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**Answer following questions.:**

**1. Explain the concept of average. Write major characteristics of a good average.**

**2. Differentiate between dependent and independent variable. Discuss different categories of correlation.**

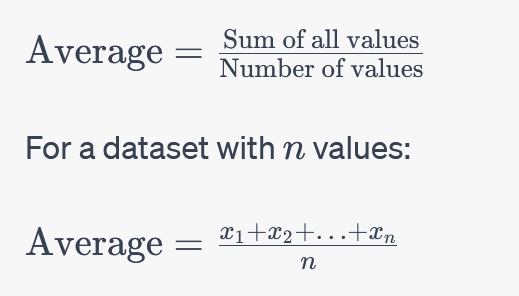
**3. What is chi-square? Evaluate properties of chi-square test.**

**4. Define report. What are the features of a good business report?**

**Answer to the question no. 1**

The concept of average, often referred to as the mean, is a measure of central tendency that represents the typical or central value of a set of numbers. It is a way to summarize a dataset by providing a single value that is representative of the entire set. The average is calculated by summing up all the values in a dataset and then dividing the sum by the total number of values.

**Mathematically, the average (mean) is calculated as follows:**



**Major characteristics of a good average:** A good average, or measure of central tendency, should possess certain characteristics to accurately represent the central or typical value of a dataset. Here are the major characteristics of a good average:

1. **Representativeness:**
   * A good average should be representative of the dataset, reflecting the central tendency and providing a sense of the typical value.
2. **Sensitivity to Every Value:**
   * It should take into account every value in the dataset, giving appropriate weight to each observation. This ensures that no data point is ignored or disproportionately emphasized.
3. **Uniqueness:**
   * An ideal average is unique for a given dataset. Different measures of central tendency may be appropriate in different situations, but within a specific context, the chosen average should be clear and unambiguous.
4. **Computationally Feasible:**
   * The method of calculating the average should be computationally feasible and not excessively complex. This ensures practicality and ease of use in various applications.
5. **Stability:**
   * A good average should be relatively stable and not highly sensitive to minor changes in the dataset. Stability ensures that the average provides a consistent representation even when there are small fluctuations in the data.
6. **Efficiency in Computation:**
   * The average should be efficiently computable, especially for large datasets. Computational efficiency is crucial for real-time applications and data analysis.
7. **Scale Invariance:**
   * Scale invariance means that the choice of units used to measure variables does not affect the value of the average. It should be consistent regardless of the unit of measurement.
8. **Robustness to Outliers:**
   * A good average should be robust to the influence of outliers or extreme values. Outliers should not unduly skew the average, and the measure should accurately reflect the central tendency of the majority of data points.
9. **Ease of Interpretation:**
   * The average should be easily interpretable and meaningful within the context of the data. Users should be able to understand and explain the average without difficulty.
10. **Compatibility with Data Distribution:**
    * The choice of average should be compatible with the distribution of the data. For example, in skewed distributions, alternatives such as the median may be more appropriate.
11. **Applicability to Different Types of Data:**
    * A good average should be applicable to different types of data, including numerical, categorical, or ordinal data. It should be versatile and suitable for a wide range of datasets.
12. **Mathematical Properties:**
    * The average should have desirable mathematical properties, such as being algebraically definable, which facilitates statistical analysis and mathematical modeling.

In practice, different averages (mean, median, mode) may be more suitable for different types of data and specific analytical objectives. The choice of the average depends on the characteristics of the dataset and the goals of the analysis.

**Answer to the question no. 2**

**Dependent Variable:**

* **Definition:** The dependent variable is the variable being measured or observed in an experiment. It's the outcome or response that researchers are interested in understanding or predicting.
* **Representation:** In equations, the dependent variable is often denoted as "Y."
* **Role in Cause and Effect:** The dependent variable responds to changes in the independent variable. Changes in the dependent variable are often the result of manipulating or changing the independent variable.
* **Outcome:** The dependent variable is the result or outcome that researchers want to explain or predict. It's what is measured or observed.
* **Examples:** In an educational experiment, test scores can be the dependent variable. In a study of plant growth, the height of plants could be the dependent variable.

