Name: Shivam Tiwari
Roll No: 5117060

EXPERIMENT 07

Aim: Demonstrate Statistical Graphs and its use in HMI

Theory:

What is data visualization?

Yes, you know what data visualization is, but by definition, it means much more. In simple words, data visualization is a graphical representation of any data or information. Visual elements such as charts, graphs, and maps are the few data visualization tools that provide the viewers with an easy and accessible way of understanding the represented information. In this world governed by Big Data, data visualization enables you or decision-makers of any enterprise or industry to look into analytical reports and understand concepts that might otherwise be difficult to grasp.

Why is data visualization important?

By now, you would have understood how data visualization simplifies the way information is presented. However, is that the only power of data visualization? Not really. As the world is changing, the need for information is changing as well. Here are a few benefits of data visualization:

- Easily, graspable information – Data is increasing day-by-day, and it is not wise for anyone to scram through such a quantity of data to understand it. Data visualization comes handy then.
- Establish relationships – Charts and graphs do not only show the data but also established co-relations between different data types and information.
- Share – Data visualization is also easy to share with others. You could share any important fact about a market trend using a chart and your team would be more receptive about it.
- Interactive visualization – today, when technological inventions are making waves in every market segment, regardless of big or small, you could also leverage interactive visualization to dig deeper and segment the different portions of charts and graphs to obtain a more detailed analysis of the information being presented.
- Intuitive, personalized, updatable – Data visualization is interactive. You could click on it and get another big picture of a particular information segment. They are also tailored according to the target audience and could be easily updated if the information modifies.

What are different Data Visualization Tools?

Data visualization tool helps in, well, visualizing data. Using these tools, data and information can be generated and read easily and quickly. Many data visualization tools range from simple to complex and from intuitive to obtuse.

- Tableau Desktop – A business intelligence tool which helps you in visualizing and understanding your data.
- Zoho Reports – Zoho Reports is a self-service business intelligence (BI) and analytics tool that enables you to design intuitive data visualizations.
- Microsoft Power BI – Developed by Microsoft, this is a suite of business analytics tools that allows you to transform information into visuals.
- MATLAB – A detailed data analysis tool that has an easy-to-use tool interface and graphical design options for visuals.
- Sisense – A BI platform that allows you to visualize the information to make better and more informed business decisions.

What are Data Visualization Techniques?

Here are a few data visualizations that you must know:

- Know the target audience – this shouldn't come as a surprise. Designing a chart of a graph should always be done based on the audience that will view it.
- Create a goal – or more like a logical narrative. Ensure to set clear goals that must be conveyed through the infographic. Also, the relevant content type is a must.
- Choose the chart type – A pie chart does not complement every information visually. Similarly, a bar graph does not show every statistic clearly. Choose the chart part accurately to put forth the information.
- Context – Use of colours is encouraged depending upon the context. A decrease in the profit growth could be marked red, whereas green could show the increasing parameter.
- Use tools – Yes, one of the easiest ways to create data visuals is using tools. Use them as they make the charts intuitive as well as easy to read.

What are Data Visualization examples?

What better way to understand data visualization, if not with examples? Here are a few for your reference:

- Government Budget – Government budgets are always tough to understand as they number and more numbers. A recent example is a colour-coded treemap that was designed by The White House during Barack Obama's presidency, which visually broke down the US's 2016 the budget for better understanding and put government programs in context.
- World population – How would you present the world population along with their

density? Simple, by visual representation. A world map showing the population density is another data visualization example.

- Profit and loss – Business companies often resort to pie charts or bar graphs showing their annual profit or loss margin.
- Films and dialogues – Out of many characters in the film who will have how many dialogues? Data visualization is the answer here. The makers of popular sitcom 'FRIENDS' used a pie chart during shooting to ensure that every six characters have an equal number of jokes and dialogues.
- Anscombe's quartet – It is one of the most well-known and popular, which has four data sets of identical descriptive statistics, but they appear different when graphed. All of these four data sets have different distributions and consist of 11 points marked on x and y-axis.

