Hypothesis testing schemes for RAG

1. Chi-square test:
    a. Description: A statistical test used to determine if there is a significant association between two categorical variables.

    b. Use Cases
        i. Testing Independence in Contingency Tables:
        A market researcher wants to determine if there is a relationship between gender (male/female) and favorite genre of music (rock/pop/jazz). They collect data from a sample of individuals and organize it into a contingency table. By performing a Chi-square test on this data, the researcher can determine if there is a statistically significant association between gender and music preference.

        ii. Goodness-of-Fit Tests:
        A biologist is studying the genetics of a particular species of plants and wants to test whether observed genetic ratios match the expected ratios predicted by Mendelian genetics. By conducting a Chi-square goodness-of-fit test, the biologist can determine if the observed genetic frequencies are consistent with the expected frequencies based on Mendelian principles.

        iii. Comparing Observed vs. Expected Outcomes:
        A quality control manager in a manufacturing plant wants to assess whether the observed defect rates in different production batches match the expected defect rates based on historical data. By using a Chi-square test, the manager can determine if there is a significant difference between the observed and expected defect frequencies, helping to identify potential issues in the manufacturing process.

        iv. Association between Variables in Survey Data:
        A social scientist conducts a survey to investigate the relationship between socioeconomic status (low/middle/high) and political affiliation (liberal/conservative/independent). By analyzing the survey responses using a Chi-square test, the researcher can assess whether there is a significant association between socioeconomic status and political affiliation among the respondents.

        v. Testing Hypotheses in Epidemiology:
        An epidemiologist wants to study the association between smoking status (smoker/non-smoker) and the incidence of lung cancer among a sample of individuals. By collecting data on smoking status and lung cancer diagnoses and performing a Chi-square test, the epidemiologist can

determine if there is a statistically significant relationship between smoking status and the likelihood of developing lung cancer.

2. p-value testing:
    a. Description: A method used to determine the likelihood of observing a sample statistic as extreme as the one calculated from the data, assuming the null hypothesis is true.

    b. Use cases:
        i. Clinical Trials:
        A pharmaceutical company conducts a clinical trial to test the effectiveness of a new drug for treating a specific medical condition. By comparing the outcomes of the treatment group with those of the control group and calculating the p-value associated with the difference in outcomes, researchers can determine if the observed difference is statistically significant, providing evidence for the efficacy of the new drug.

        ii. Market Research:
        A marketing team launches a new advertising campaign to promote a product and wants to assess its impact on consumer behavior. By comparing sales data before and after the campaign and calculating the p-value associated with the change in sales, marketers can determine if the observed increase in sales is statistically significant, indicating the effectiveness of the advertising campaign.

        iii. Educational Research:
        A researcher conducts a study to investigate the effectiveness of a teaching method on student performance in mathematics. By comparing test scores of students taught using the new method with those taught using the traditional method and calculating the p-value associated with the difference in scores, educators can determine if the observed improvement is statistically significant, providing evidence for the efficacy of the new teaching approach.

        iv. Public Health Studies:
        Epidemiologists investigate the association between a particular behavior, such as smoking, and the risk of developing a certain disease, such as lung cancer. By analyzing data from a large cohort study and calculating the p-value associated with the relationship between smoking status and disease incidence, researchers can determine if the observed association is statistically significant, providing evidence for the link between smoking and the disease.

v. Social Science Research:
Sociologists study the relationship between socioeconomic status and access to healthcare services. By analyzing survey data from individuals of different socioeconomic backgrounds and calculating the p-value associated with the association between income level and healthcare utilization, researchers can determine if the observed disparities are statistically significant, highlighting the impact of socioeconomic factors on access to healthcare.

