FACULTY OF ENGINEERING AND TECHNOLOGY

A REPORT ABOUT VISUALIZING AND ANALYZING OF DATA

COURSE UNIT: COMPUTER PROGRAMMING

LECTURER: MR. MASERUKA BENEDICTO

GROUP 13

SUBMITTED BY

NAME	COURSE	REG. NO.
NYEMERA ANNA GRACE	AMI	BU/UP/2024/0838
NASASIRA AUSTINE	WAR	BU/UP/2024/1048
BARASA ELVIS	AMI	BU/UP/2024/3817
BRAVO GIFT	PTI	BU/UG/2024/5059
NAMUWAWU PATRICIA	APE	BU/UG/2024/2670
AINAMATSIKO JEREMIAH	WAR	BU/UP/2024/3826
ACHAM LOYCE	AMI	BU/UP/2024/0821
MUGUME MATHIAS	MEB	BU/UP/2024/0983
ABUROT MARTHA	WAR	BU/UP/2024/3823
KINTU GADAFFI	AMI	BU/UP/2024/3734

DATE OF SUBMISSION: ……

DECLARATION

We hereby certify and confirm that the information in this report is out of our own efforts, research and it has never been submitted in any institution for any academic award

NAME	SIGNATURE
1. NASASIRA AUSTINE	……
2. KINTU GADAFI	……
3. 3. ABUROT MARTHA	……
4. MUGUME MATHIAS	…….
5. ACHAM LOYCE	…….
6. AINAMATSIKO JEREMIAH	…….
7. NAMUWAWU PATRICIA	……..
8. 8. BRAVO GIFT	……..
9. NYEMERA ANNA GRACE	……..
10. BARASA ELVIS	……..

APPROVAL

We are presenting this report which has been written and produced under our efforts. We carried out research on visualizing the different parameters, patterns, trends and relationships of data.

ACKNOWLEDGEMENT

First and foremost, we would like to thank the Almighty God for giving us the strength to carry on with our research as Group 13. We would love to extend our gratitude to all the persons with whose help we managed to make it this far

The willingness of each one of us to invest time and provide constructive feedback has been immensely valuable in this assignment.

Finally, we would like to express our gratitude to all the sources and references that have been cited in this report

DEDICATION.

We dedicate this report to all the individuals especially **Group 13** members, who have been there for us in the process of formulating and producing this report. To our lecturer Mr. Maseruka Benedicto whose guidance and expertise have been invaluable, your mentorship and insightful feedback have shaped our understanding.

ABSTRACT

We started our research from 18th September, 2025 in the university library with division of work for intense research in the different sections, where were obtained the best ways of how to do the assignment and that are used in the engineering field to solve problems. Information we used was mainly obtained from YouTube tutorials. Plotting the time, accuracy graphs and the number of steps followed graph. The division of work, eased the work and saved time.

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Understand the data types, distributions, and potential relationships within your dataset
Use color, line styles, markers, and sizes strategically to highlight key data points or
Use built-in plotting functions and customize their properties programmatically for fine-
Clean, filter, and transform your data appropriately before visualization to ensure accurac

1 CHAPTER ONE: INTRODUCTION

1.1 Background.

MATLAB, which stands for matrix laboratory, is a high-performance programming language and environment designed primarily for technical computing. Its origins trace back to the late 1970s when Cleve Moler, a professor of computer science, developed it to provide his students with easy access to mathematical software libraries without requiring them to learn Fortran.

1.2 Historical Development

Early Development (1970s)

- **Origins in Matrix Algebra:** MATLAB's foundation was built on research papers by J. H. Wilkinson and others, focusing on algorithms for solving matrix linear equation and eigenvalue problems.
- **Academic Tool:** Cleve Moler, a mathematics professor, developed the initial Fortran-based version in the 1970s as a free, interactive tool for his students, called the "Matrix Laboratory".
- **Basis in LINPACK and EISPACK:** This early version used subroutines from the LINPACK and EISPACK matrix software libraries for solving linear equations and eigenvalue problems.

Commercialization and Expansion (1980s)

- **Commercial Launch:** In 1984, Cleve Moler and John N. Little commercialized the software, founding MathWorks to market it to engineers and scientists.
- **Rewritten in C:** The commercial version was a significant rewrite of the original Fortran code, incorporating a proper programming language, user functions, and graphics capabilities.
- **Toolboxes:** Early toolboxes were introduced, including the Control System Toolbox (1985) and the Signal Processing Toolbox (1987), significantly expanding MATLAB's capabilities.

Continued Evolution (1990s to Present)

- **Advanced Data Structures:** The introduction of sparse matrices in 1992 and toolboxes like Image Processing and Symbolic Math in 1993 marked further advancements.
- **Broadened Scope:** While initially focused on numerical linear algebra, MATLAB evolved into a comprehensive technical computing environment for a wide range of applications.
- **Modern Capabilities:** Today, MATLAB supports advanced features such as parallel computing, object-oriented programming, and extensive integration with other languages and platform. It has also introduced features like the *Live Editor*, which allows users to create interactive documents that combine code, output, and formatted text. This evolution

reflects MATLAB's ongoing adaptation to meet the needs of its diverse user base across academia and industry.

1 CHAPTER 2: STUDY METHODOLOGY

2:1 Introduction

At the start time of the research, we divided ourselves accordingly to enable easy understanding of work and great participation of members in the assignment. Both groups organized discussions and discussed their findings to the entire group after thorough research.

Names and question researched

NAME	QUESTION RESEACHED
NASASIRA AUSTINE KINTU GADAFI ABUROT MARTHA MUGUME MATHIAS ACHAM LOYCE	Question Two
AINAMATSIKO JEREMIAH NAMUWAWU PATRICIA BRAVO GIFT NYEMERA ANNA GRACE BARASA ELVIS	Question One

2.2 Discussion chapter

MATLAB Tools and Environment

All members were encouraged to know how to use the MATLAB Tools and study its environment to be well conversant with it. Some of the keynotes members were advised to observe are as follows

- Become familiar with the MATLAB desktop environment, including the Current Folder, Command Window, and Workspace.

- Use the MATLAB documentation, such as the MathWorks website, to find information on best practices, specific functions, and troubleshooting.
- Explore and use the various apps available in MATLAB for different tasks, depending on your installed toolboxes.

Code Quality and Maintainability

When generating the code the members came to a conclusion to follow certain guidelines as mentioned below;

- Focus on producing code that is more likely to be correct.
- Make your code readable to others and yourself by using meaningful variable names and consistent formatting.
- Provide comments and explanations within your code to help with future maintenance and understanding.
- Incorporate testing into your development process to ensure code functionality and reliability.

3 CHAPTER THREE: TASK ONE

Introduction

Task one was about using the knowledge obtained in question one in the first assignment to visualize the different parameters, patterns, trends and relationships.

Task one

In this task, we were able to obtain a file from Kaggle.com named "**Electric cars dataset**" and using this data, we were able to do the following activities

1. Reading the data into MATLAB
2. Creating tables of different years
3. Converting the tables into structural arrays into different worksheets
4. Exporting the data to excel
5. Analyzed data through statistics
6. Visualizing of the data

READING THE DATA INTO MATLAB

The code that was used is as follows

```
data = readtable("C:\Users\LENOVO\Desktop\Electric cars dataset.xlsx");
disp(data);
```

CREATING TABLES OF DIFFERENT YEARS

```
Year2015 = data(data.Year == 2015, :);
Year2016 = data(data.Year == 2016, :);
Year2017 = data(data.Year == 2017, :);
Year2018 = data(data.Year == 2018, :);
Year2019 = data(data.Year == 2019, :);
Year2020 = data(data.Year == 2020, :);
Year2021 = data(data.Year == 2021, :);
Year2022 = data(data.Year == 2022, :);
Year2023 = data(data.Year == 2023, :);
Year2024 = data(data.Year == 2024, :);
Year2025 = data(data.Year == 2025, :);
disp(Year2015); disp(Year2016);
```

```
disp(Year2017); disp(Year2018);
disp(Year2019); disp(Year2020);
disp(Year2021); disp(Year2022);
disp(Year2023); disp(Year2024);
disp(Year2025);
```

