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STA. MESA MANILA

“Analyzing and Visualizing Carbon Emissions in Philippine Provinces Using R”

Final Requirement for INTE-E1: IT Elective 1

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Overview

This R program analyzes and visualizes carbon emissions data by province in the Philippines. The program uses the dplyr, tidyr, ggplot2, and writexl libraries. First, the program generates a data frame with the names of the provinces, years from 2000 to 2020, and randomly generated carbon emissions data. It then pivots the data into a wide format, saves it as a CSV file, and creates a line graph showing the trend of carbon emissions by province over time. Next, the program calculates the total carbon emissions per province using the *dplyr* library, groups the data by province, and summarizes the total carbon emissions. Finally, the program creates a bar graph showing the total carbon emissions per province. The resulting chart provides a clear visualization of how carbon emissions have changed over time in different provinces. This program can be a starting tool that may allow policymakers and researchers to gain insights into carbon emissions trends and to identify areas for potential interventions to reduce carbon emissions.

Instructions on how to run the program:

1. Open a code editor or integrated development environment (IDE) such as RStudio.
2. Create a new script file and paste the entire code into the editor.
3. Ensure that you have installed all the required packages (dplyr, tidyr, ggplot2, and writexl) by running the relevant installation commands or checking if they are already installed.
4. Highlight the entire code by clicking and dragging your mouse over it, or by pressing Ctrl + A to select all.
5. Press Ctrl + Enter (or Cmd + Enter on a Mac) to run the entire script at once.
6. The script will run and produce the output as specified, including the line graph and bar graph. You may need to adjust the plot window or zoom in/out to see the graphs clearly.

Google Drive link for the R Program Files:

https://drive.google.com/drive/u/0/folders/1efVV4zuidhM0ozp501xEJn3DVTYHEyZk

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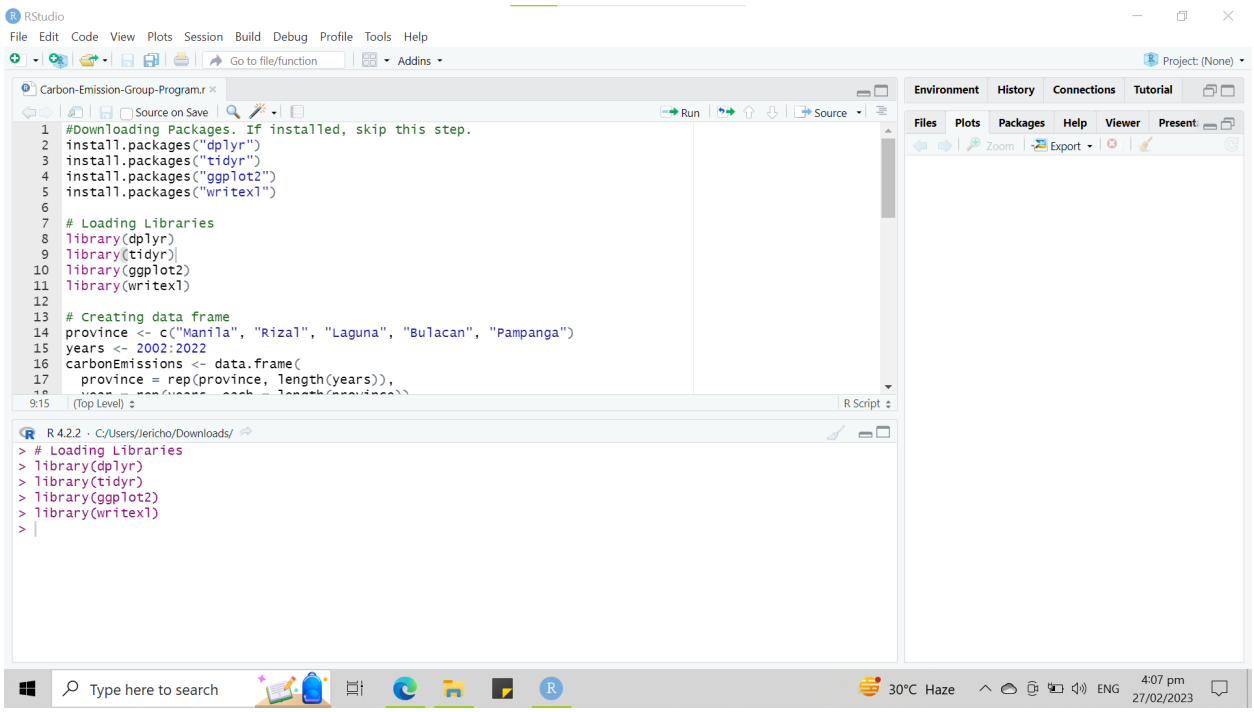
Step 1: Essential Libraries

Install the needed package for the program. Just type in R studio “install.packages(“name of the package”) dplyr, tidyr, and ggplot2, and writexl. If the packages are already installed to your computer then load the library to your console.