Why do we need data visualization?

We need data visualization because a visual summary of information makes it easier to identify patterns and trends than looking through thousands of rows on a spreadsheet. It's the way the human brain works. Since the purpose of data analysis is to gain insights, data is much more valuable when it is visualized. Even if a data analyst can pull insights from data without visualization, it will be more difficult to communicate the meaning without visualization. Charts and graphs make communicating data findings easier even if you can identify the patterns without them.

In undergraduate business schools, students are often taught the importance of presenting data findings with visualization. Without a visual representation of the insights, it can be hard for the audience to grasp the true meaning of the findings. For example, rattling off numbers to your boss won't tell them why they should care about the data, but showing them a graph of how much money the insights could save/make them is sure to get their attention.

1. **Know Your Audience**

This is one of the most overlooked yet vital concepts around. In the grand scheme of things, the World Wide Web and Information Technology as a concept are in its infancy – and data visualization is an even younger branch of digital evolution. That said, some of the most accomplished entrepreneurs and executives find it difficult to digest more than a pie chart, bar chart, or a neatly presented visual, nor do they have the time to delve deep into data. Therefore, ensuring that your content is both inspiring and tailored to your audience is one of the most essential data visualization techniques imaginable. Some stakeholders within your organization or clients and partners will be happy with a simple pie chart, but others will be looking to you to delve deeper into the insights you've gathered. For maximum impact and success, you should always conduct research about those you're presenting prior to a meeting, and collating your report to ensure your visuals and level of detail meet their needs exactly.

2. **Set Your Goals**

Like any business-based pursuit, from brand storytelling right through to digital selling and beyond – with the visualization of your data, your efforts are only as effective as the strategy behind them. To structure your visualization efforts, create a logical narrative and drill down into the insights that matter the most. It's important to set a clear-cut set of aims, objectives, and goals prior to building your management reports, graphs, charts, and additional visuals. By establishing your aims for a specific campaign or pursuit, you should sit down in a collaborative environment with others invested in the project and establish your ultimate aims in addition to the kind of data that will help you achieve them. One of the most effective ways to guide your efforts is by using a predetermined set of relevant KPIs for your project, campaigns, or ongoing commercial efforts and using these insights to craft your visualizations.

3. **Choose The Right Chart Type**

One of the most effective data visualization methods on our list; to succeed in presenting your data effectively, you must select the right charts for your specific project, audience, and purpose. For instance, if you are demonstrating a change over a set of time periods with more than a small handful of insights, a line graph is an

effective means of visualization. Moreover, lines make it simple to plot multiple series together.

4. **Take Advantage Of Color Theory**

The most straightforward of our selected data visualization techniques – selecting the right color scheme for your presentational assets will help enhance your efforts significantly. The principles of color theory will have a notable impact on the overall success of your visualization model. That said, you should always try to keep your color scheme consistent throughout your data visualizations, using clear contrasts to distinguish between elements (e.g. positive trends in green and negative trends in red). As a guide, people, on the whole, use red, green, blue, and yellow as they can be recognized and deciphered with ease.

5. **Handle Your Big Data**

With an overwhelming level of data and insights available in today's digital world – with 1.7 megabytes of data to be generated per second for every human being on the planet by the year 2020 – handling, interpreting and presenting this rich wealth of insight does prove to be a real challenge.

6. **Use Ordering, Layout, And Hierarchy To Prioritize**

Following on our previous point, once you've categorized your data and broken it down

to the branches of information that you deem to be most valuable to your organization, you should dig deeper, creating a clearly labelled hierarchy of your data, prioritizing it by using a system that suits you (color-coded, numeric, etc.) while assigning each data set a visualization model or chart type that will showcase it to the best of its ability. Of course, your hierarchy, ordering, and layout will be in a state of constant evolution but by putting a system in place, you will make your visualization efforts speedier, simpler, and more successful.