CONVERTING THE TABLES INTO STRUCTURAL ARRAYS INTO DIFFERENT WORKSHEETS

```
struct2015 = table2struct(Year2015);
struct2016 = table2struct(Year2016);
struct2017 = table2struct(Year2017);
struct2018 = table2struct(Year2018);
struct2019 = table2struct(Year2019);
struct2020 = table2struct(Year2020);
struct2021 = table2struct(Year2021);
struct2022 = table2struct(Year2022);
struct2023 = table2struct(Year2023);
struct2024 = table2struct(Year2024);
struct2025 = table2struct(Year2025);
disp(struct2015); disp(struct2016);
disp(struct2017); disp(struct2018);
disp(struct2019); disp(struct2020);
disp(struct2021);
disp(struct2022); disp(struct2023);
disp(struct2024); disp(struct2025);
```

EXPORTING THE DATA TO EXCEL

```
output1 = "C:\Users\LENOVO\Desktop\Question1\car_struct2015.xlsx"
writetable(Year2015,output1,"Sheet","Year2015");
```

```
output2 = "C:\Users\LENOVO\Desktop\Question1\car_struct2016.xlsx"
writetable(Year2016,output2,"Sheet","Year2016");

output3 = "C:\Users\LENOVO\Desktop\Question1\car_struct2017.xlsx"
writetable(Year2017,output3,"Sheet","Year2017");

output4 = "C:\Users\LENOVO\Desktop\Question1\car_struct2018.xlsx"
writetable(Year2018,output4,"Sheet","Year2018");

output5 = "C:\Users\LENOVO\Desktop\Question1car_struct2019.xlsx"
writetable(Year2019,output5,"Sheet","Year2019");

output6 = "C:\Users\LENOVO\Desktop\Question1\car_struct2020.xlsx"
writetable(Year2020,output6,"Sheet","Year2020");

output7 = "C:\Users\LENOVO\Desktop\Question1\car_struct2021.xlsx"
writetable(Year2021,output7,"Sheet","Year2021");

output8 = "C:\Users\LENOVO\Desktop\Question1\car_struct2022.xlsx"
writetable(Year2022,output8,"Sheet","Year2022");

output9 = "C:\Users\LENOVO\Desktop\Question1\car_struct2023.xlsx"
writetable(Year2023,output9,"Sheet","Year2023");

output10 = "C:\Users\LENOVO\Desktop\Question1\car_struct2024.xlsx"
writetable(Year2024,output10,"Sheet","Year2024");

output11 = "C:\Users\LENOVO\Desktop\Question1\car_struct2025.xlsx"
writetable(Year2025,output11,"Sheet","Year2025");
```

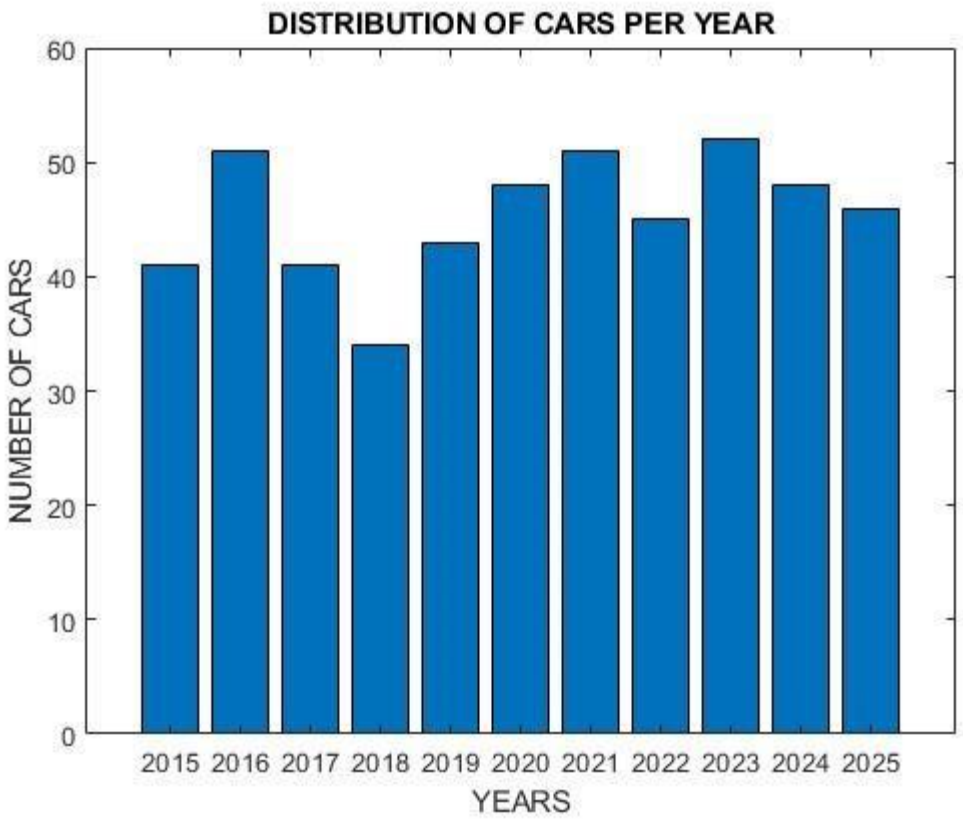
ANALYZED DATA THROUGH STATISTICS

```
 Yearly_distribution_of_cars = groupsummary(data,"Year")
 disp(Yearly_distribution_of_cars(:,["Year","GroupCount"]));


Country_distribution_of_cars                                    =
 groupsummary(data,"Country_of_Manufacture")
 disp(Country_distribution_of_cars(:,["Country_of_Manufacture","GroupC
 ount"]));
 maximum_Country_distribution_of_cars                           =
 max(Country_distribution_of_cars.GroupCount);
 disp(maximum_Country_distribution_of_cars);
 fprintf("mean        country       distribution       of       cars:
 %.2f\n",mean(Country_distribution_of_cars.GroupCount));
 fprintf("mode        country       distribution       of       cars:
 %.2f\n",mode(Country_distribution_of_cars.GroupCount));
 fprintf("median       country       distribution       of       cars:
 %.2f\n",median(Country_distribution_of_cars.GroupCount));
 fprintf("standard deviation country distribution of cars:
 %.2f\n",std(Country_distribution_of_cars.GroupCount));
fprintf("maximum        country       distribution       of       cars:
 %.d\n",max(Country_distribution_of_cars.GroupCount));
fprintf("minimum        country       distribution       of       cars:
 %.d\n",min(Country_distribution_of_cars.GroupCount));


 Color_distribution_of_cars = groupsummary(data,"Color")
 disp(Color_distribution_of_cars(:,["Color","GroupCount"]));


 Manufacturer_distribution_of_cars = groupsummary(data,"Manufacturer")
 disp(Manufacturer_distribution_of_cars(:,["Manufacturer","GroupCount"
 ]));
fprintf("mean        Manufacturer      distribution      of      cars:
 %.2f\n",mean(Manufacturer_distribution_of_cars.GroupCount));
fprintf("mode        Manufacturer      distribution      of      cars:
 %.2f\n",mode(Manufacturer_distribution_of_cars.GroupCount));
fprintf("median       Manufacturer      distribution      of      cars:
```