3. Analysis of Variance (ANOVA):
    a. Description: A statistical method used to compare means of three or more groups to determine if there are statistically significant differences between them.

    b. Use Cases:
        i. Medical Research:
        A pharmaceutical company is testing the efficacy of three different drug treatments for a particular medical condition. They conduct a randomized controlled trial with three treatment groups and measure the effectiveness of each treatment in reducing symptoms. By performing ANOVA on the outcome measures, researchers can determine if there are statistically significant differences in treatment effectiveness among the three drug groups.

        ii. Education Research:
        An educational psychologist wants to compare the effectiveness of three different teaching methods (traditional lecture, active learning, and online modules) on student performance in mathematics. They conduct a study with three groups of students, each taught using one of the methods, and assess the students' performance on standardized tests. By conducting ANOVA on the test scores, researchers can determine if there are statistically significant differences in learning outcomes among the three teaching methods.

        iii. Market Analysis:
        A marketing research firm wants to assess the impact of advertising campaigns on brand perception for three different consumer products. They conduct a survey with participants exposed to different advertising campaigns for each product and measure brand perception using a standardized scale. By performing ANOVA on the survey responses, researchers can determine if there are statistically significant differences in brand perception among the three advertising campaigns.

iv. Industrial Quality Control:
A manufacturing company produces electronic components and wants to compare the mean lifetimes of three different production processes. They collect data on the lifetimes of components produced using each process and analyze the data using ANOVA. By conducting ANOVA on the lifetimes of the components, quality control engineers can determine if there are statistically significant differences in mean lifetimes among the three production processes.

v. Social Science Research:
A sociologist is studying the effect of socioeconomic status on mental health outcomes across three different socioeconomic groups (low-income, middle-income, and high-income). They collect data on mental health measures from individuals in each group and use ANOVA to compare the mean mental health scores. By conducting ANOVA, researchers can determine if there are statistically significant differences in mental health outcomes among the three socioeconomic groups.

4. t-tests (Student's t-test):
    a. Description: A statistical test used to determine if there is a significant difference between the means of two independent or paired samples.

    b. Use Cases:
        i. Clinical Trials:
        A pharmaceutical company conducts a clinical trial to compare the effectiveness of two different drug treatments for a particular medical condition. They randomly assign patients to either the experimental group receiving Treatment A or the control group receiving Treatment B. After the trial period, researchers measure the outcomes (e.g., reduction in symptoms) for each group and use a t-test to determine if there is a statistically significant difference in effectiveness between the two treatments.

        ii. Before-and-After Studies:
        A fitness trainer wants to assess the effectiveness of a new exercise program in improving cardiovascular health. They measure participants' resting heart rates before starting the program and again after completing it. By comparing the mean change in heart rate using a paired t-test, the trainer can determine if there is a statistically significant difference in cardiovascular health before and after participating in the exercise program.

        iii. Educational Interventions:

A school administrator implements a new teaching method in one group of classrooms while maintaining the traditional teaching method in another group as a control. At the end of the semester, students in both groups take a standardized test to assess their academic performance. By comparing the mean test scores between the two groups using an independent samples t-test, the administrator can determine if there is a statistically significant difference in academic achievement between students taught using the new method and those taught using the traditional method.

iv. Market Research:
A marketing team wants to evaluate the effectiveness of two different advertising strategies in increasing brand awareness. They randomly assign participants to view either Advertisement A or Advertisement B and measure brand recognition scores immediately after exposure. By comparing the mean brand recognition scores using an independent samples t-test, the team can determine if there is a statistically significant difference in brand awareness between the two advertising strategies.

v. Psychological Studies:
A psychologist conducts a study to investigate the impact of sleep deprivation on cognitive function. Participants are randomly assigned to either a sleep-deprived group or a control group. After a period of sleep deprivation, all participants complete a battery of cognitive tests. By comparing the mean cognitive test scores between the two groups using an independent samples t-test, the psychologist can determine if there is a statistically significant difference in cognitive function between sleep-deprived individuals and those who are well-rested.

