1.   a. This treemap is effective in visually representing the distribution of electoral votes in the 2012 U.S. Presidential election. Each state is sized proportionally to its electoral votes, making it easy to see which states carry more weight in the election. The use of color to differentiate between the two candidates also helps in quickly identifying which candidate won which states.

b.

- Legibility: The text for smaller states is quite small, making it hard to read. States like Rhode Island, Delaware, and Vermont are not easily identifiable.
- Color Contrast: There is insufficient contrast between the colors of some states, especially between adjacent states with similar shades of red or blue, which can make it difficult to distinguish their boundaries.
- Detail: The treemap does not include any information about the margin of victory or the vote percentages within each state, which could provide more insight into the election dynamics.

c.

- Opacity Levels: Adjust the opacity of each state's color based on the percentage of the popular vote received by the candidate winning the state. A higher opacity could indicate a larger share of the popular vote.
- Color Intensity: Vary the intensity of the color to reflect the popular vote percentage. Darker shades could represent a higher percentage of the popular vote.
- Additional Text Labels: Include a small label inside each state box that shows the popular vote percentage or total number of votes for the candidate who won the state.

d. The color choice here uses red and blue, which are traditional for representing the two major U.S. political parties. However, this choice may not be the friendliest for those with color vision deficiencies (CVD), particularly because shades of red and blue can be difficult to distinguish for some types of color blindness.

To improve CVD accessibility, using distinctively different hues (such as purple and yellow) or adding patterns (like stripes or dots) to the colors could help differentiate the states for viewers with color vision issues.

2.     a. This treemap is a strong visual representation of the stock market's performance. It effectively groups companies by industry, provides color-coded data on individual stock changes, and shows relative sizes based on market capitalization or another financial metric. The additional large labels for major companies and the varied shades indicating stock price movement enhance the usability and informative value of the map.

b.

- Complexity: The treemap is highly detailed, which can be overwhelming at first glance. There is a lot of information packed into a small space, making it challenging for a novice or someone not familiar with the stock market to understand quickly.
- Color Saturation: There is heavy use of green and red colors, which, while standard for showing market movement, could be difficult for people with color vision deficiencies to differentiate.
- Interactivity Requirement: The need to hover or click to get more detailed information makes this less usable in static or printed form. It also can be less accessible on mobile or touch devices where hover functionality may not be as straightforward.

c.

- Simplify Visuals: Introduce filtering options to allow users to view only certain sectors or to simplify the display to show only major movers.
- Accessibility Improvements: Add alternative color schemes to cater to users with color vision deficiencies. Incorporating textures or patterns could also help.
- Static Information Display: Include some basic information statically visible without needing interaction, such as percentage change, to make the treemap useful in non-interactive contexts.

d. The color associated with each industry likely represents the collective or average stock movement within that sector. For example, a predominantly

green sector would indicate overall growth in that industry for the day, whereas red would indicate a decline. This aggregation helps investors quickly gauge sector performance and can influence investment decisions based on industry trends.

e.

- Adding a Level Above: Introducing a higher level, such as grouping industries into larger categories (e.g., technology, consumer goods, services), could help by providing an even broader overview. However, it could also make individual stock movements less discernible briefly.
- Adding a Level Below: Adding more granular details, such as sub-sectors or individual product lines, could provide deeper insights but might overwhelm the viewer with too much information, making the treemap cluttered and harder to interpret.

3. a. This treemap is a good visualization for representing the world oil consumption data because it allows for a quick visual comparison of oil consumption across different countries. Each block's size is proportional to the amount of oil consumed, which provides an intuitive sense of scale and importance. The use of different colors helps distinguish between countries, although the specific choice of colors seems arbitrary and does not indicate a category or trend.

b.

- Color Coding by Region: Implement a color scheme that groups countries by geographical region or economic status. For instance, countries from the same continent could share similar hues but different shades. This would provide additional context and make the map more informative.
- Consistent Color Gradient: Use a color gradient to indicate levels of consumption more clearly. For example, darker colors could indicate higher consumption, and lighter colors could indicate lower consumption. This would help in quickly identifying high and low consumers of oil.