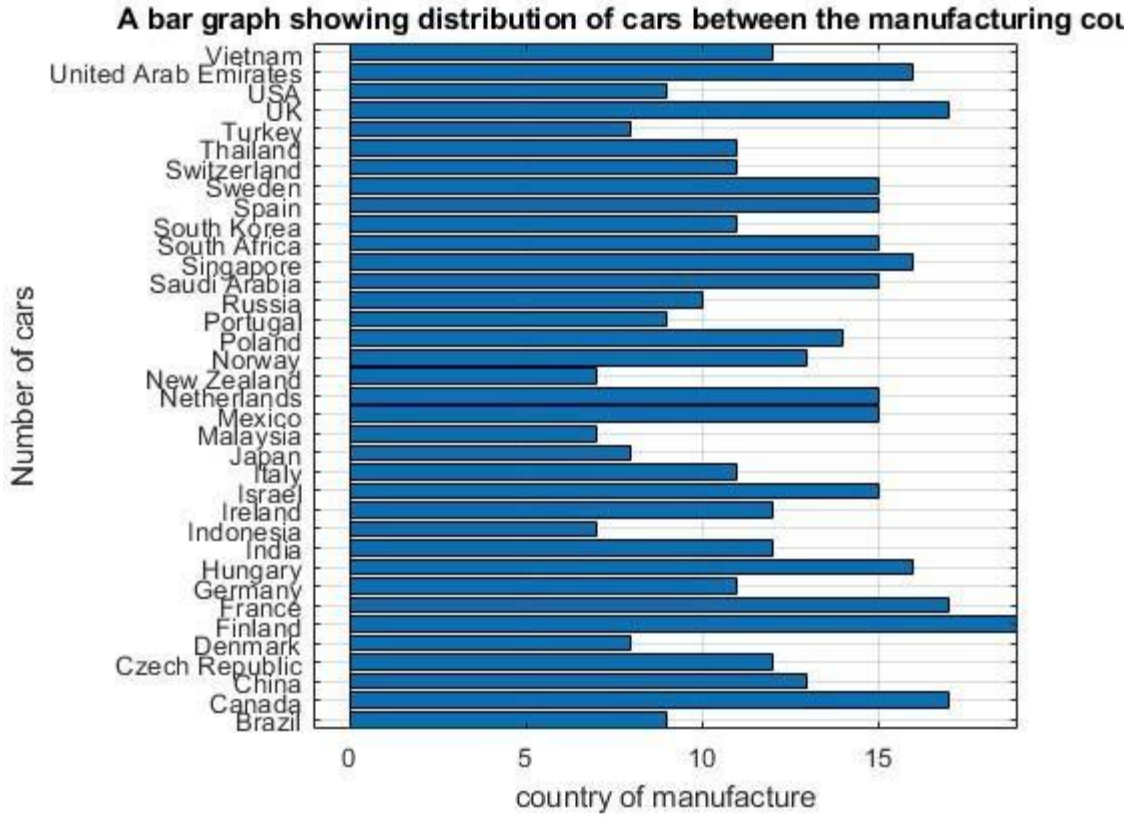
```
%.2f\n",median(Manufacturer_distribution_of_cars.GroupCount));
fprintf("standard deviation Manufacturer distribution of cars:
%.2f\n",std(Manufacturer_distribution_of_cars.GroupCount));
fprintf("maximum Manufacturer distribution of cars:
%.d\n",max(Manufacturer_distribution_of_cars.GroupCount));
fprintf("minimum Manufacturer distribution of cars:
%.d\n",min(Manufacturer_distribution_of_cars.GroupCount));

Model_distribution_of_cars = groupsummary(data,"Model")
disp(Model_distribution_of_cars(:,["Model","GroupCount"]));

Battery_Type_distribution_of_cars = groupsummary(data,"Battery_Type")
disp(Battery_Type_distribution_of_cars(:,["Battery_Type","GroupCount"
]));
fprintf("mean Battery Type distribution of cars:
%.2f\n",mean(Battery_Type_distribution_of_cars.GroupCount));
fprintf("mode Battery Type distribution of cars:
%.2f\n",mode(Battery_Type_distribution_of_cars.GroupCount));
fprintf("median Battery Type distribution of cars:
%.2f\n",median(Battery_Type_distribution_of_cars.GroupCount));
fprintf("standard deviation Battery Type distribution of cars:
%.2f\n",std(Battery_Type_distribution_of_cars.GroupCount));
fprintf("maximum Battery Type distribution of cars:
%.d\n",max(Battery_Type_distribution_of_cars.GroupCount));
fprintf("minimum Battery Type distribution of cars:
%.d\n",min(Battery_Type_distribution_of_cars.GroupCount));
```

VISUALIZING OF THE DATA

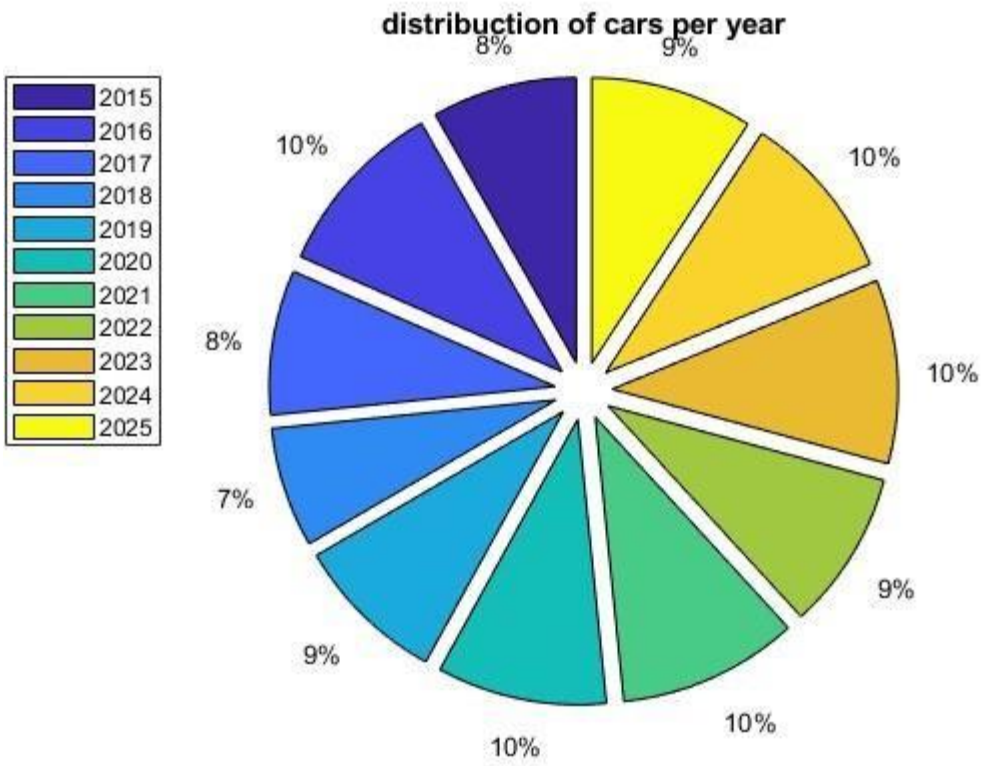
```
bar(Yearly_distribution_of_cars.Year,Yearly_distribution_of_cars.Grou
pCount);
xlabel("YEARS"); ylabel("NUMBER
OF CARS");
title("DISTRIBUTION OF CARS PER YEAR"); saveas(gcf,"bar
graph.png");
```