5. Z-test:
    a. Description: A statistical test used to compare a sample mean to a known population mean when the population standard deviation is known.

    b. Use Cases:
        i. Quality Control:
        A manufacturing company produces bottles of a beverage and wants to ensure that the average fill volume of each bottle matches the target volume specified by regulations. The company periodically samples bottles from the production line and measures their fill volumes. By comparing the mean fill volume of the sample to the target volume using a Z-test, the company can determine if the production process is meeting quality control standards.

ii. Large Sample Hypothesis Testing:
A market researcher wants to test a hypothesis about the average age of customers who purchase a particular product. The researcher collects a large sample of customer data and calculates the mean age. By comparing the sample mean to the hypothesized population mean using a Z-test, the researcher can determine if there is sufficient evidence to support the hypothesis.

iii. Public Health Studies:
Epidemiologists conduct a study to compare the average blood pressure levels of individuals in a population to established national health guidelines. They collect blood pressure measurements from a large sample of individuals and calculate the sample mean. By comparing the sample mean to the recommended blood pressure threshold using a Z-test, epidemiologists can determine if there is a significant deviation from the guidelines and assess the prevalence of hypertension in the population.

iv. Financial Analysis:
A financial analyst wants to determine if the average return on investment (ROI) for a particular stock portfolio is significantly different from the market average. The analyst collects historical data on the ROI of the portfolio and calculates the sample mean. By comparing the sample mean to the market average using a Z-test, the analyst can assess whether the portfolio's performance is statistically different from the broader market.

v. Educational Research:
An education researcher conducts a study to evaluate the effectiveness of a new teaching method in improving standardized test scores among students. The researcher administers pre-test and post-test assessments to a large sample of students and calculates the mean score change. By comparing the mean score change to zero (indicating no improvement) using a Z-test, the researcher can determine if there is a statistically significant improvement in test scores attributable to the new teaching method.

6. F-test:
    a. Description: A statistical test used to compare variances or test the overall significance of a model in regression analysis.

    b. Use Cases:
        i. Assessing Regression Model Fit:

A data analyst wants to assess the fit of a regression model that predicts housing prices based on various predictor variables such as square footage, number of bedrooms, and location. By conducting an F-test on the regression model, the analyst can determine if the overall model significantly improves the prediction of housing prices compared to a simple mean model.

ii. Comparing Variability in ANOVA:
A biologist conducts an experiment to compare the growth rates of three different species of plants under different environmental conditions. After collecting data on plant growth for each species and condition, the biologist uses ANOVA to compare the variability in growth rates between species. By conducting an F-test, the biologist can determine if there are statistically significant differences in variability between the species.

iii. Evaluating Treatment Effects in Clinical Trials:
A pharmaceutical company conducts a clinical trial to evaluate the effectiveness of three different drug treatments for a medical condition. After administering the treatments to patients and collecting data on treatment outcomes, the company uses ANOVA to compare the variability in treatment effects between the three groups. By conducting an F-test, the company can determine if there are statistically significant differences in treatment efficacy among the groups.

iv. Comparing Test Scores in Education Research:
An education researcher conducts a study to compare the effectiveness of three different teaching methods (traditional lecture, active learning, and online modules) in improving student test scores in mathematics. After administering the teaching methods to different groups of students and collecting test scores, the researcher uses ANOVA to compare the variability in test scores between the groups. By conducting an F-test, the researcher can determine if there are statistically significant differences in effectiveness among the teaching methods.

v. Analyzing Variability in Quality Control:
A manufacturing company wants to assess the variability in product quality across three different production lines. After collecting data on product quality from each production line, the company uses ANOVA to compare the variability in quality between the lines. By conducting an F-test, the company can determine if there are statistically significant differences in variability among the production lines, helping to identify potential areas for improvement in quality control processes.