7. **Utilize Word Clouds And Network Diagrams**

To handle semi-structured or decidedly unstructured sets of data efficiently, you should consult the services of network diagrams or cloud words. A network diagram is often utilized to draw a graphical chart of a network. This style of layout is useful for network engineers, designers, and data analysts while compiling comprehensive network documentation. Akin to network diagrams, word clouds offer a digestible means of presenting complex sets of unstructured information. But, as opposed to graphical assets, a word cloud is an image developed with words used for a particular text or subject, in which the size of each word indicates its frequency or importance within the context of the information.

8. **Include Comparisons**

This may be the briefest of our data visualization methods, but it's important nonetheless: when you're presenting your information and insights, you should include as many tangible comparisons as possible. By presenting two graphs, charts, diagrams together, each showing contrasting versions of the same information over a particular time frame, such as monthly sales records for 2016 and 2017 presented next to one another, you will provide a clear-cut guide on the impact of your data, highlighting strengths, weaknesses, trends, peaks, and troughs that everyone can ponder and act upon.

9. **Tell Your Tale**

Similar to content marketing, when you're presenting your data in a visual format with the aim of communicating an important message or goal, telling your story will engage your audience and make it easy for people to understand with minimal effort. Scientific studies confirm that humans, in large, respond better to a well-told story and by taking this approach to your visualization pursuits, you will not only dazzle your colleagues, partners, and clients with your reports and presentations, but you will increase your chances of conveying your most critical messages, getting the buy-in and response you need to make the kind of changes that will result in long-term growth, evolution and success. To do so, you should collate your information, thinking in terms of a writer, establishing a clear-cut beginning, middle, and end, as well as a conflict and resolution, building tension during your narrative to add maximum impact to your various visualizations.

10. **Apply Visualization Tools For The Digital Age**

We live in a fast-paced, hyper-connected digital age that is far removed from the pen and paper or even copy and paste mentality of the yesteryears – and as such, to make a roaring visualization success, you should use the digital tools that will help you make the best possible decisions while gathering your data in the most efficient, effective way. A task-specific, interactive online dashboard or tool offers a digestible, intuitive, comprehensive, and interactive means of collecting, collating, arranging, and presenting data with ease – ensuring that your techniques have the most possible impact while taking up a minimal amount of your time. We hope these data visualization concepts served to help propel your efforts to new successful heights. To enhance your ongoing activities, explore our cutting-edge business intelligence and online data visualization tool.

Types of Graphs

1. **Pareto Diagram or Bar Graph**

A Pareto diagram or bar graph is a way to visually represent qualitative data. Information is displayed either horizontally or vertically and allows viewers to compare items. The bars are arranged in order of frequency, so more important categories are emphasized Bar graphs can be either single, stacked, or grouped.

2. **Pie Chart**

A general way to represent data graphically is a pie chart. It gets its name from the way it looks, just like a circular pie that has been cut into several slices. This kind of graph is helpful when graphing qualitative data where the information describes a trait or attribute and is not numerical. Each slice of pie represents a different category, and each trait corresponds to a different slice of the pie

3. **Histogram**

This type of graph is used with quantitative data. Ranges of values, called classes, are listed at the bottom, and the classes with greater frequencies have taller bars. A histogram often looks similar to a bar graph, but they are different because of the level of measurement of the data. Bar graphs measure the frequency of categorical data. A categorical variable is one that has two or more categories, such as gender or hair color. Histograms, by contrast, are used for data that involves ordinal variables, or things that are not easily quantified, like feelings or opinions.

4. **Stem and Leaf Plot**

A stem and leaf plot breaks each value of a quantitative data set into two pieces: a stem, typically for the highest place value, and a leaf for the other place values. It provides a way to list all data values in a compact form.

5. **Dot Plot**

A dot plot is a hybrid between a histogram and a stem and leaf plot. Each quantitative data value becomes a dot or point that is placed above the appropriate class values. Where histograms use rectangles—or bars—these graphs use dots, which are then joined together with a simple line, says statisticshowto.com.