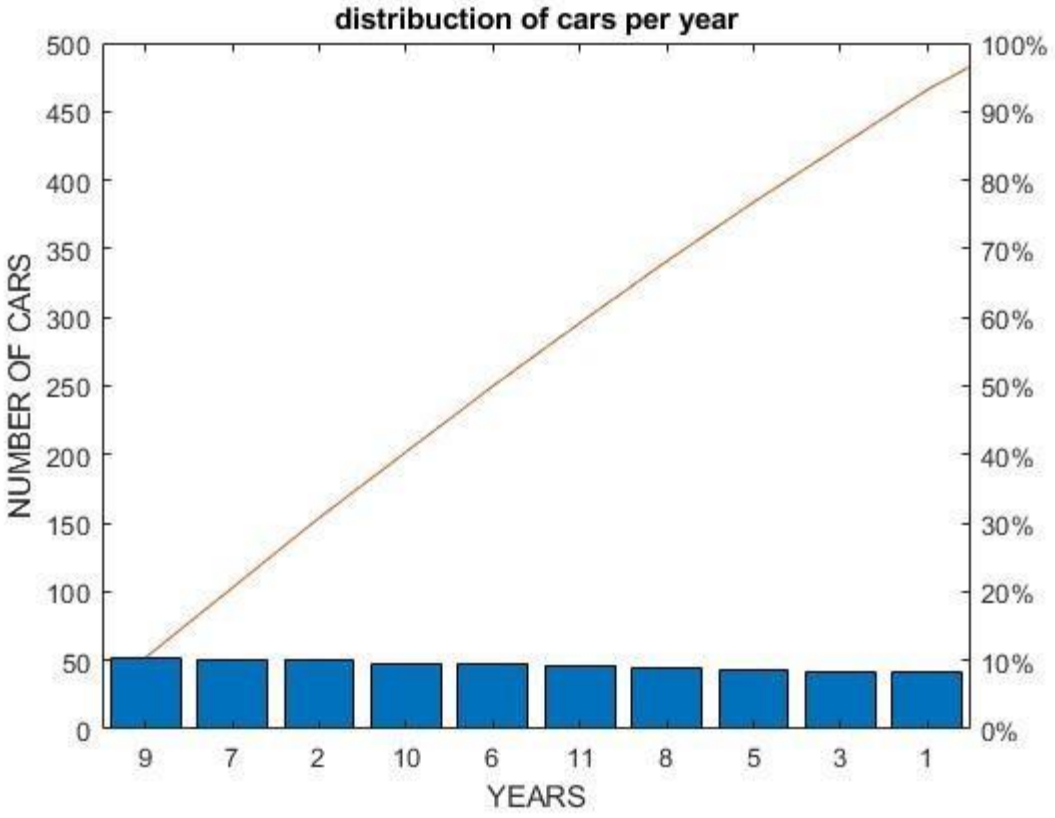

```
barh(Country_distribution_of_cars.Country_of_Manufacture,Country_dist
ribution_of_cars.GroupCount); xlabel("country of manufacture");
ylabel("Number of cars");
title("A bar graph showing distribution of cars between the
manufacturing countries") saveas(gcf,"horizontal bar.png"); grid on;
```



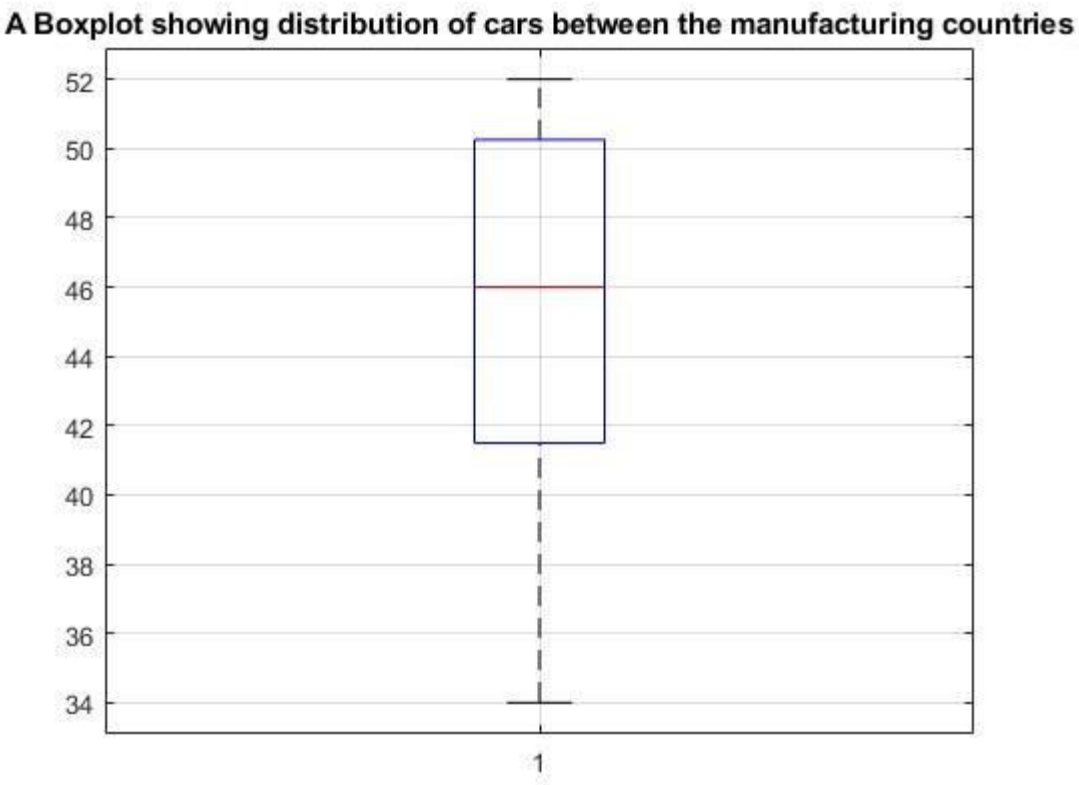

```
pie(Yearly_distribution_of_cars.GroupCount,Yearly_distribution_of_car
s.Year);

title("distribuction of cars per year");

legend("2015","2016","2017","2018","2019","2020","2021","2022","2023"
,"2024","2025"); saveas(gcf,"pie

chart.png");
```



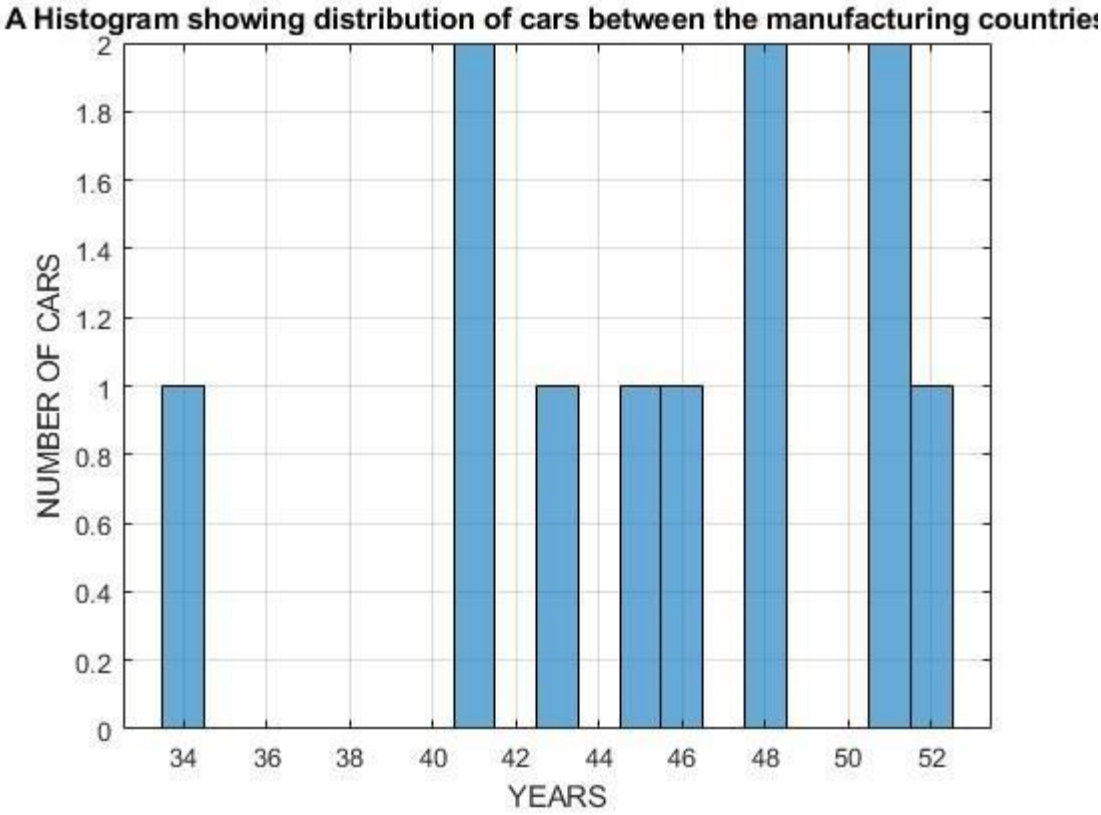

```
pareto(Yearly_distribution_of_cars.GroupCount);
title("distribuction of cars per year");
xlabel("YEARS"); ylabel("NUMBER OF CARS");
saveas(gcf,"pareto.png");
```