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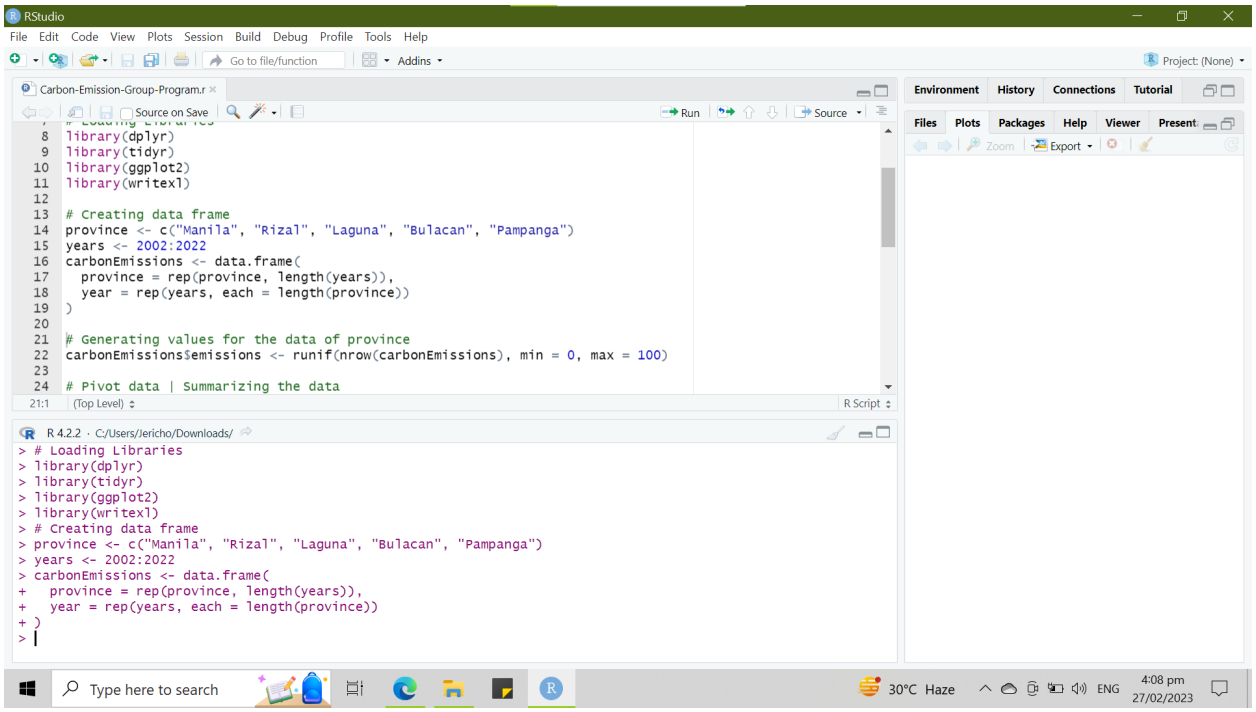
Step 2: Creating data frame

In this step you need to put the data in the variable “province” and what range of the year to compare the data. After that you need to add another variable by inserting the data.frame where the values are province and years.