7. Mann-Whitney U test:
    a. Description: A nonparametric test used to determine if there is a significant difference between the distributions of two independent samples.

    b. Use Cases:
        i. Medical Research:
        A clinical trial is conducted to compare the effectiveness of two different treatments for a specific medical condition. Patients are randomly assigned to either the treatment group or the control group. The outcome of interest, such as pain reduction scores, is measured for each patient. The Mann-Whitney U test is used to determine if there is a significant difference in pain reduction between the two treatment groups, taking into account the non-normal distribution of the data.

        ii. Educational Research:
        A study is conducted to compare the reading comprehension levels of students who received traditional instruction versus those who received a new reading program. Students from two different schools are selected as independent samples. The Mann-Whitney U test is used to determine if there is a significant difference in reading comprehension scores between the two groups, especially when the assumptions of the t-test, such as normality, are violated.

        iii. Market Research:
        A marketing team wants to assess the effectiveness of two different advertising strategies on consumer purchasing behavior. Participants are randomly assigned to view either Advertisement A or Advertisement B. After exposure to the ads, participants are asked to indicate their purchase intent on a scale. The Mann-Whitney U test is used to determine if there is a significant difference in purchase intent between the two groups, accounting for the non-normally distributed nature of the data.

        iv. Social Science Studies:
        A sociologist conducts a study to compare the income levels of residents in two different neighborhoods. Household income data are collected from residents of each neighborhood. The Mann-Whitney U test is used to determine if there is a significant difference in income distribution between the two neighborhoods, especially when the assumption of normality is violated or when income data are highly skewed.

        v. Psychological Research:

A psychologist investigates the effect of a mindfulness intervention on stress levels among adults. Participants are randomly assigned to either the intervention group or the control group. Stress levels are measured using a standardized stress scale. The Mann-Whitney U test is used to determine if there is a significant difference in stress reduction between the two groups, particularly when the assumption of normality is not met or when the data are ordinal rather than interval.

8. Wilcoxon signed-rank test:
    a. Description: A nonparametric test used to determine if there is a significant difference between paired samples.

    b. Uses Cases:
        i. Medical Research - Before-and-After Studies:
        A clinical trial is conducted to assess the effectiveness of a new drug treatment for hypertension. Blood pressure measurements are taken from each participant before and after receiving the treatment. The Wilcoxon signed-rank test is used to determine if there is a significant difference in blood pressure levels before and after treatment, providing evidence of the drug's efficacy.

        ii. Educational Research - Intervention Studies:
        A study is conducted to evaluate the effectiveness of a new teaching method on students' academic performance. Pre-test and post-test scores are collected from students who receive the new teaching method and those who receive traditional instruction. The Wilcoxon signed-rank test is used to determine if there is a significant difference in test scores before and after implementing the new teaching method, indicating the effectiveness of the intervention.

        iii. Psychological Studies - Therapy Effectiveness:
        A psychologist investigates the impact of a cognitive-behavioral therapy (CBT) program on reducing symptoms of anxiety in individuals. Anxiety levels are assessed using a standardized questionnaire before and after completing the CBT program. The Wilcoxon signed-rank test is used to determine if there is a significant reduction in anxiety symptoms following the therapy, providing evidence of its effectiveness.

        iv. Quality Improvement - Process Changes:
        A manufacturing company implements a new production process aimed at reducing defect rates in its products. The number of defects is recorded before and after implementing the new process. The Wilcoxon signed-rank test is used to determine if there is a significant difference in

defect rates before and after the process change, indicating the effectiveness of the improvement effort.

v. Public Health - Behavior Change Interventions:
A public health campaign aims to reduce smoking rates in a community through a targeted intervention program. Surveys are conducted before and after the intervention to assess changes in smoking behavior among participants. The Wilcoxon signed-rank test is used to determine if there is a significant decrease in smoking prevalence following the intervention, providing evidence of its impact on behavior change.