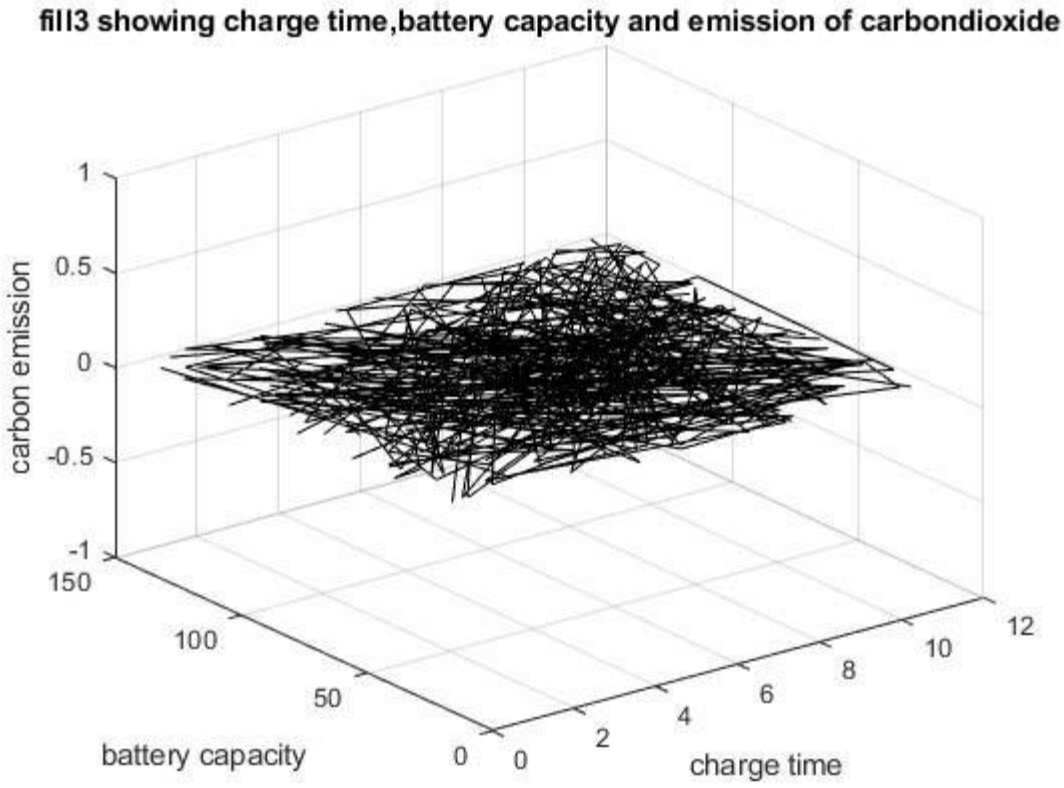

```
boxplot(Yearly_distribution_of_cars.GroupCount);

title("A Boxplot showing distribution of cars between the
manufacturing countries")

saveas(gcf,"boxplot.png"); grid

on;
```



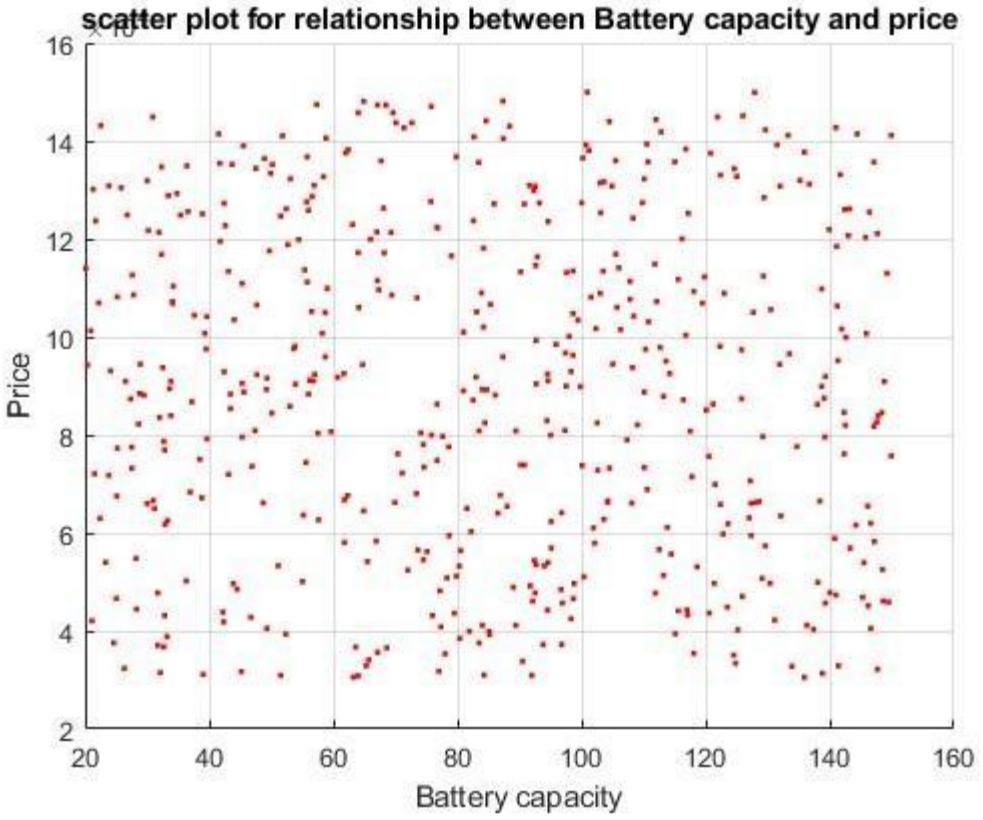

```
histogram(Yearly_distribution_of_cars.GroupCount);
xlabel("YEARS"); ylabel("NUMBER OF CARS");
title("A Histogram showing distribution of cars between the
manufacturing countries") saveas(gcf,"histogram.png"); grid on;
```



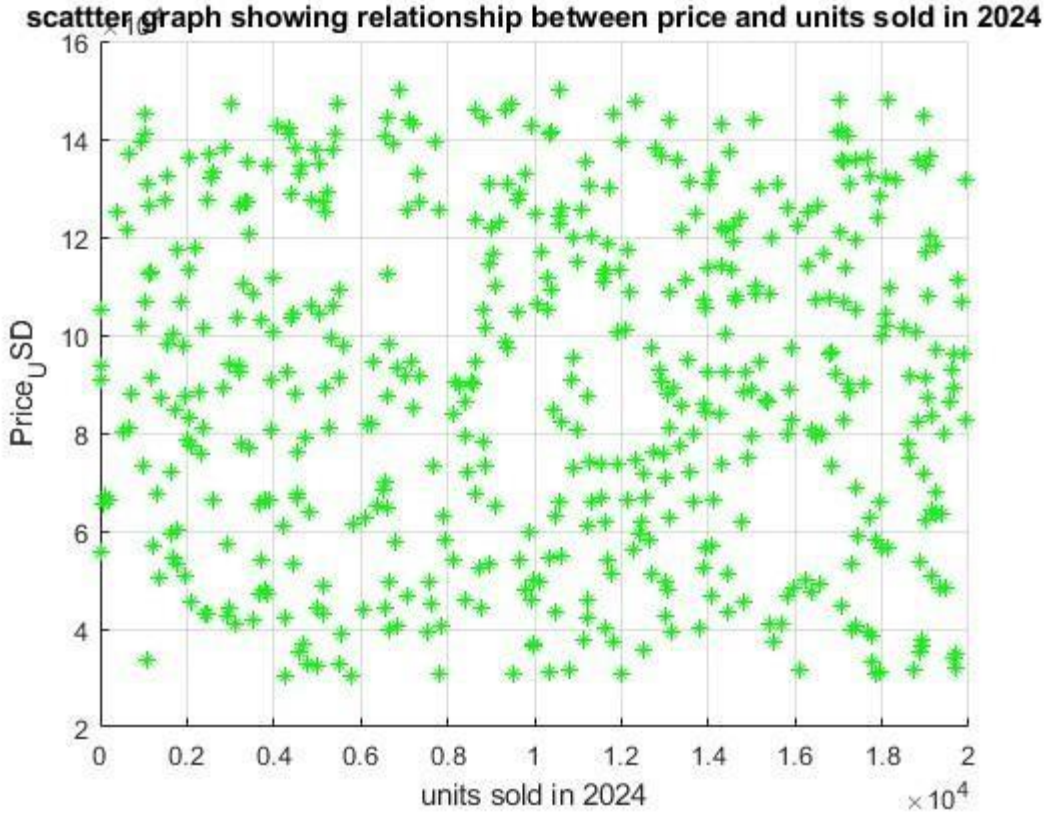

```
x = data.Charge_Time_hr; y =
data.Battery_Capacity_kWh; z =
data.CO2_Emissions_g_per_km;
fill3(x,y,z,'r')
title("fill3 showing charge time,battery capacity and emission of carbondioxide"); xlabel("charge time"); ylabel("battery capacity"); zlabel("carbon emission") saveas(gcf,"fill3.png"); grid on;
```




```
scatter(data.Battery_Capacity_kWh,data.Price_USD,".r");
xlabel("Battery capacity"); ylabel("Price");
title("scatter plot for relationship between Battery capacity and
price");
saveas(gcf,"scatter1.png"); grid
on;
```




```
scatter(data.Units_Sold_2024,data.Price_USD,"*g");
xlabel("units sold in 2024") ylabel("Price_USD")
title("scattter graph showing relationship between price and units sold in 2024"); grid on;
saveas(gcf,"scatter2.png");
```