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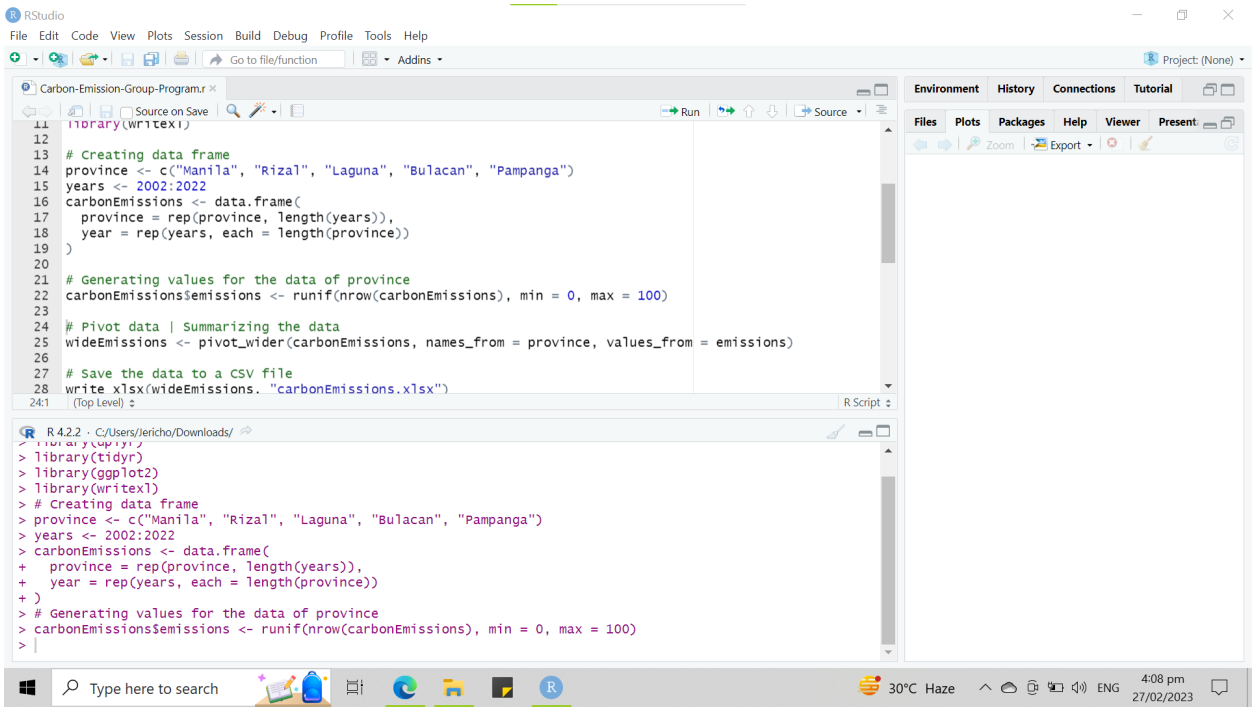
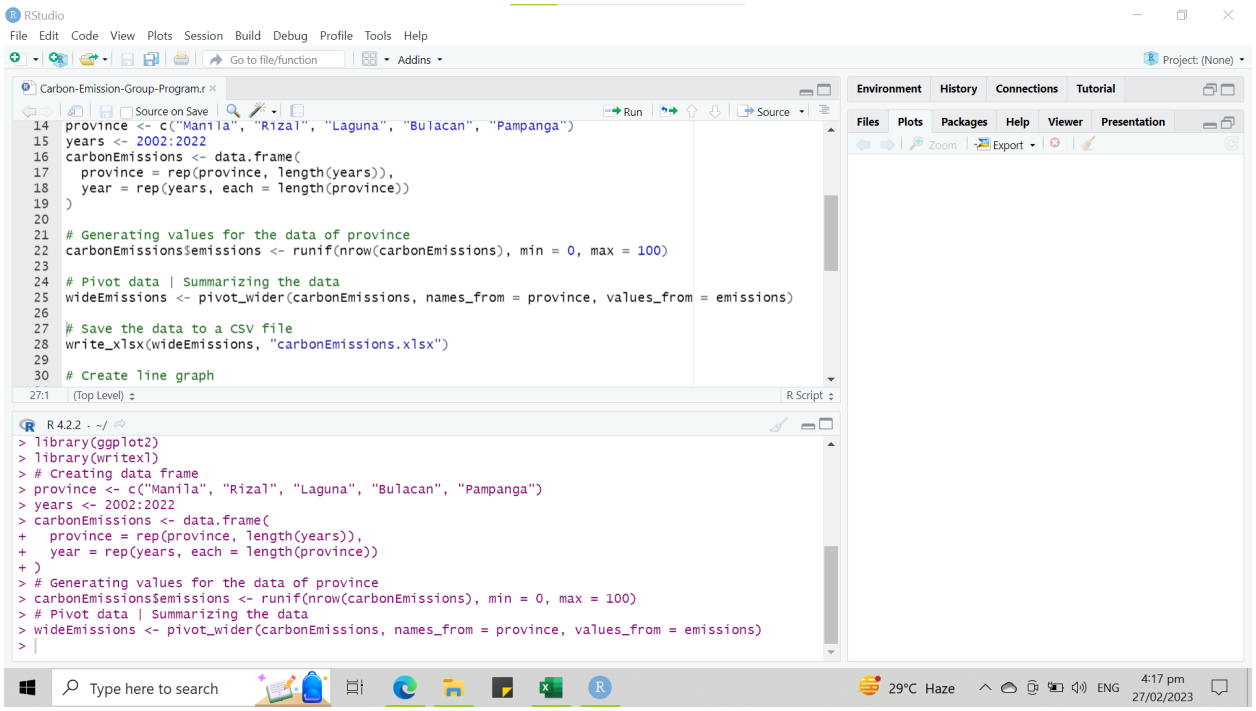
Step 3: Generating values

In this step, we are asking the R program to generate random values or data for the province that ranges between 0 - 100 outputs.



Step 4: Pivot data

Next, Pivot the data to wide format for easier viewing. Also, summarize, sort, group and reorganize data, as well as execute other complex calculations on it.



