
Please enter the month of the survey in the format MM: 06
Please enter the year of the survey in the format YYYY: 2024
*****
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 Busses 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 total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for 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 date is 52
The total number of vehicles recorded through Hanley Highway/Westway junction is 49
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 6%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 5
The most vehicles through Hanley/Westway were recorded between 1:00 and 2:00
The number of hours of rain for this date is 3
Do you want to select another data file for a different date? (Y/N): |

```

Figure 8-Valid inputs 16th

```

Please enter the day of the survey in the format DD: 21
Please enter the month of the survey in the format MM: 06
Please enter the year of the survey in the format YYYY: 2024
*****
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 Busses leaving Elm Avenue/Rabbit Road heading north is 19
The total number of vehicles through both junctions not turning left or right is 494
The percentage of total vehicles recorded that are trucks for this date is 10%

The average number of Bikes per hour for this date is 10
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 date is 651
The total number of vehicles recorded through Hanley Highway/Westway junction is 683
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 10%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 71
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 6
Do you want to select another data file for a different date? (Y/N): |

```

Figure 9-Valid inputs 21st

Task C. Save Results as a Text File: Test Cases

Test case	input	Expected output	Result
Save results to a text file 15 th	Date-15, month-06, year-2024	Program runs and creating a text file - "results.txt" with results	Pass
Save results to a text file 16 th	Date-16, month-06, year-2024	Program runs and creating a text file - "results.txt" with results	Pass
Save results to a text file 21 st	Date-21, month-06, year-2024	Program runs and creating a text file - "results.txt" with results	Pass
Multiple runs (appending results)	Date-15, month-06, year-2024 and Date-16, month-06, year-2024	"results.txt" contains results from both runs	Pass

Table 3 - Task C -Save Results: Test Cases

```

results.txt
File Edit View

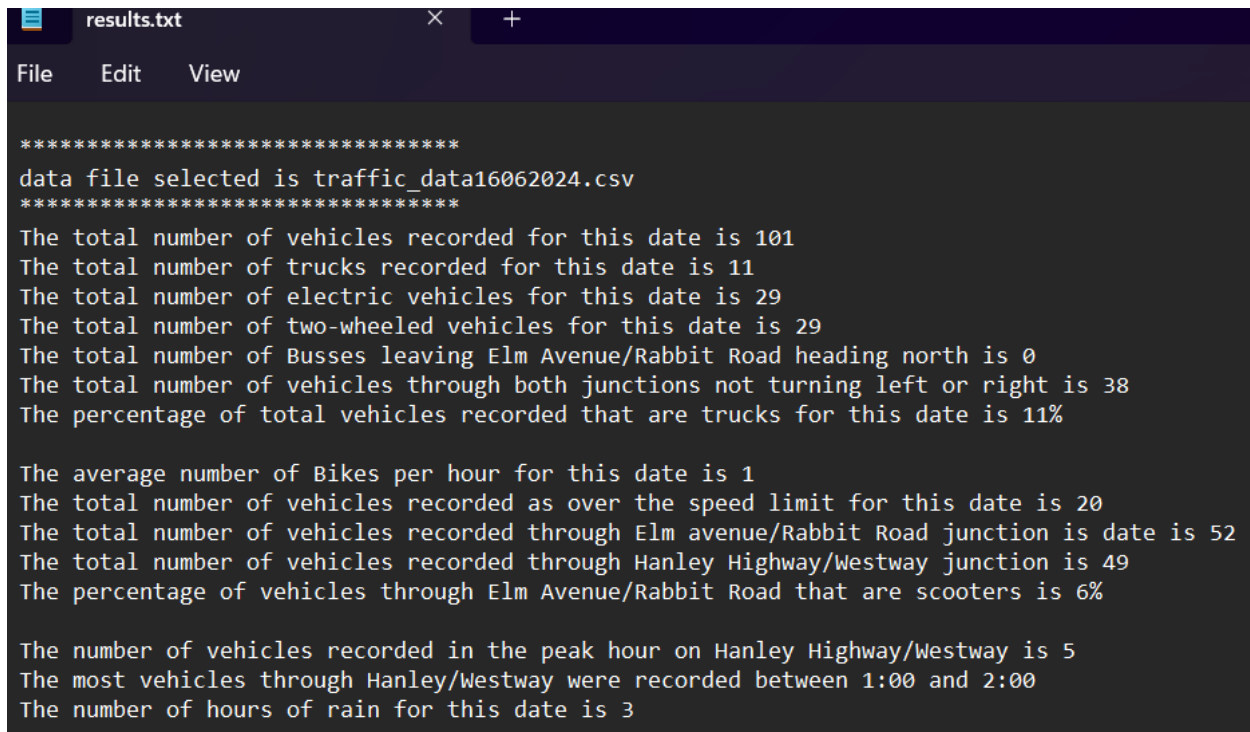
*****
data file selected is traffic_data15062024.csv
*****
The total number of vehicles recorded for this date is 1037
The total number of trucks recorded for this date is 109
The total number of electric vehicles for this date is 368
The total number of two-wheeled vehicles for this date is 401
The total number of Busses leaving Elm Avenue/Rabbit Road heading north is 15
The total number of vehicles through both junctions not turning left or right is 363
The percentage of total vehicles recorded that are trucks for this date is 11%

