**Instructions on how to run your code and view the visualizations**

**1.1 D3 Visualization: Global Terrorism Heatmap**

1. Open heatmap.html in VS Code.
2. Right-click anywhere in the code.
3. Click “Open with Live Server”.
4. A browser window will open the visualization.

**1.2 Top 10 Terrorist Groups Bar Chart**

1. Right-click bar\_chart.html in VS Code
2. Select “Open with Live Server”

**2. Plotly Visualization: Attack Types Over Time**

Right-click on attack\_types\_chart.html in VS Code and select "Open with Live Server".

**3. Bokeh Visualization: Target Types and Casualties**

Make sure Bokeh is installed, if not run “pip install bokeh”

Run the following command

(“python -m bokeh serve --show plot\_target\_casualties.py”) in the terminal.

**If you already have the terminal open:**

1. **Stop the existing server**  
   Press Ctrl + C in the terminal to stop the Bokeh server.
2. **Restart the app**  
   Run the command again:

python -m bokeh serve --show plot\_target\_casualties.py

**Brief explanation of your design choices and any insights gained from the visualizations.**

**1.1 D3 Heatmap: Global Terrorism Heatmap**

**Design Choices:**

* World Map with Color Encoding: I chose to display the data on a world map using D3.js to visualize the global distribution of terrorist incidents by country. The number of incidents in each country is color-coded to make the data easily interpretable.
* Interactive Year Slider: The inclusion of a year slider allows users to filter the data by specific years. This makes the heatmap dynamic and lets users observe how terrorism patterns change over time.
* Color Legend: The color gradient was chosen to represent the intensity of incidents, with a higher count represented by a darker color. This helps users easily identify regions with higher terrorism activity.
* Tooltips: The tooltips show specific information (country name and number of incidents) when hovering over a country. This makes the map more informative and interactive.
* From the heatmap visualization, we can see that the terrorism incidents in United States is higher than Canada and Mexico in most of the years.
* The terrorism incidents had a maximum of 488 in United States in 1970 and reduced and 95 in Mexico in the year 1997 and a maximum of 16 in 2017.

**1.2 Top 10 Terrorist Groups Bar Chart**

**1. Horizontal Bar Chart**:

Chosen to easily show the **relative frequency of terrorist incidents** for different groups in a **top 10 format**.

Horizontal layout allows for better visibility of longer group names.

1. **Color Scheme**:

Bars are colored in **gradients of red** to match the heatmap design, providing visual coherence across both visualizations.

1. **Year Dropdown**:

Allows users to select a year and see how the rankings of terrorist groups change.

1. **Text Labels**:

Incident counts are displayed on the bars to give users quick access to the exact data without needing to hover.

1. **General Trends and Observations:**

* **Persistence of White Supremacist Groups**:
  + White Supremacists/Nationalists are a consistent presence across most years, reflecting ongoing issues with racial violence and hate crimes.
* **Emerging Extremist Movements**:
  + Newer extremist movements like the Boogaloo Movement and Conspiracy Theory Extremists show a shift towards anti-government and anti-establishment ideologies, often amplified by online platforms.
* **Ideological Shift**:
  + There’s a clear shift from traditional terrorist groups to those driven by political conspiracy, social justice movements, and eco-terrorism, indicating evolving global and domestic challenges.

**2. Plotly Visualization: Attack Types Over Time**

Based on the three visualizations (Stacked, Grouped, and 100% Stacked area charts), here are the insights:

**1. Stacked Area Chart:**

* **Trends Over Time:** The Stacked Area chart shows the cumulative number of incidents for each attack type over time. You can see that incidents peaked around the early 1980s and then gradually declined until around the mid-1990s.
* **Major Attack Types:** Armed Assault, Bombing/Explosion, and Facility/Infrastructure Attack consistently have the highest number of incidents across the years. These attack types dominate the data in terms of frequency.
* **Emerging Patterns:** In the 2000s, incidents related to "Hostage Taking (Kidnapping)" and "Unknown" incidents started to rise, especially post-2010, suggesting a shift in the type of terrorism-related activities. The "Facility/Infrastructure Attack" also has a noticeable increase in recent years.