- Interactive Elements: Add tooltips or clickable links that provide more detailed information about each country's oil consumption history, sources of oil, and other relevant economic data.
- Legibility Improvements: Increase the font size for smaller blocks or provide a mini-map or sidebar with listed data that users can refer to if the text in the treemap is too small to read. This would help in cases where countries with small consumption figures become difficult to identify.
- Border Contrasts: Increase the contrast or thickness of borders between countries to enhance separation in visually crowded areas of the map. This would make it easier to distinguish between countries with similar consumption levels.
- Include a Legend or Scale: Provide a legend explaining what the colors signify (if a meaningful color scheme is implemented) and a scale indicating the range of consumption values represented by the size of the blocks.


4. **Structures Suited for Treemaps:**

- Shallow Trees: Trees with few levels of hierarchy (low depth) are ideal for treemaps because they provide a clear and uncluttered view of each category and its relative importance without overwhelming the viewer.
- Balanced Trees: Trees where each node has roughly the same number of children or similar weights ensure that the treemap is balanced and easy to read. This helps in avoiding too small or indistinguishably tiny sections that are hard to interact with or interpret.
- Trees with Larger Leaf Nodes: Trees where the leaf nodes (final level nodes) represent a significant portion of the total weight or size provide more meaningful data points for comparison in a treemap, as they highlight significant categories effectively.

**Structures Poorly Suited for Treemaps:**

- Deep Trees: Trees with many levels of hierarchy can make treemaps very cluttered and difficult to navigate. The deeper the tree, the smaller and more compressed the subcategories become, which can

render labels unreadable and distinctions between categories less clear.

- Unbalanced Trees: If a tree has very uneven distributions of weight or node counts (e.g., one branch is significantly heavier or has more nodes than others), it can lead to a treemap where some sections dominate the view disproportionately, making it difficult to appreciate smaller but potentially important categories.
- Sparse Trees: Trees with many nodes having only one or very few children can result in a treemap with many thin, elongated sections, which are not only visually unappealing but also inefficient in space usage and difficult to interpret.

5.

- Overcrowding: In treemaps, particularly those with deep hierarchies or many categories, the space can become overcrowded. This makes it difficult to discern smaller categories or those that take up less space, potentially leading to a loss of information.
- Legibility Issues: The labels within smaller blocks can become unreadable, especially as the number of categories increases. This compromises the utility of the treemap, particularly in static forms where interactive features like zooming are not available.
- Non-intuitive for Hierarchical Depth: While treemaps are good for showing hierarchical data in terms of area, they do not inherently convey the depth of the hierarchy very well.
- Color and Pattern Limitations: Dependence on color to differentiate between categories can lead to issues for users with color vision deficiencies. Furthermore, using too many colors or patterns can make the map chaotic and difficult to interpret.
- Aspect Ratios: Treemaps can sometimes produce very elongated rectangles, which can distort the perception of their relative size. This geometric distortion can mislead viewers about the true significance of certain data points.
- Static Nature: While interactive treemaps can mitigate many issues, static treemaps do not offer this flexibility. Users cannot drill down for more details

or adjust the view to better understand the data, which limits the treemap's usefulness in printed or fixed media formats.

- Sensitivity to Data Changes: Treemaps can be sensitive to minor changes in data, which might result in significantly different layouts. This lack of stability in the visualization can be confusing if the treemap is used for comparative purposes over time.
- No Standard Scales: Unlike bar charts or line graphs, there is no standard scale in a treemap. This can make it hard for viewers to judge the exact proportions of the categories without explicit numerical labels, which themselves can clutter the visualization.
- Boundary Definition: The boundaries between categories in a treemap can sometimes be hard to distinguish, especially if the colors are similar or if the divisions are very narrow. This can lead to misinterpretation of which area belongs to which category.


6. Aging Population: There is a clear trend of an ageing population over the years. In 1961, the pyramid had a broad base, indicating a large younger population. By 2017, the base has narrowed significantly, and there is a noticeable expansion in the higher age groups (50-80+ years). This suggests a decrease in birth rates and an increase in life expectancy, typical of a demographic transition in developed regions.

Gender Imbalance in Older Age Groups: In the later years, particularly in 2001 and 2017, there is a noticeable gender imbalance in the older age groups, with more females than males. This could be indicative of higher life expectancy for females in Hong Kong, which is a common trend observed in many parts of the world.