6. **Scatter Plot**

A scatter plot displays data that is paired by using a horizontal axis (the x-axis), and a vertical axis (the y-axis). The statistical tools of correlation and regression are then used to show trends on the scatterplot. A scatter plot usually looks like a line or curve moving up or down from left to right along the graph with points "scattered" along the line. The scatter plot helps you uncover more information about any data set, including:

- The overall trend among variables. You can quickly see if the trend is upward or downward.
- Any outliers from the overall trend
- The shape of any trend
- The strength of any trend

7. **Time Series**

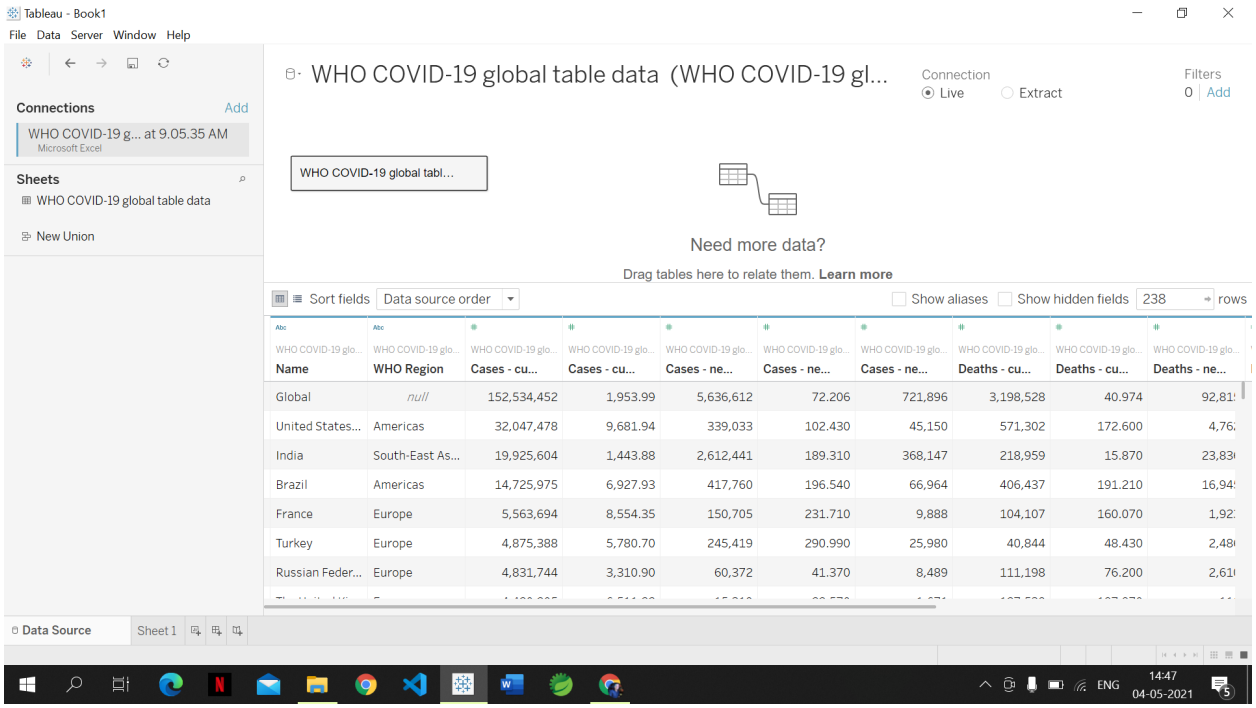
A time-series graph displays data at different points in time, so it is another kind of graph to be used for certain kinds of paired data. As the name implies, this type of graph measures trends over time, but the timeframe can be minutes, hours, days, months, years, decades, or centuries. For example, you might use this type of graph to plot the population of the United States over the course of a century.