scattter graph showing relationship between price and units sold in 2024
×10^4
16
14
12
10
8
6
4
2
Price_USD
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
units sold in 2024
×10^4

2 CHAPTER FOUR: TASK TWO

Introduction

Task Two was about describing the different statistical characteristic of data and visualizing it. The data was collected from the group members with their different attributes detailed enough to describe them

Task two

In task two, after collecting the necessary information from all the members, we then obtained codes for the following activities;

1. Created a table for the data collected
2. Obtained statistical analysis on religion, tribes, hobbies and districts
3. Obtained statistics (mode, mean, standard deviation, maximum and minimum values) 4. Visualizing of the data

CODES OF THE ACTIVIES DONE

Created a table for the data collected

```
Name = ["Bravo Gift";"Austine NASASIRA";"Patricia Namuwawu";"Nyemere Anna
Grace";"Kintu Gadaffi";"Jeremiah Ainamatsiko";"Mugume Mathias";"Aburot
Martha";"Barasa Elvis";"Acham Royce"];
Age = [21;22;21;22;22;21;22;26;23;22;]; Tribe
=
["alur";"munyankole";"muganda";"itesot";"muganda";"munyankole";"munyankole";"it
esot";"samia";"langi"]; District =
["pakwach";"bushenyi";"masaka";"butebo";"mityana";"kazo";"bushenyi";"amuria";"b
usia";"lira"]; Hobby =
["music";'dancing';"reading";"footbal";"swimming";"music";"praying";"adventure"
;"football";"adventure"];
YearofBirth = [2004;2003;2004;2003;2003;2004;2003;1999;2002;2003];
IncomeLevel = [23;34;68;90;23;12;6;23;45;89];
WeeksAttended = [8;9;10;11;12;13;10;11;14;15];
MarksScored = [51;56;79;90;89;67;56;54;53;60];
Course = ["PTI";"WAR";"APE";"AMI";"AMI";"WAR";"MEB";"WAR";"AMI";"AMI"];
Religion =
["catholic";"catholic";"anglican";"catholic";"muslim";"anglican";"catholic";"an
glican";"anglican";"catholic"];

Students =
table(Name,Age,Tribe,District,Hobby,YearofBirth,IncomeLevel,WeeksAttended,Marks
Scored,Course,Religion); disp(Students);
```

Obtained statistical analysis on religion, tribes, hobbies and districts

```
distribution of religion



Religion_distribution = groupsummary(Students,"Religion");

disp(Religion_distribution(:,["Religion","GroupCount"]));

 distribution of

tribes



Tribe_distribution = groupsummary(Students,"Tribe");

disp(Tribe_distribution(:,["Tribe","GroupCount"]));

 distribution of

hobbies



HObby_distribution = groupsummary(Students,"Hobby");

disp(HObby_distribution(:,["Hobby","GroupCount"]));

 distribution of

districts



District_distribution = groupsummary(Students,"District");
disp(District_distribution(:,["District","GroupCount"]));
```

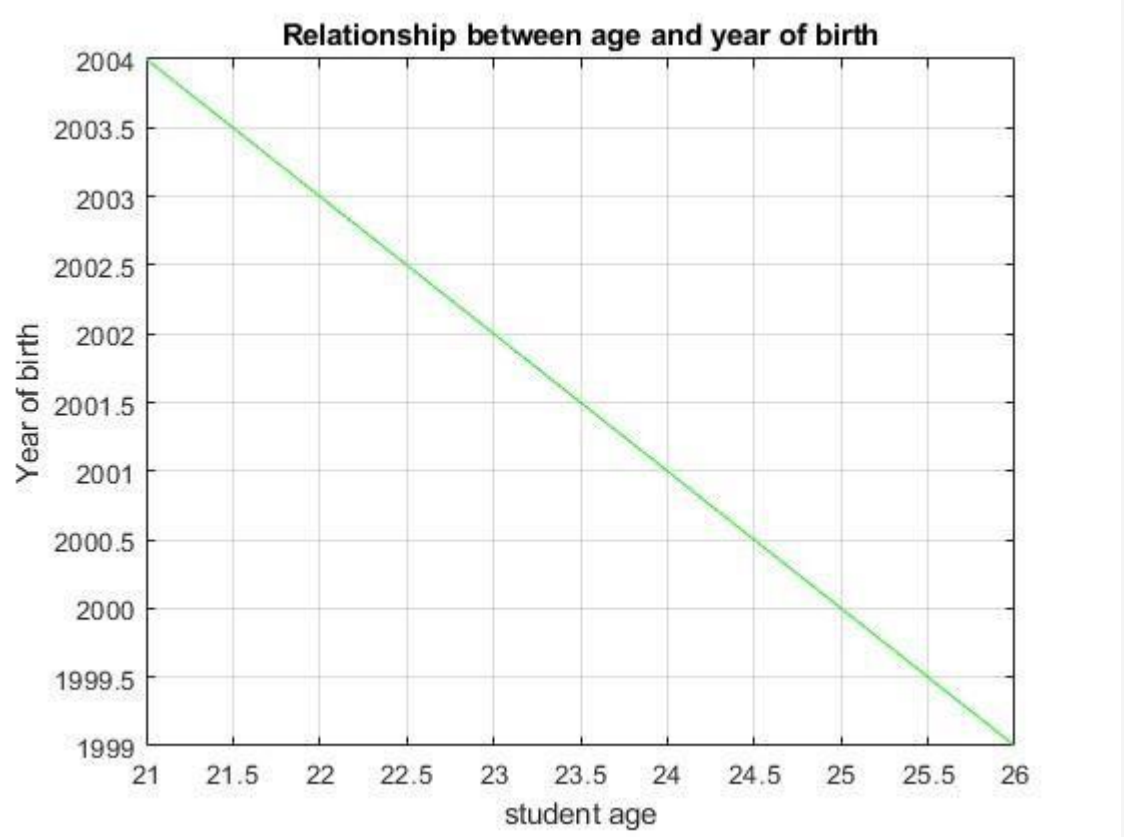
1. Obtained statistics (mode, mean, standard deviation, maximum and minimum values)

```
2.    fprintf("mean Age: %.2f\n",mean(Students.Age));
3.    fprintf("median Age: %.2f/n",median(Students.Age));
4.    fprintf("modal Age: %.2f/n",mode(Students.Age));
5.    fprintf("standard dviation Age: %.2f/n",std(Students.Age));
6.    fprintf("minimum Age: %d/n",min(Students.Age)); 7. fprintf("maximum
Age: %d/n",max(Students.Age))
8.
9.
10.statistics on marks
11.fprintf("mean mark scored: %.2f\n",mean(Students.MarksScored));
```

```
12. fprintf("median mark scored: %.2f\n",median(Students.MarksScored));
13. fprintf("modal mark scored: %.2f\n",mode(Students.MarksScored));
14.    fprintf("standard deviation mark scored:
   %.2f\n",mean(Students.MarksScored));
15.    fprintf("maximum mark scored: %.d\n",max(Students.MarksScored));
16.    fprintf("minimum mark scored: %.d\n",min(Students.MarksScored)); 17.
18.
19. statistic on income level
20.
21.    fprintf("mean income level: %.2f\n",mean(Students.IncomeLevel));
22.    fprintf("median income level:
%.2f\n",median(Students.IncomeLevel)); 23. fprintf("modal income level:
%.2f\n",mode(Students.IncomeLevel)); 24. fprintf("standard deviation
income level:
   %.2f\n",std(Students.IncomeLevel));
25.    fprintf("maximum income level: %.d\n",max(Students.IncomeLevel));
26.    fprintf("minimum income level: %.d\n",min(Students.IncomeLevel));
27.
```