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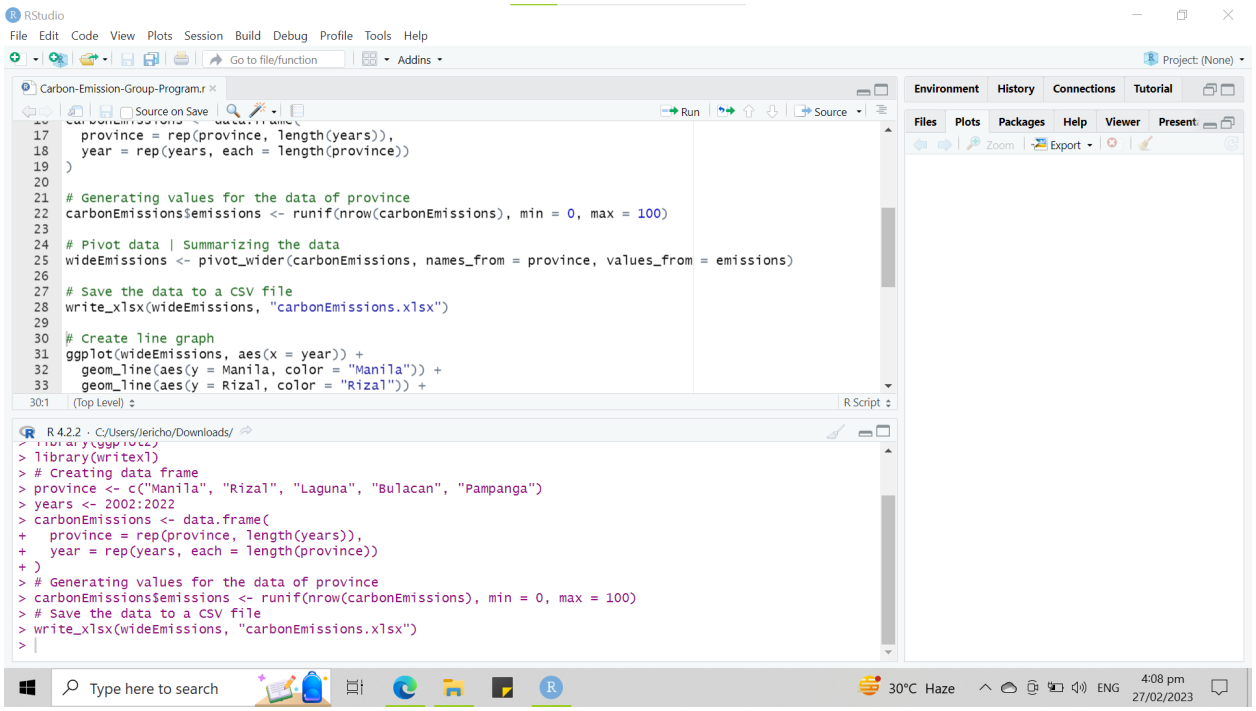
Step 5: Save the data to an Excel file

By saving the data to a .xlsx file, excel will automatically open and display the data to a new workbook.



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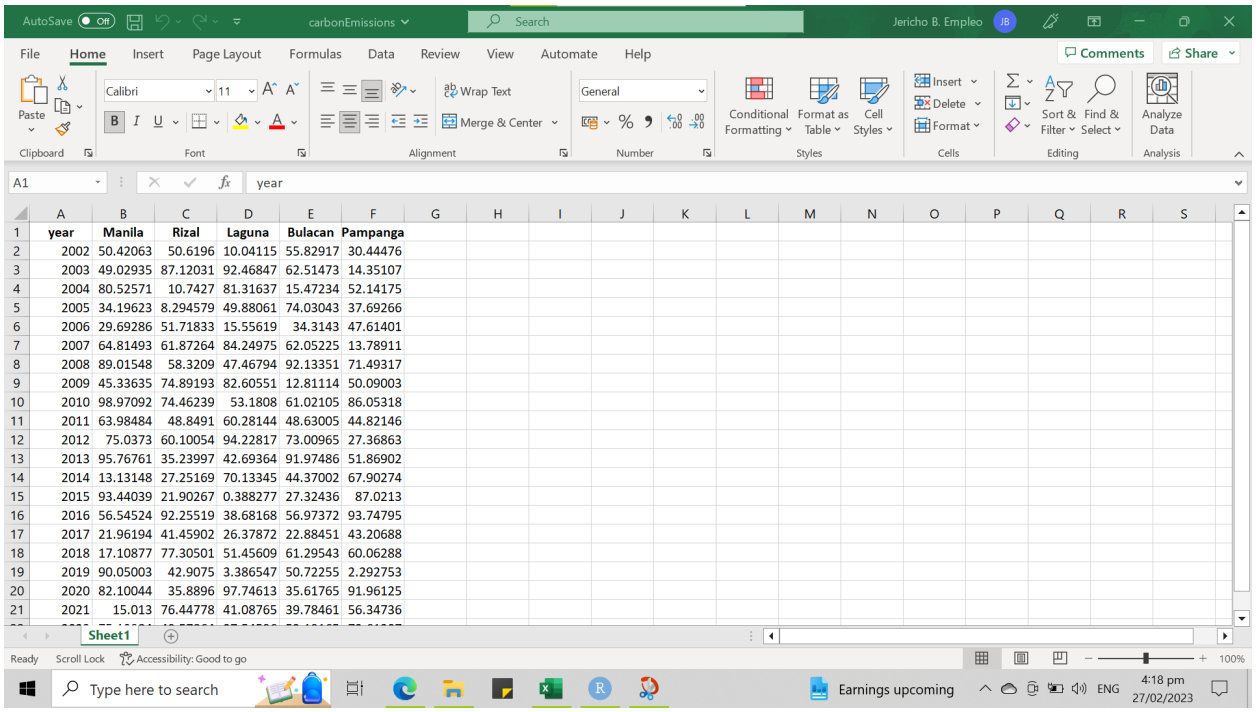
Here is the excel file of the data inserted:



