

## Part 1: Fundamentals of Visualization 1(a).

- **Clarity** means that the viewer can easily interpret what the visualization is saying, without confusion or distraction.
- **Precision** ensures that the data is accurately represented, such that small differences or trends are faithfully shown.
- **Efficiency** refers to how quickly and intuitively someone can grasp the insight from the visual—without needing excessive explanation.

### 1(b).

A pie chart showing budget distribution across 20 categories might lack clarity due to too many segments. Replacing it with a horizontal bar chart would improve clarity and precision by better comparing values side-by-side.

### 2(a).

In a world flooded with data, visualization becomes essential for transforming raw numbers into understandable insights. When data is freely available, the ability to extract meaning and communicate it visually is what sets valuable analysis apart.

### 2(b).

Effective visualization highlights trends, outliers, and relationships in data. For example, a scatter plot showing income vs. education level can reveal patterns more clearly than raw tables, helping to derive conclusions and actionable insights.

## Part 2: Visual Encoding and Perception

### 3(a).

Exploratory visualization is used when analyzing data to discover patterns, trends, or anomalies. For example, during early analysis of customer behavior data, the goal is to identify meaningful patterns.

### 3(b).

Explanatory visualization is used to communicate a known story or insight. For instance, presenting a line chart showing a steady rise in revenue over quarters to stakeholders with the goal of communicating business growth.

### 4(a).

According to Tamara Munzner, position and length are the most effective channels for encoding

quantitative data. This is because humans are best at perceiving position and length accurately, leading to better interpretation.

**4(b).**

Identity channels like color hue and shape are used to differentiate categories rather than show quantities. For example, in a scatter plot, different shapes can represent product categories like electronics, clothing, and books.

**5.**

- **Expressiveness** means all necessary information is visually represented—nothing more, nothing less.
- **Effectiveness** ensures that the visual elements are easy to interpret.  
Both are crucial to avoid misleading visuals and to help users gain accurate insights efficiently.

## **Part 3: Narrative, Color, and Design**

**6(a).**

Florence Nightingale's "Diagram of the Causes of Mortality" is a polar area diagram that displays causes of death during the Crimean War across months.

**6(b).**

Her visualization aimed to show that most deaths were from preventable diseases, not battle injuries—arguing for better hygiene and medical practices.

**6(c).**

Its radial format made seasonal patterns visually compelling and easy to grasp. Color coding helped separate causes of death clearly, enhancing emotional and visual impact.

**7(a).**

- **Qualitative palettes** are for categorical data. Example: Different industries in a bar chart.
- **Sequential palettes** are for ordered values. Example: Heatmap of temperature ranges.
- **Diverging palettes** highlight deviation from a midpoint. Example: Population growth vs. decline in regions.

**7(b).**

Considering color-blindness ensures visuals are readable by everyone. A strategy is to use color-blind-friendly palettes like ColorBrewer's, or add text labels/shapes for redundancy.

**8.**

- **What is the purpose of the visualization?** Clarify whether it's to explore data or communicate a result.
- **Who is the audience?** Helps tailor complexity and design to their level.
- **What data is available and relevant?** Ensures accuracy and prevents clutter or misinterpretation.

## **Part 4: Dynamic Visualization and Creative Coding**

**9(a).**

Dynamic visualizations enable users to interact with data, explore different views, and uncover insights. They're ideal for dashboards or exploratory tools and adapt well to large, complex datasets.

**9(b).**

**Filtering** allows users to narrow down large datasets by category or time. In a sales dashboard, filtering by region helps users focus on specific trends, improving clarity and personalization.

**10(a).**

Creative coding means using code as a medium for expression—beyond function, it includes aesthetics and narrative. In data visualization, it blends storytelling with interactivity and design.

**10(b).**

One creative example:

<https://informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/>

It shows data breaches with interactive bubbles sized by impact. It's creative because it combines clear data encoding with an engaging, exploratory interface that invites deeper learning.