*****
The average number of Bikes per hour for this date is 7
The total number of vehicles recorded as over the speed limit for this date is 205
The total number of vehicles recorded through Elm avenue/Rabbit Road junction is date is 494
The total number of vehicles recorded through Hanley Highway/Westway junction is 543
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 11%

*****
The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 39
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 0

```

Figure 10-Save results to a text file 15th



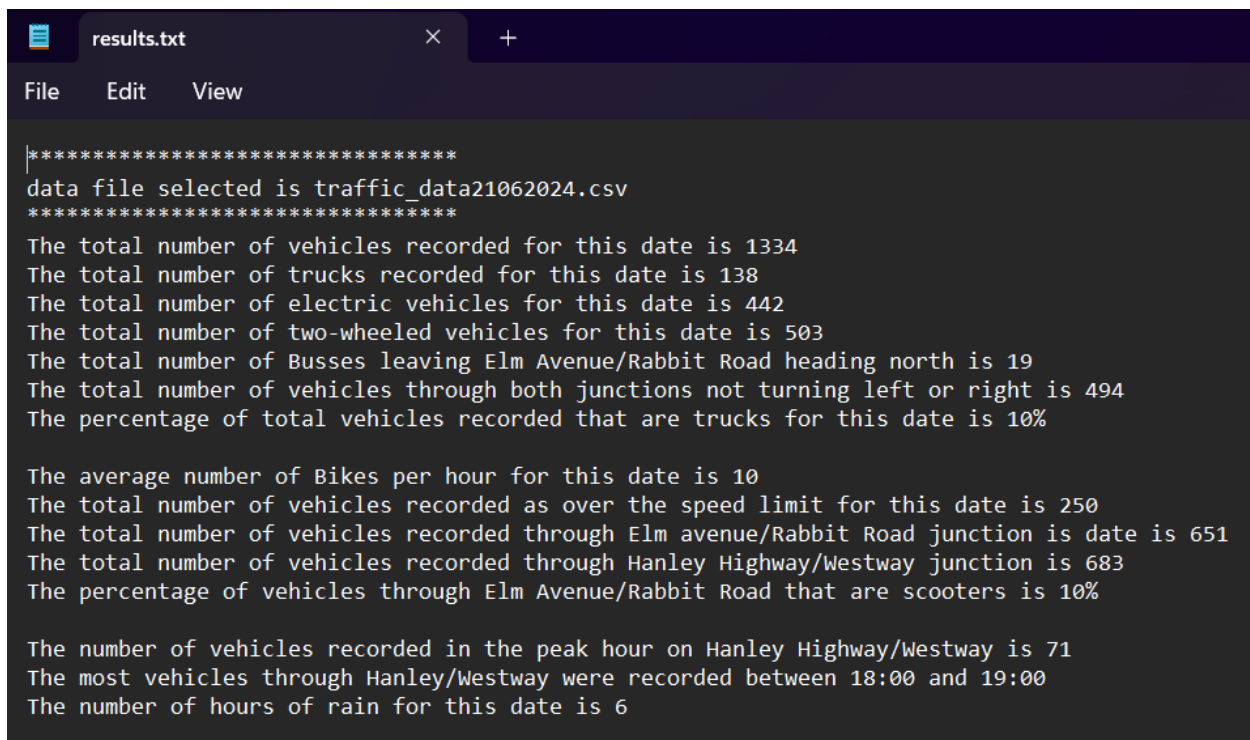
```
results.txt
File Edit View