year	Manila	Rizal	Laguna	Bulacan	Pampanga
2002	50.42063	50.6196	10.04115	55.82917	30.44476
2003	49.02935	87.12031	92.46847	62.51473	14.35107
2004	80.52571	10.7427	81.31637	15.47234	52.14175
2005	34.19623	8.294579	49.88061	74.03043	37.69266
2006	29.69286	51.71833	15.55619	34.3143	47.61401
2007	64.81493	61.87264	84.24975	62.05225	13.78911
2008	89.01548	58.3209	47.46794	92.13351	71.49317
2009	45.33635	74.89193	82.60551	12.81114	50.09003
2010	98.97092	74.46239	53.1808	61.02105	86.05318
2011	63.98484	48.8491	60.28144	48.63005	44.82146
2012	75.0373	60.10054	94.22817	73.00965	27.36863
2013	95.76761	35.23997	42.69364	91.97486	51.86902
2014	13.13148	27.25169	70.13345	44.37002	67.90274
2015	93.44039	21.90267	0.388277	27.32436	87.0213
2016	56.54524	92.25519	38.68168	56.97372	93.74795
2017	21.96194	41.45902	26.37872	22.88451	43.20688
2018	17.10877	77.30501	51.45609	61.29543	60.06288
2019	90.05003	42.9075	3.386547	50.72255	2.292753
2020	82.10044	35.8896	97.74613	35.61765	91.96125
2021	15.013	76.44778	41.08765	39.78461	56.34736