Conclusion:

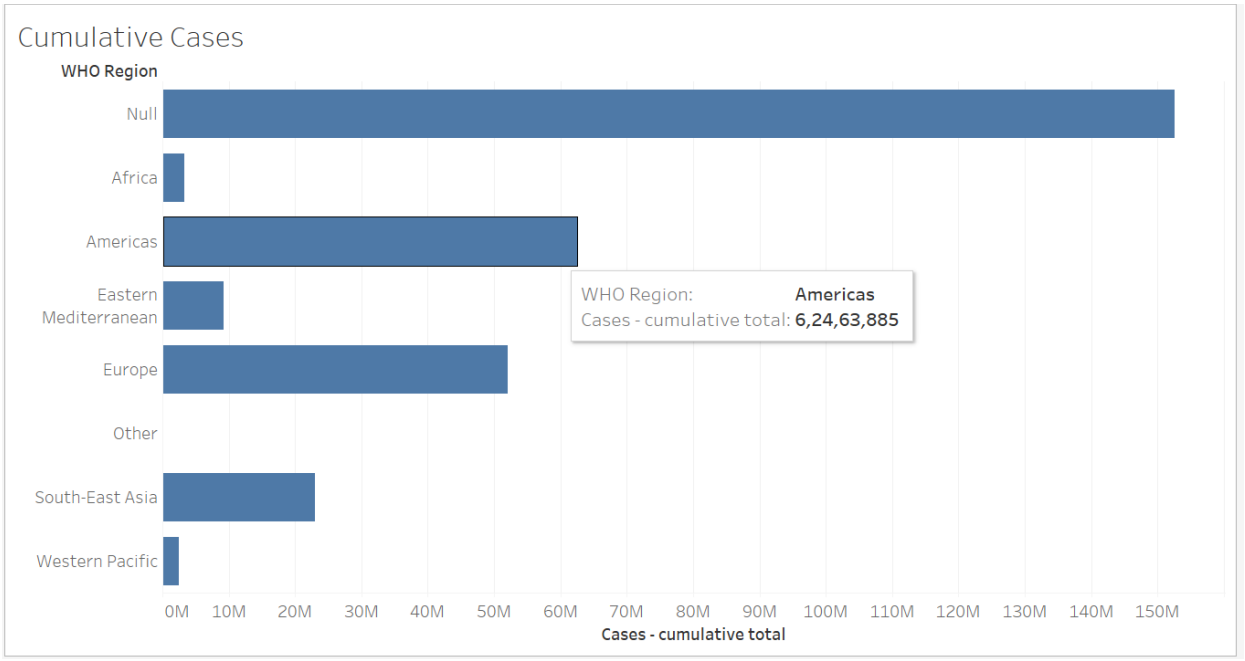
Data visualization is a graphical representation of any data or information. Visual elements such as charts, graphs, and maps are the few data visualization tools that provide the viewers with an easy and accessible way of understanding the represented information. Using data visualization tools, data and information can be generated and read easily and quickly.

OUTPUT:

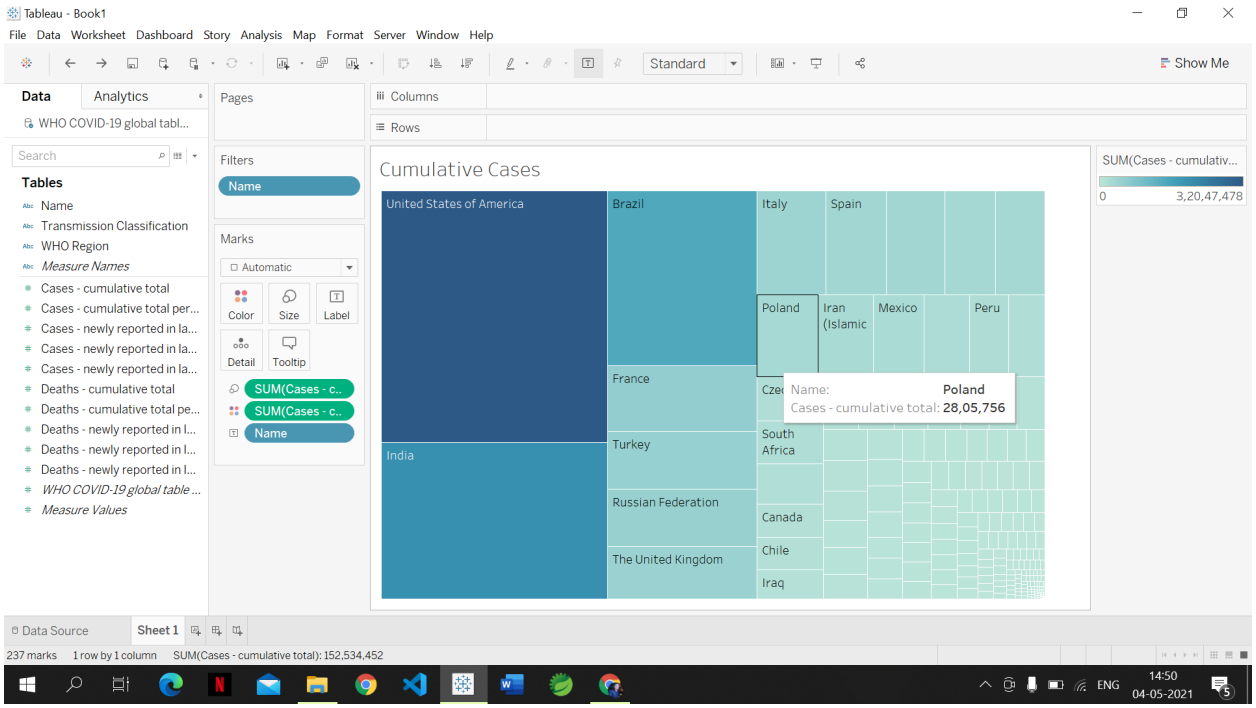
Using Tableau to visualize covid 19 Data, Using the Dataset provided by WHO



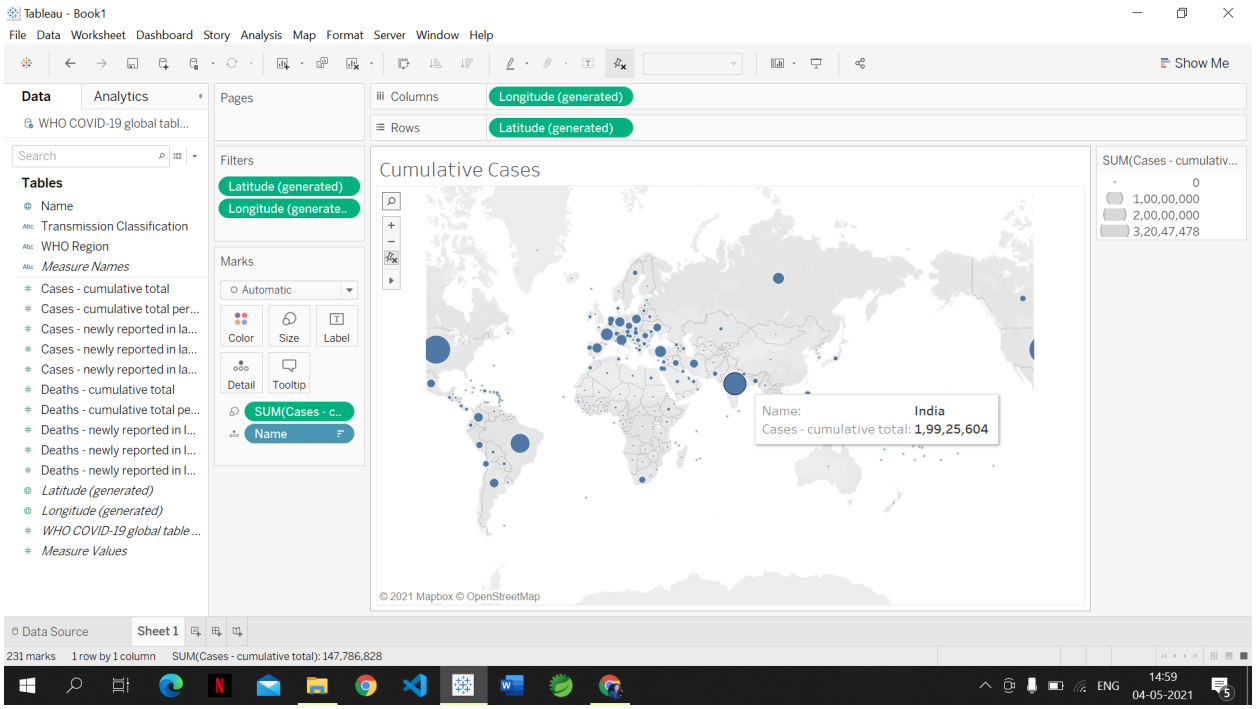
Using a Horizontal bar plot to visualize the cumulative cases by region