*****
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 Busses 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 total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for 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 date is 52
The total number of vehicles recorded through Hanley Highway/Westway junction is 49
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 6%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 5
The most vehicles through Hanley/Westway were recorded between 1:00 and 2:00
The number of hours of rain for this date is 3
```

Figure 11-Save results to a text file 16th



```
results.txt
File Edit View

*****
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 Busses leaving Elm Avenue/Rabbit Road heading north is 19
The total number of vehicles through both junctions not turning left or right is 494
The percentage of total vehicles recorded that are trucks for this date is 10%

The average number of Bikes per hour for this date is 10
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 date is 651
The total number of vehicles recorded through Hanley Highway/Westway junction is 683
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 10%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 71
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 6
```

Figure 12-Save results to a text file 21st

```
results.txt
File Edit View
*****
data file selected is traffic_data15062024.csv
*****
The total number of vehicles recorded for this date is 1037
The total number of trucks recorded for this date is 109
The total number of electric vehicles for this date is 368
The total number of two-wheeled vehicles for this date is 401
The total number of Busses leaving Elm Avenue/Rabbit Road heading north is 15
The total number of vehicles through both junctions not turning left or right is 363
The percentage of total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for this date is 7
The total number of vehicles recorded as over the speed limit for this date is 205
The total number of vehicles recorded through Elm avenue/Rabbit Road junction is date is 494
The total number of vehicles recorded through Hanley Highway/Westway junction is 543
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 11%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 39
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 0