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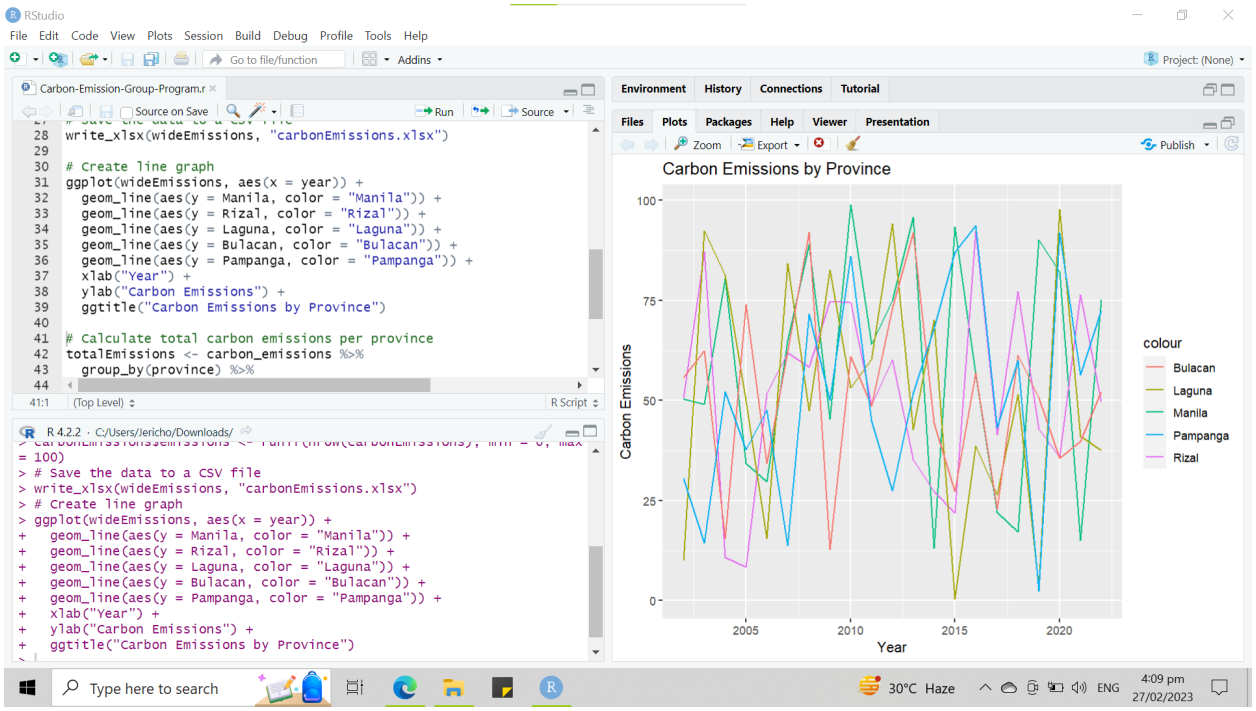
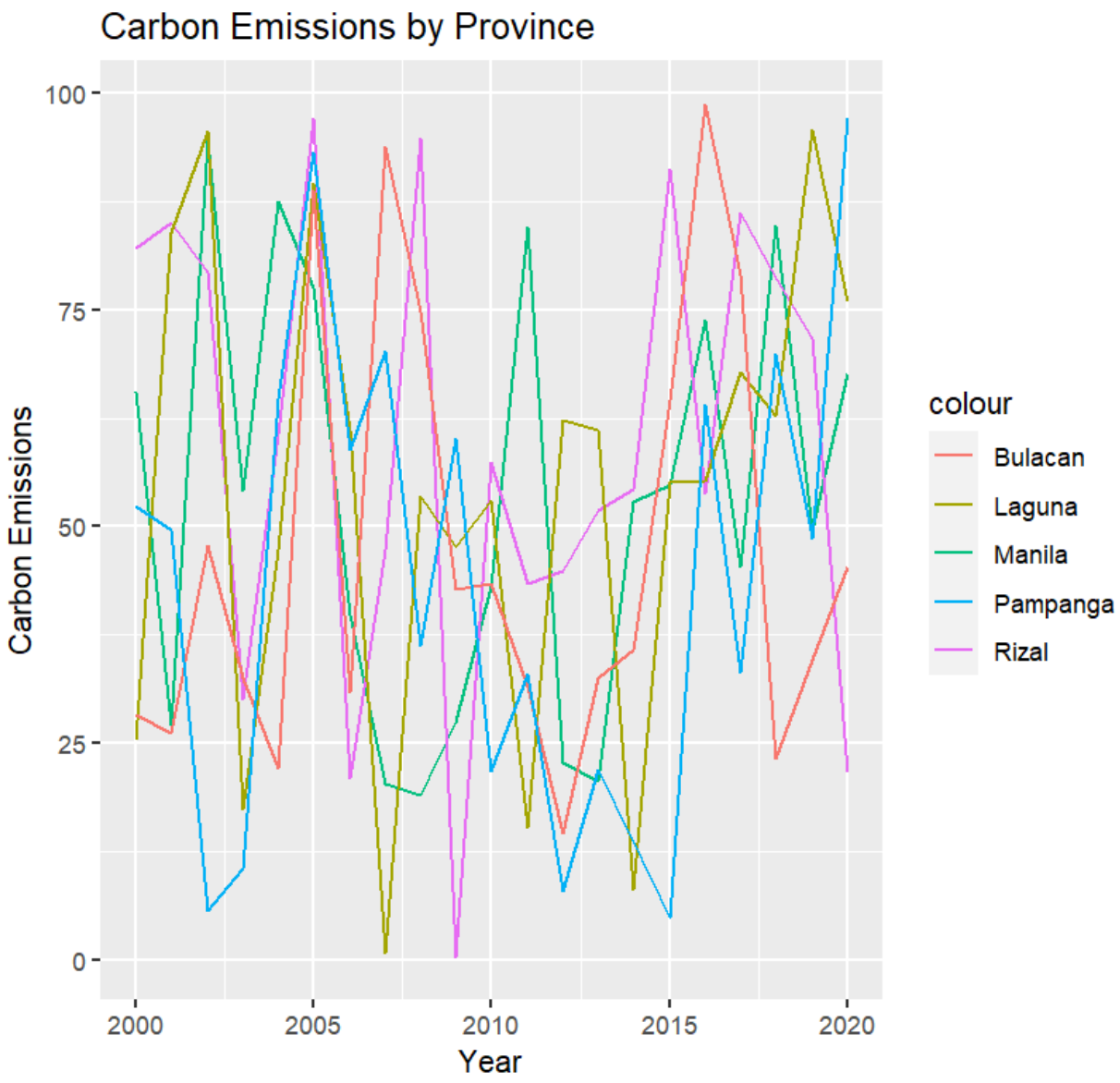
Step 6: Plotting data using ggplot2

After reading the whole excel file, plot the data as x and y axis. Import first the required library for visualization and import the xlsx library for reading xlsx data.