**Independent Variable:**

* **Definition:** The independent variable is the variable that is manipulated or controlled by the researcher. It's the variable thought to have an effect on the dependent variable.
* **Representation:** In equations, the independent variable is often denoted as "X."
* **Role in Cause and Effect:** The independent variable is what is being tested to see if it has an effect on the dependent variable. Changes in the independent variable are considered the cause.
* **Outcome:** The independent variable is used to predict or explain changes in the dependent variable. It's the variable that is thought to influence the outcome.
* **Examples:** In a growth study of plants, the amount of fertilizer applied could be the independent variable. In a chemical reaction, temperature could be the independent variable.

The dependent variable is what you measure in the experiment and what is affected during the experiment. The independent variable is what you manipulate or change in order to observe the effect on the dependent variable.

**Correlation** is a statistical technique used to measure the strength and direction of a relationship between two variables. There are different categories of correlation that describe the nature of the relationship between variables. The most common categories include:

1. **Positive Correlation:**
   * **Definition:** Positive correlation exists when an increase in one variable is associated with an increase in another variable. Similarly, a decrease in one variable is linked to a decrease in the other.
   * **Graphical Representation:** In a scatter plot, points tend to cluster along a line that slopes upward from left to right.
2. **Negative Correlation:**
   * **Definition:** Negative correlation occurs when an increase in one variable is associated with a decrease in another variable, and vice versa. As one variable goes up, the other tends to go down.
   * **Graphical Representation:** In a scatter plot, points tend to cluster along a line that slopes downward from left to right.
3. **Zero Correlation:**
   * **Definition:** Zero correlation implies that there is no systematic relationship between the two variables. Changes in one variable are not associated with changes in the other.
   * **Graphical Representation:** In a scatter plot, points are scattered randomly without forming any clear pattern or trend.
4. **Perfect Positive Correlation:**
   * **Definition:** Perfect positive correlation exists when all data points fall perfectly along a straight line with a positive slope. Any increase in one variable is matched by an equivalent increase in the other.
   * **Correlation Coefficient (r):** In this case, the correlation coefficient is +1.
5. **Perfect Negative Correlation:**
   * **Definition:** Perfect negative correlation occurs when all data points fall perfectly along a straight line with a negative slope. An increase in one variable is matched by an equivalent decrease in the other.
   * **Correlation Coefficient (r):** In this case, the correlation coefficient is -1.
6. **Non-Linear Correlation:**
   * **Definition:** Non-linear correlation describes a relationship where the variables are related, but not in a straight line. The correlation can be strong, but the pattern is curved rather than linear.
   * **Graphical Representation:** In a scatter plot, points form a curve or some other non-linear shape.
7. **Spurious Correlation:**
   * **Definition:** Spurious correlation refers to a situation where there is an apparent statistical association between two variables, but the relationship is coincidental. There is no true cause-and-effect connection.
   * **Caution:** Correlation does not imply causation, and spurious correlations may arise due to confounding variables or random chance.

Understanding the category of correlation is important for interpreting relationships between variables accurately. It helps researchers and analysts make informed decisions about the strength and nature of the association between the variables they are studying.

**Answer to the question no. 3**

**Chi-Square:**

Chi-square (χ2χ2) is a statistical test used to determine whether there is a significant association between two categorical variables. It is commonly applied to analyze the distribution of observed and expected frequencies in a contingency table. The chi-square test assesses whether any difference between the expected and observed frequencies is statistically significant.