*****
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 Busses 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 total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for 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 date is 52
The total number of vehicles recorded through Hanley Highway/Westway junction is 49
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 6%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 5
The most vehicles through Hanley/Westway were recorded between 1:00 and 2:00
The number of hours of rain for this date is 2
```

Figure 13-Multiple runs

Task D. Histogram Display: Test Cases

Test Case	Input	Expected Output	Result
Histogram of 15 th	Date-15, month-06, year-2024	Display histogram and vehicle counts	Pass
Histogram of 16 th	Date-16, month-06, year-2024	Display histogram and vehicle counts	Pass
Histogram of 21 st	Date-21, month-06, year-2024	Display histogram and vehicle counts	Pass

Table 4-Task D: Histogram Display

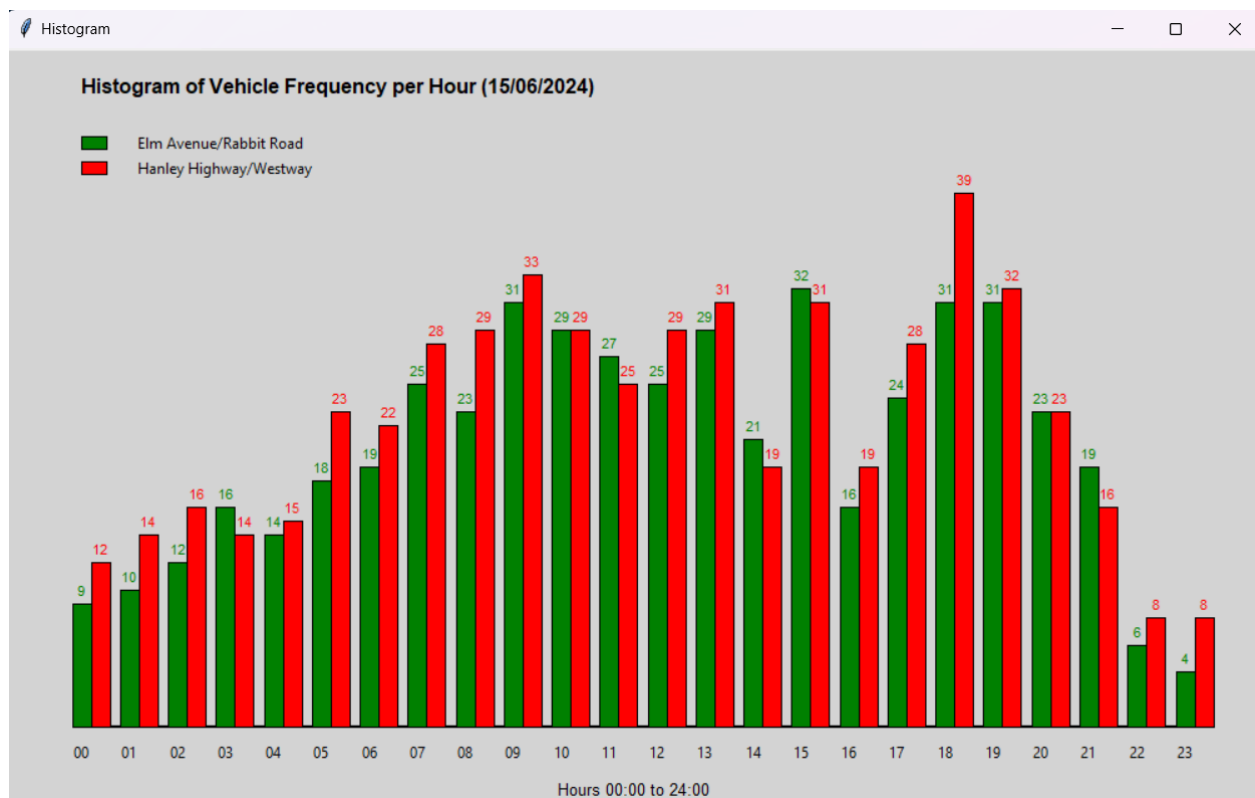


Figure 14-15th histogram

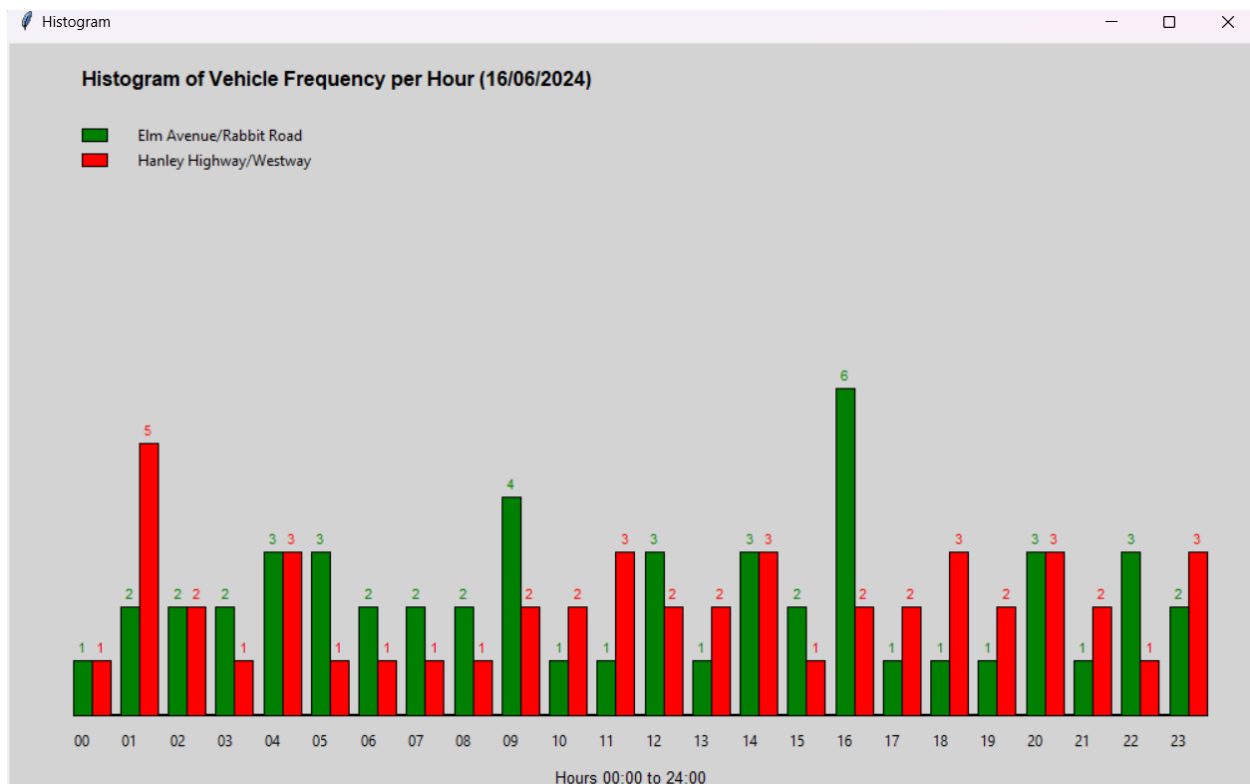


Figure 15-16th histogram

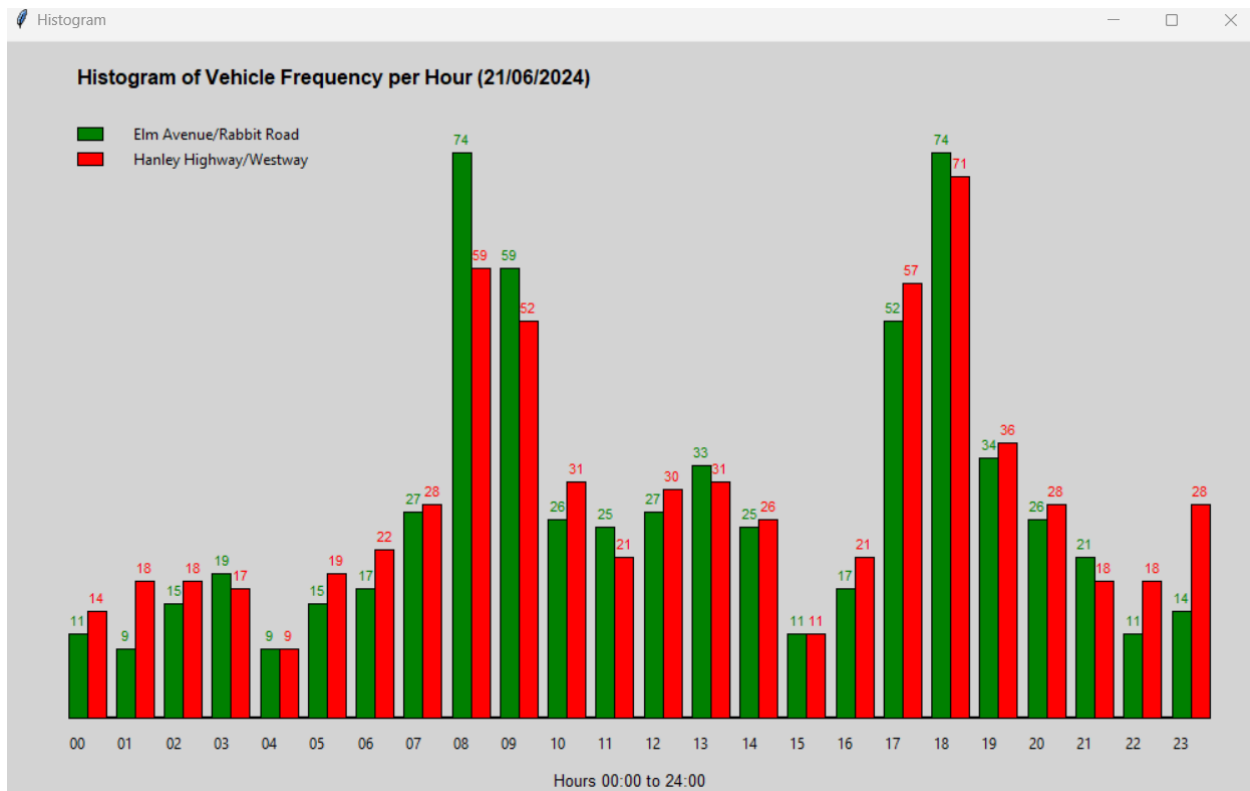


Figure 16-21st histogram

Task E. Handle multiple CSV files: Test Cases

Test case	Input	Expected output	Result
Valid dataset	Date-15, month-06, year-2024	Processes and display result and saves outcomes to results.txt	Pass
File not found (CSV file doesn't exist)	Date-02, month-10, year-2024	Display "Error 'traffic_data02102024.csv' not found"	Pass
Empty file (CSV file exists but with no data)	Date-25, month-06, year-2024	Display "No vehicles recorded for this date."	Pass
Continuing after valid dataset	Input -Y	Prompt – "Do you want to select another data file"	Pass

		for a different date? (Y/N):” Display- “Loading another dataset.”	
Invalid continue input	Input - H	Display “Please enter 'Y' or 'N'.”	Pass
Exiting	Input - N	Display “Exiting program.”	Pass

Table 5 - Main Function: Test Cases