Step 7: Output line graph

Here is the Line graph of Carbon Emissions by Province:



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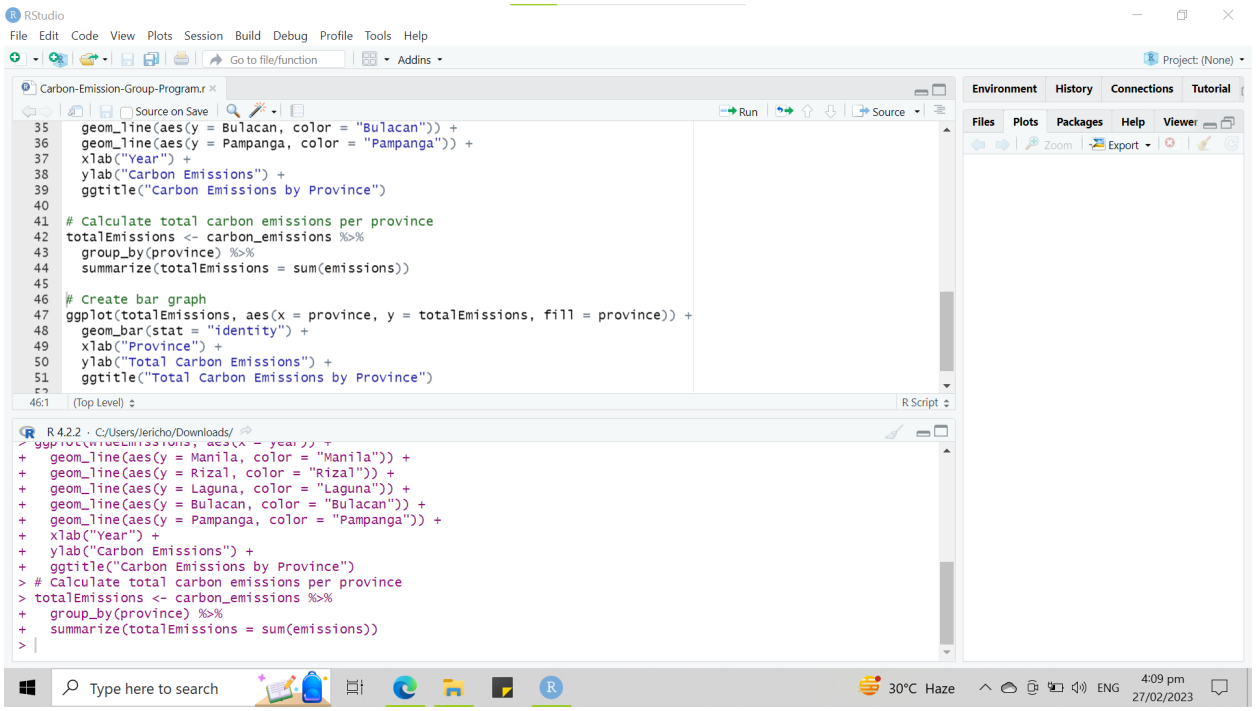
Step 8: Calculate total carbon emissions per province for bar graph

Next step is to collect all the data and calculate the total Carbon Emissions per Province and generate a bar graph of the output.