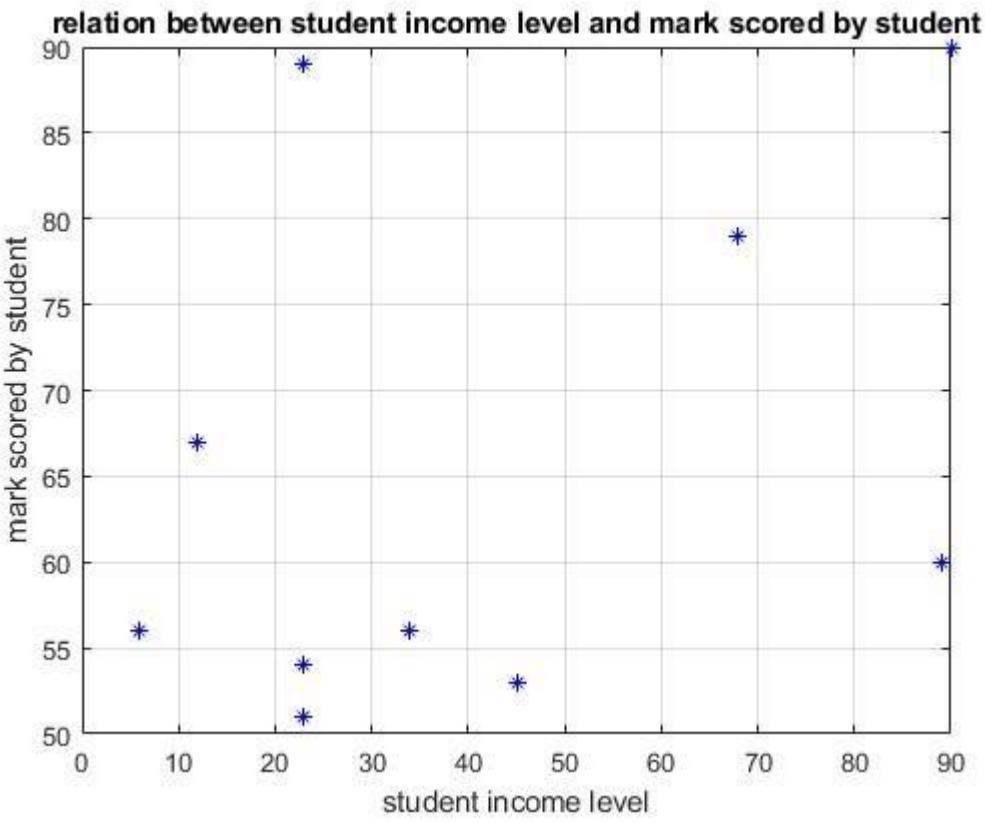
Visualizing of the data

```
relationship between students' age and year of birth

 plot(Age,YearofBirth,"g"); xlabel("student age"); ylabel("Year

of birth"); title("Relationship between age and year of birth");

grid on;
```



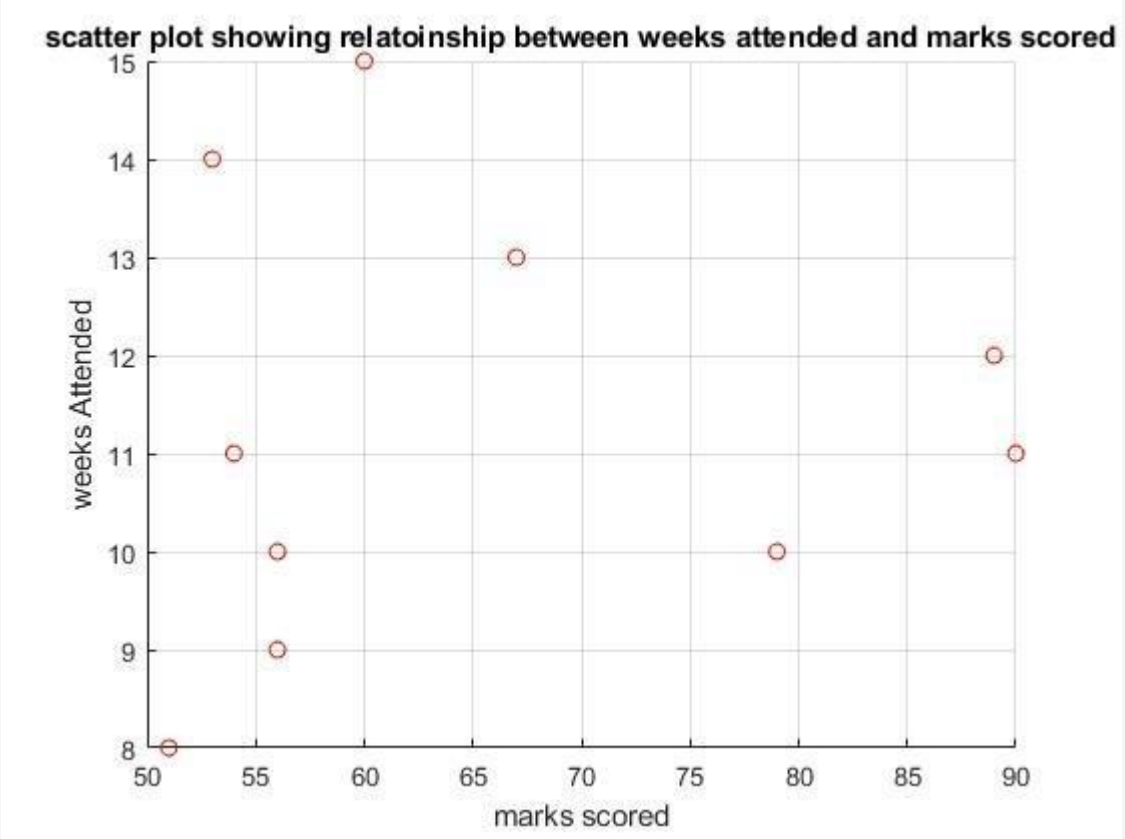
relationship between income level and marksscored

```
plot(IncomeLevel,MarksScored,"b*");
xlabel("student income level");
ylabel("mark scored by student");
title("relation between student income level and mark scored by student");
grid on;
```