```
= RESTART: C:\Users\sapoo\Downloads\pro cw\2.py
Please enter the day of the survey in the format DD: 15
Please enter the month of the survey in the format MM: 06
Please enter the year of the survey in the format YYYY: 2024
*****
data file selected is traffic_data15062024.csv
*****
The total number of vehicles recorded for this date is 1037
The total number of trucks recorded for this date is 109
The total number of electric vehicles for this date is 368
The total number of two-wheeled vehicles for this date is 401
The total number of Busses leaving Elm Avenue/Rabbit Road heading north is 15
The total number of vehicles through both junctions not turning left or right is 363
The percentage of total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for this date is 7
The total number of vehicles recorded as over the speed limit for this date is 205
The total number of vehicles recorded through Elm avenue/Rabbit Road junction is date is 494
The total number of vehicles recorded through Hanley Highway/Westway junction is 543
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 11%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 39
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 0
Do you want to select another data file for a different date? (Y/N): |
```

Figure 17-Valid dataset (IDLE)

```
results.txt
File Edit View

*****
data file selected is traffic_data15062024.csv
*****

The total number of vehicles recorded for this date is 1037
The total number of trucks recorded for this date is 109
The total number of electric vehicles for this date is 368
The total number of two-wheeled vehicles for this date is 401
The total number of Busses leaving Elm Avenue/Rabbit Road heading north is 15
The total number of vehicles through both junctions not turning left or right is 363
The percentage of total vehicles recorded that are trucks for this date is 11%

The average number of Bikes per hour for this date is 7
The total number of vehicles recorded as over the speed limit for this date is 205
The total number of vehicles recorded through Elm avenue/Rabbit Road junction is date is 494
The total number of vehicles recorded through Hanley Highway/Westway junction is 543
The percentage of vehicles through Elm Avenue/Rabbit Road that are scooters is 11%

The number of vehicles recorded in the peak hour on Hanley Highway/Westway is 39
The most vehicles through Hanley/Westway were recorded between 18:00 and 19:00
The number of hours of rain for this date is 0
```

Figure 18-Valid dataset (results.txt)

```
Please enter the day of the survey in the format DD: 02
Please enter the month of the survey in the format MM: 10
Please enter the year of the survey in the format YYYY: 2024
Error 'traffic_data02102024.csv' not found
Do you want to select another data file for a different date? (Y/N): |
```

Figure 19-File not found

```
Please enter the day of the survey in the format DD: 25
Please enter the month of the survey in the format MM: 06
Please enter the year of the survey in the format YYYY: 2024
No vehicles recorded for this date
Do you want to select another data file for a different date? (Y/N): |
```

Figure 20-Empty file

```
Do you want to select another data file for a different date? (Y/N): y
Loading another dataset.
Please enter the day of the survey in the format DD:
```

Figure 21-Continuing after valid dataset

```
Do you want to select another data file for a different date? (Y/N): H
Please enter 'Y' or 'N'.
Do you want to select another data file for a different date? (Y/N):
```

Figure 22-Invalid continue input

```
Do you want to select another data file for a different date? (Y/N): N
Exiting program.
```

Figure 23-Exiting