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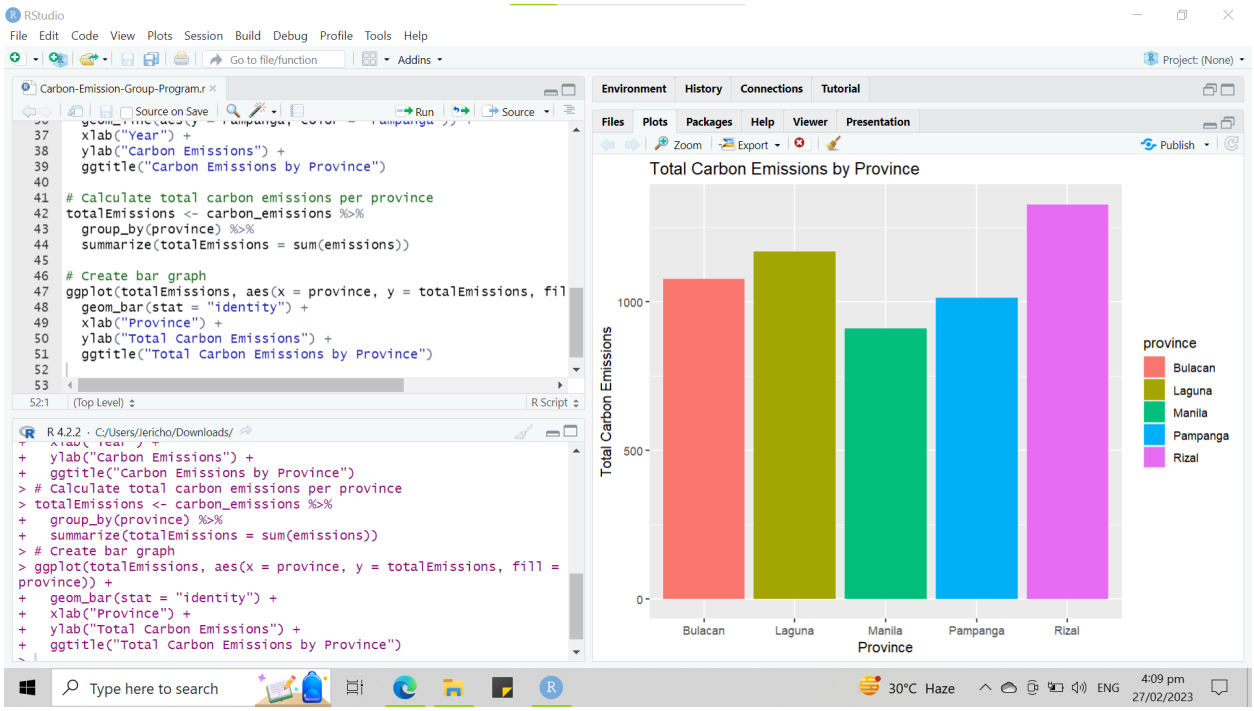
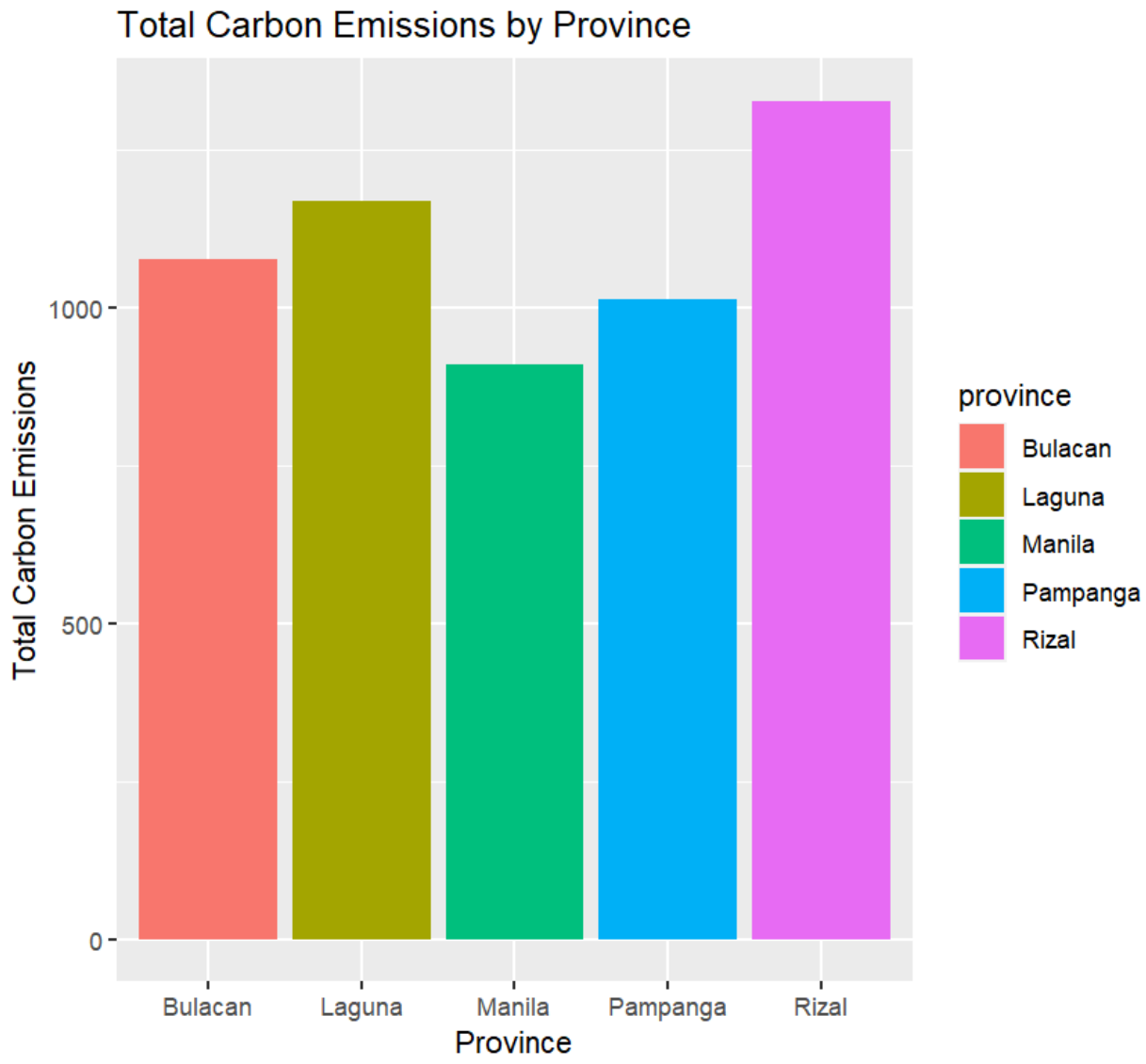
Step 9: Creating bar graph

Finally, create a bar graph for this output to visualize the total Carbon Emissions by Province.



Step 10: Output bar graph