9. Kruskal-Wallis test:
    a. Description: A nonparametric test used to determine if there are statistically significant differences between three or more independent groups.

    b. Use Cases:
        i. Healthcare Research - Pain Management:
        A study is conducted to compare the effectiveness of three different pain management techniques for patients undergoing surgery: medication, acupuncture, and relaxation therapy. Pain levels are measured using a standardized pain scale after the surgical procedure. The Kruskal-Wallis test is used to determine if there is a significant difference in pain relief among the three treatment groups, especially when the assumption of normality is violated or when pain scores are ordinal rather than interval.

        ii. Market Research - Customer Satisfaction:
        A market research firm wants to assess customer satisfaction levels with three different brands of smartphones: Brand A, Brand B, and Brand C. Participants are asked to rate their satisfaction with each brand on a scale from 1 to 10. The Kruskal-Wallis test is used to determine if there is a significant difference in satisfaction levels among the three brands, particularly when the assumption of normality is not met or when satisfaction ratings are ordinal.

        iii. Environmental Science - Pollution Levels:
        A study is conducted to compare pollution levels in three different regions: urban, suburban, and rural areas. Air quality data, such as particulate matter concentrations, are collected from monitoring stations in each region. The Kruskal-Wallis test is used to determine if there is a significant difference in pollution levels among the three regions, especially when the assumption of normality is violated or when pollution data are skewed.

        iv. Educational Research - Learning Outcomes:

A study is conducted to evaluate the effectiveness of three different teaching methods (lecture-based, problem-based learning, and experiential learning) in improving students' performance in mathematics. Test scores are collected from students taught using each method. The Kruskal-Wallis test is used to determine if there is a significant difference in test scores among the three teaching methods, particularly when the assumption of normality is violated or when test scores are ordinal.

v. Social Science Studies - Income Disparities:
A sociologist wants to investigate income disparities among three different socioeconomic groups: low-income, middle-income, and high-income individuals. Income data are collected from surveys conducted in each group. The Kruskal-Wallis test is used to determine if there is a significant difference in income levels among the three groups, especially when the assumption of normality is violated or when income data are highly skewed.

10. Kolmogorov-Smirnov test:
    a. Description: A nonparametric test used to compare the cumulative distribution functions of two samples.

    b. Use Cases:
        i. Goodness-of-Fit Testing:
        A researcher wants to test whether a dataset of exam scores follows a normal distribution. They collect exam scores from a sample of students and compare the cumulative distribution function (CDF) of the sample to the theoretical normal distribution using the Kolmogorov-Smirnov test. If the p-value is greater than the chosen significance level, the data can be considered to follow a normal distribution.

        ii. Comparing Distributions of Two Samples:
        An analyst wants to compare the distribution of income levels between two cities. They collect income data from random samples of residents in each city and use the Kolmogorov-Smirnov test to compare the CDFs of the income distributions. If the p-value is below the chosen significance level, it indicates that there is a statistically significant difference between the income distributions of the two cities.

        iii. Assessing Whether a Sample Comes from a Particular Distribution:
        A biologist wants to determine whether the lengths of fish in a lake follow a specific distribution, such as the exponential distribution. They collect length measurements from a sample of fish and compare the CDF of the sample to the theoretical exponential distribution using the Kolmogorov-Smirnov test. If the p-value is greater than the chosen

significance level, the lengths of the fish can be considered to follow the exponential distribution.

iv. Testing for Normality in Residuals:
A statistician fits a linear regression model to a dataset and wants to assess whether the residuals from the model follow a normal distribution. They calculate the residuals for each observation and use the Kolmogorov-Smirnov test to compare the CDF of the residuals to the theoretical normal distribution. If the p-value is greater than the chosen significance level, it indicates that the residuals can be considered to follow a normal distribution.

v. Comparing Empirical and Theoretical Distributions:
An engineer wants to assess whether the failure times of a certain type of component follow the Weibull distribution as hypothesized. They collect failure time data from a sample of components and compare the empirical CDF of the failure times to the theoretical Weibull distribution using the Kolmogorov-Smirnov test. If the p-value is greater than the chosen significance level, it suggests that the failure times may follow the Weibull distribution.