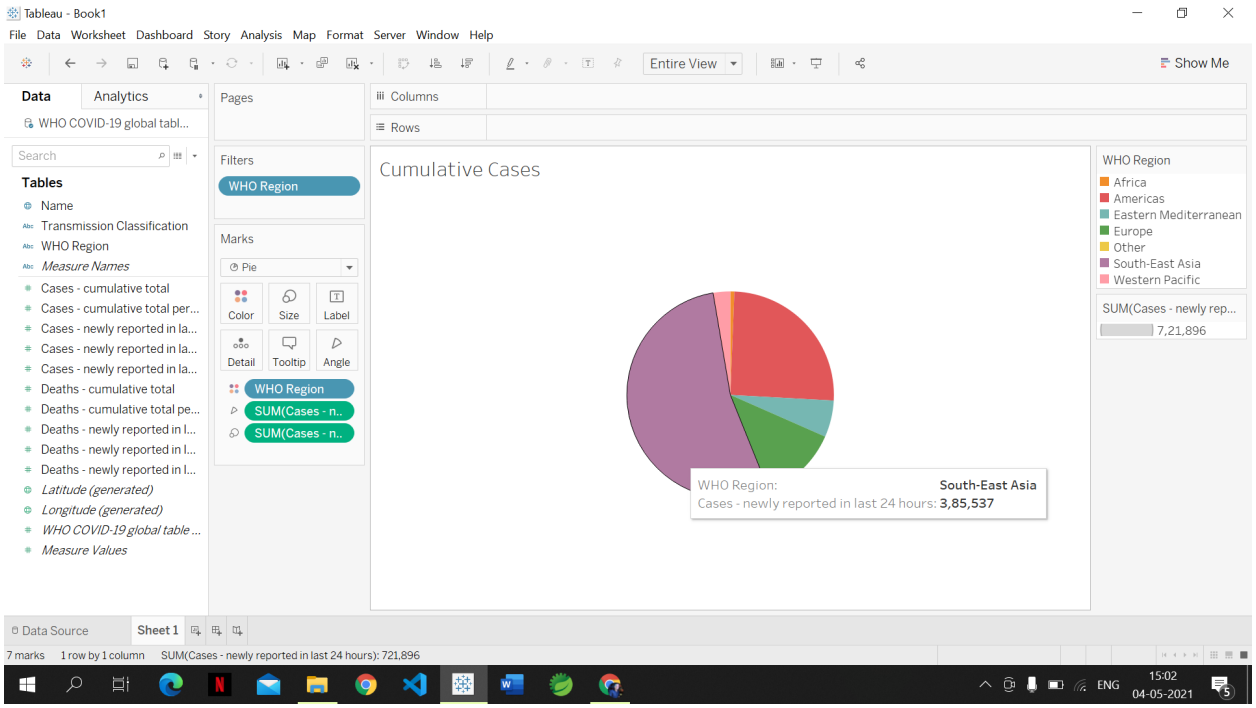
Using Tree Maps to show the cases by regions



Cumulative Cases on a MAP



Viewing the Cases by Region



Scatter Plot for Visualizing Deaths per region