**Properties of the Chi-Square Test:**

1. **Applicability:**
   * Chi-square is applicable when dealing with categorical data, where observations are divided into categories or groups. It is not suitable for continuous data.
2. **Null Hypothesis (H0):**
   * The null hypothesis in a chi-square test typically states that there is no significant difference between the observed and expected frequencies. Rejection of the null hypothesis indicates a significant association between variables.
3. **Degrees of Freedom (df):**
   * The degrees of freedom in a chi-square test depend on the number of categories in the variables being analyzed. For a 2x2 contingency table, df = 1; for a 3x3 table, df = 4 (3 rows minus 1 times 3 columns minus 1).
4. **Expected Frequencies:**
   * The expected frequencies are calculated based on the assumption that there is no association between variables. These are compared to the observed frequencies to assess the goodness-of-fit.
5. **Test Statistic:**
   * The chi-square test statistic (χ2χ2) is calculated as the sum of the squared differences between observed and expected frequencies divided by the expected frequency for each cell in the contingency table.
6. **Chi-Square Distribution:**
   * The chi-square distribution is skewed and varies with degrees of freedom. As the degrees of freedom increase, the distribution approaches normality. Critical values from the chi-square distribution are used to determine the significance level of the test.
7. **Interpretation of Results:**
   * If the calculated chi-square value is greater than the critical value at a chosen significance level, the null hypothesis is rejected, indicating a significant association between the variables.
8. **Assumption of Independence:**
   * The chi-square test assumes that observations are independent. If data are not independent, the test results may be invalid.
9. **Categorical Variables:**
   * Chi-square is specifically designed for analyzing the association between categorical variables. It is not suitable for continuous variables.
10. **Post Hoc Tests:**
    * In some cases, post hoc tests or further analyses may be required to identify which categories contribute to the observed association.
11. **Use Cases:**
    * Chi-square is commonly used in fields such as social sciences, epidemiology, and market research to assess relationships between categorical variables.
12. **Limitations:**
    * Chi-square does not provide information about the strength or direction of the association. It only indicates whether an association exists.

Understanding these properties is crucial for the correct application and interpretation of the chi-square test in various research scenarios. It is a valuable tool for detecting associations and patterns in categorical data.

**Answer to the question no. 4**

**Definition of a Report:**

A report is a formal document that presents information, findings, analyses, and recommendations on a specific topic or issue. It is typically prepared for a particular audience, often within a business or organizational context. Reports are used to communicate data-driven insights, inform decision-making, and provide a structured format for conveying information.

**Features of a Good Business Report:**

1. **Clarity of Purpose:**
   * A good business report clearly defines its purpose. It should convey why the report was created, what information it seeks to communicate, and what action, if any, is expected.
2. **Structured Format:**
   * Reports should have a well-organized structure with clear sections such as an introduction, methodology, findings, analysis, conclusions, and recommendations. A structured format enhances readability and comprehension.
3. **Conciseness:**
   * A good report is concise and focused. It presents information in a clear and direct manner, avoiding unnecessary details or verbosity.
4. **Objective Tone:**
   * Business reports should maintain an objective and professional tone. The language used should be formal, avoiding subjective opinions or emotional language.
5. **Audience Consideration:**
   * A well-crafted report takes into account the needs and expectations of the intended audience. The level of technical detail, language complexity, and presentation style should align with the audience's background and interests.
6. **Comprehensive Analysis:**
   * A good report provides a thorough analysis of the data or information presented. It goes beyond merely stating facts and includes interpretation, insights, and implications.
7. **Accuracy and Reliability:**
   * Accuracy is crucial in business reporting. The data, facts, and analyses presented should be reliable, verifiable, and based on sound research or methodology.
8. **Visual Elements:**
   * Effective use of visual elements such as charts, graphs, tables, and diagrams can enhance the understanding of complex information. Visual elements should be relevant, clear, and properly labeled.
9. **Timeliness:**
   * A good business report is timely and relevant. It is delivered within a reasonable timeframe from the occurrence of the events or data it addresses.
10. **Consistency:**
    * Consistency in language, formatting, and style contributes to the professionalism of a report. A consistent presentation makes the report more cohesive and visually appealing.
11. **Actionable Recommendations:**
    * If applicable, a business report should include actionable recommendations based on the findings and analysis. Recommendations should be practical, feasible, and aligned with the report's objectives.
12. **Appendix for Additional Information:**
    * For more detailed information or supplementary data, a good report may include an appendix. This allows readers to delve deeper into specific details without cluttering the main body of the report.
13. **Proofreading and Editing:**
    * A final feature of a good business report is thorough proofreading and editing. This ensures correct grammar, spelling, and overall polished language, presenting a professional image.
14. **Distribution and Accessibility:**
    * Lastly, a good business report is distributed to the relevant stakeholders and made easily accessible. Whether in print or electronic form, it should reach those who need the information.

By embodying these features, a business report becomes a valuable tool for decision-making, strategic planning, and communication within an organization.