**2. Grouped Area Chart:**

* **Individual Trends:** Unlike the stacked chart, the Grouped Area chart separates each attack type by its own trendline. This allows for clearer comparisons between attack types.
* **Decreased Dominance of Armed Assault:** The “Armed Assault” category shows a significant drop after the early 1980s, whereas incidents of “Hostage Taking (Kidnapping)” and "Hijacking" see slight increases post-1990.
* **Increase in Other Attack Types:** Bombing/Explosion and Facility/Infrastructure Attack see a noticeable rise post-2000, indicating a shift in the types of attacks that are occurring. The rise in the "Unknown" category in the later years suggests that incidents are being categorized differently, possibly due to more detailed data or broader definitions in the modern era.

**3. 100% Stacked Area Chart:**

* **Proportional Analysis:** This chart normalizes the data, meaning that the total number of incidents each year is represented as 100%. This helps to understand the relative contribution of each attack type, independent of the overall number of incidents.
* **Shift in Proportions:** The proportion of "Armed Assault" as a fraction of the total incidents decreases significantly after the 1980s, while the proportion of "Hostage Taking (Kidnapping)" and "Hijacking" gradually increases. In particular, "Hostage Taking (Kidnapping)" becomes more prevalent in the recent years.
* **Bombing/Explosion's Share:** This attack type maintained a significant proportion throughout the years, particularly peaking around the 1970s. However, its share becomes less pronounced over time, as other attack types start to emerge and increase in frequency.
* **Emergence of New Patterns:** The chart highlights the diversification of attack types, with a notable rise in “Unknown” and “Facility/Infrastructure Attack” in recent years.

**Key Observations Across All Visualizations:**

* **Dominant Attack Types:** "Armed Assault," "Bombing/Explosion," and "Facility/Infrastructure Attack" are consistently dominant in the number of incidents. These trends show how the frequency of certain attack types has evolved over time.
* **Shifts in Attack Types:** In the recent years (post-2000), we see shifts in the type of attacks, with "Hostage Taking (Kidnapping)" and "Facility/Infrastructure Attack" showing increased trends. This reflects the global rise in targeted and strategic attacks, particularly against infrastructure.
* **Uncertain Data and Emerging Attack Types:** The "Unknown" category is steadily growing, which may imply a shift in data collection practices or a rise in new, less defined attack strategies.
* **Geopolitical Insights:** The changes in attack types suggest that geopolitical shifts, evolving terrorist strategies, and changes in the methods of attack have led to new trends over the years.

1. **Bokeh Visualization: Target Types and Casualties**

**Brief Explanation of Design Choices:**

1. **Scatter Plot**:  
   Chosen to clearly show the relationship between **number killed (x-axis)** and **number wounded (y-axis)** in each attack.
2. **Size by Total Casualties**:  
   Each circle’s size represents the **total number of casualties** (killed + wounded), making severe incidents stand out visually.
3. **Color by Target Type**:  
   Distinct colors are used for each **target type** (e.g., Police, Business, Government), helping quickly identify patterns and categories.
4. **Year Slider**:  
   An interactive **slider filters the data by year**, allowing users to explore how targets and casualty patterns change over time.
5. **Hover Tool**:  
   Displays **target type, number killed, and number wounded** when hovering, giving deeper insight without cluttering the graph.
6. **Legend Placement**:  
   The **legend is placed on the right**, neatly associating colors with target types while keeping the plot area clean.

**Insights Gained from the Visualizations**

1. **Temporal Variation in Casualties**:
   * Casualty severity varies drastically across years.
   * For example, in **1975**, there's a **large incident involving Business targets**, seen as a huge circle.
2. **Target Type Trends**:
   * Over the years, the **types of targets change**. Earlier years show attacks on **Government or Business**, while later years involve **Journalists, NGOs, and Police** more frequently.
3. **Wounded Often Outnumber Killed**:
   * Y-axis values (wounded) are often higher than X-axis (killed), meaning injuries outnumber fatalities in most cases.
4. **Low-Fatality, High-Impact Events**:
   * Some points show **very high wounded counts with few or no deaths**, suggesting **non-lethal attacks** (e.g., bombings or gas).