Population Growth Slowdown: The overall shape of the pyramid changes from a traditional pyramid shape in 1961 to a more bell-shaped in 2017. This transformation suggests a slowing down of population growth. In 1961, the larger younger population (broader base of the pyramid) indicated high birth rates and rapid population growth, whereas by 2017, the more uniform distribution across age groups and the narrower base suggests lower birth rates and a stabilization or even potential decline in population growth.

7.      Given the balanced structure of the tree in the image, a sunburst chart would generally be preferable if the goal is to clearly communicate the structure of the hierarchy and enable interactive exploration while maintaining an aesthetic and balanced representation of the data. This would allow viewers to understand the relative composition of the tree quickly and intuitively, which aligns well with the strengths of sunburst charts in visualizing structured and hierarchical data.

8.      For the initial dataset of 8 cities, Option 2 (Bar Chart) is generally the most versatile and effective choice, particularly if the goal is to compare specific numeric values across cities, such as population, tourist numbers, or economic indicators. Bar charts are straightforward and allow for easy comparison of data across different categories without the interpretative challenges of pie charts or the potential clutter of treemaps.

If the number of cities increases to 100, the pie chart (Option 1) would be impractical due to the sheer number of slices needed, making it unreadable. The treemap (Option 3) could potentially handle this increase better than the pie chart but might also become too cluttered to effectively convey detailed information for each city.

The bar chart (Option 2) remains a strong choice even with 100 cities, particularly if it is designed with interactive features like scrolling or zooming, or if it is segmented into smaller, more manageable groups (e.g., by country or continent). However, visual clutter and the difficulty of displaying all cities simultaneously without losing readability could be a challenge.

9.      a. The treemap uses color to represent median household income across different regions and states in the U.S. It appears that a gradient of green to red is used, with green likely representing a lower median income and red representing a higher median income. This coloring helps to visually differentiate the economic status of each region and state.

Similarly, the sunburst chart employs a color gradient from green to red to denote median household income. The innermost circle represents the United States, which then branches out into various regions, and further into

individual states. The same green-to-red gradient is used to indicate the economic variance from lower to higher median incomes.

b. The sunburst chart provides more explicit and visually clear information about the inner nodes of the hierarchy compared to the treemap. This is because the sunburst chart organizes its data concentrically, making it easier to follow the hierarchy from the innermost circle (the highest level, e.g., the entire country) out to the outer circles (lower levels, e.g., regions and states). Each level of the hierarchy is clearly segmented, making it easier to interpret the hierarchical relationships between the sections.

c. If another level is to be added to the bottom of the hierarchy, the sunburst chart would more suitably accommodate this addition. In a sunburst chart, adding another ring around the existing structure can seamlessly introduce more detailed subdivisions (like cities within states) while preserving the visual and intuitive understanding of the hierarchical data structure. Each ring represents a level of the hierarchy, so viewers can easily navigate through these layers to see the relationships and proportions at each level.

In contrast, adding another level in a treemap could result in smaller and more fragmented rectangles, potentially making the chart too cluttered and harder to read, especially for regions with many sub-regions or categories.

10. a. For visualizing the sales data from a fruit stand, I would recommend using the bar chart over the pie chart because of these three reasons:

- Clarity in Comparisons: The bar chart clearly shows the differences in sales volume between the different fruits. It is easy to compare the heights of the bars directly against each other, which makes it straightforward to see which fruits sell more and which sell less.
- Easier to Read Exact Values: The bar chart allows for exact values to be easily read off the y-axis, giving a precise measure of sales volume for each fruit.
- Scalability: If the number of fruit types were to increase, the bar chart would still effectively display the data without becoming cluttered,

whereas a pie chart might become too crowded with many small slices, making it hard to distinguish between them.

b. The specific pie chart provides a unique insight that is less immediately apparent in the bar chart:

- Proportional Contribution: The pie chart shows the proportion of total sales represented by each fruit, which highlights the relative importance of each fruit to the overall sales mix. For example, you can see that apples constitute a significant majority of the sales (53.0%), a detail that stands out more strikingly in the pie chart than in the bar chart.