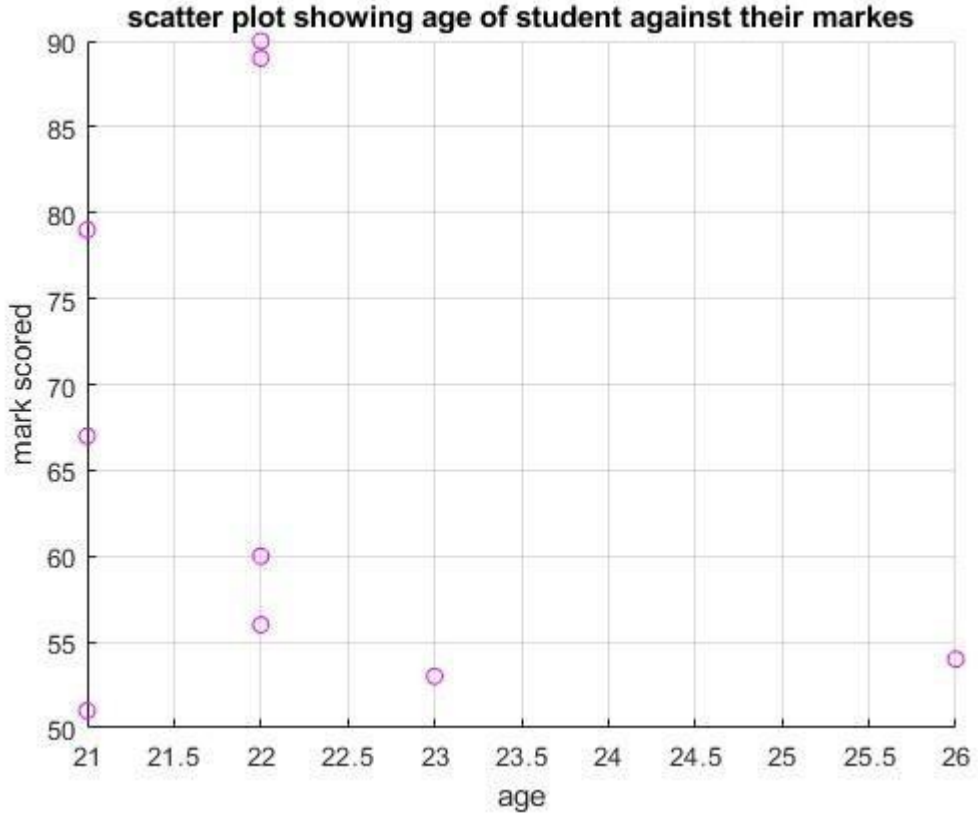
relationship of markscored and weeks attended

```
scatter(MarksScored,WeeksAttended,"r");

xlabel("marks scored");

ylabel("weeks Attended");

title("scatter plot showing relatoinship between weeks attended and marks
scored");

grid on;
```



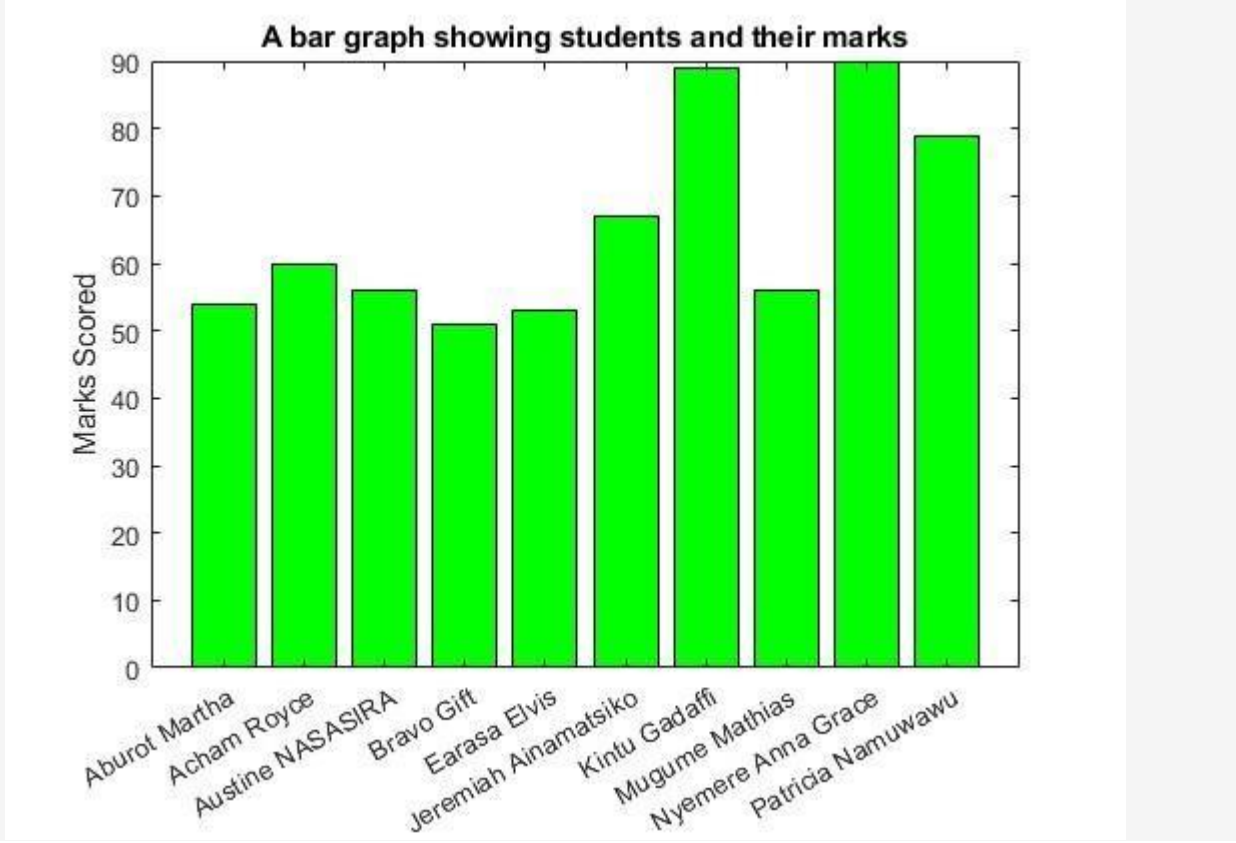
relationship of age and marks scored

```
scatter(Age,MarksScored,"magenta");
xlabel("age");
ylabel("mark scored");
title("scatter plot showing age of student against their markes");
grid on;
```



Bar Graph

```
x = categorical(Name)

y = MarksScored

bar(x,y,"g");

title("A bar graph showing students and their marks");

ylabel("Marks Scored");
```


A bar graph showing students and their marks
Marks Scored
0
10
20
30
40
50
60
70
80
90
Aburot Martha
Acham Royce
Austine NASASIRA
Bravo Gift
Earasa Elvis
Jeremiah Ainamatsiko
Kintu Gadaffi
Mugume Mathias
Nyemere Anna Grace
Patricia Namuwawu

CHAPTER 8: CONCLUSION AND RECOMMENDATION

8.1 Recommendations

1. Understand Your Data and Purpose:

Clearly identify the specific questions you aim to answer with your data analysis.

Understand the data types, distributions, and potential relationships within your dataset before visualizing.

2. Choose the Right Visualization Type: Select plot types that effectively represent your data and the insights you want to convey

(e.g., plot for time series, scatter for relationships, histogram for distributions, surf for 3D surfaces).

3. Enhance Clarity and Impact:

- Simplify:
- Use Labels and Titles:
- Color and Styling:

Use color, line styles, markers, and sizes strategically to highlight key data points or differentiate categories.

4. Programmatic Control for Reproducibility and Customization:

Use built-in plotting functions and customize their properties programmatically for fine-grained control over appearance.

5. Best Practices for Data Handling:

Clean, filter, and transform your data appropriately before visualization to ensure accuracy and meaningful insights.

8.2 Conclusion

The analysis and visualization of data using MATLAB successfully revealed clear commuting patterns that were not obvious from the raw dataset.

Overall, MATLAB's data visualization tools proved highly effective for transforming a complex dataset into meaningful and actionable insights for urban planning and traffic management.

References

Books

- Fundamentals of Data Science with MATLAB: Introduction to Scientific Computing, Data Analysis, and Data Visualization by Arash Karimpour.
- MATLAB: Data Analysis and Visualization by Antonio Siciliano.