11. Fisher's exact test:
    a. Description: A statistical test used to determine if there are significant associations between two categorical variables in a 2x2 contingency table.

    b. Use Cases:
        i. Clinical Trials - Treatment Efficacy:
        A pharmaceutical company conducts a clinical trial to compare the effectiveness of two treatments for a rare disease. Patients are randomly assigned to receive Treatment A or Treatment B, and their outcomes (e.g., survival vs. non-survival) are recorded. The data are organized into a 2x2 contingency table, and Fisher's exact test is used to determine if there is a significant association between treatment type and patient outcome, especially when the sample size is small or the assumptions of the chi-square test are violated.

        ii. Genetics - Disease Association Studies:
        Geneticists investigate the association between a particular genetic variant (e.g., SNP) and the risk of developing a disease (e.g., cancer). Genotype data (e.g., presence vs. absence of the variant) are collected from individuals with and without the disease and organized into a 2x2 contingency table. Fisher's exact test is used to determine if there is a significant association between the genetic variant and disease status,

especially when the sample size is small or the assumptions of the chi-square test are violated.

iii. Public Health - Disease Risk Factors:
Epidemiologists study the association between a specific risk factor (e.g., smoking status) and the incidence of a disease (e.g., lung cancer) in a population. Data on smoking status (smoker vs. non-smoker) and disease status (lung cancer vs. no lung cancer) are collected and arranged into a 2x2 contingency table. Fisher's exact test is used to determine if there is a significant association between smoking status and the risk of developing lung cancer, particularly when the sample size is small or the assumptions of the chi-square test are violated.

iv. Environmental Science - Pollution Exposure and Health Outcomes:
Environmental researchers investigate the association between exposure to a particular pollutant (e.g., air pollution levels) and the prevalence of a health outcome (e.g., respiratory diseases) in a community. Data on pollution exposure (high vs. low) and health outcome (presence vs. absence of disease) are collected and organized into a 2x2 contingency table. Fisher's exact test is used to determine if there is a significant association between pollution exposure and health outcomes, especially when the sample size is small or the assumptions of the chi-square test are violated.

v. Market Research - Product Preference:
A marketing team wants to assess the association between a promotional campaign (e.g., offering discounts) and customer purchasing behavior (e.g., buying vs. not buying a product). Data on campaign exposure (exposed vs. not exposed) and purchasing behavior (purchase vs. no purchase) are collected and arranged into a 2x2 contingency table. Fisher's exact test is used to determine if there is a significant association between campaign exposure and purchasing behavior, particularly when the sample size is small or the assumptions of the chi-square test are violated.

12. One-sample proportion test:
    a. Description: A statistical test used to determine if the proportion of successes in a single sample is significantly different from a hypothesized value.

    b. Use Cases:
        i. Quality Control - Defective Products:
        A manufacturing company wants to assess the proportion of defective products in a production batch. A sample of products is randomly selected

from the batch, and the number of defective items is counted. The company hypothesizes that the proportion of defective products is no more than 5%. A one-sample proportion test is conducted to determine if the observed proportion of defects differs significantly from the hypothesized value of 5%, helping to identify potential quality control issues.

ii. Opinion Polls - Political Surveys:
A polling agency conducts a survey to estimate the proportion of voters who support a particular political candidate. A random sample of eligible voters is selected, and each participant is asked whether they intend to vote for the candidate. The agency wants to test whether the proportion of supporters differs significantly from 50%, indicating a potential lead for the candidate. A one-sample proportion test is used to assess the statistical significance of the observed proportion of supporters compared to the hypothesized value of 50%.

iii. Assessing Success Rate of Interventions - Health Campaigns:
A public health organization launches a smoking cessation campaign and wants to evaluate its effectiveness in reducing smoking rates among participants. Participants are surveyed before and after the campaign, and they indicate whether they have successfully quit smoking. The organization hypothesizes that the proportion of successful quitters after the campaign is at least 30%. A one-sample proportion test is conducted to determine if the observed proportion of successful quitters is significantly different from the hypothesized value of 30%, providing insight into the campaign's impact.

iv. Customer Satisfaction Surveys - Service Industry:
A hotel chain conducts a customer satisfaction survey to estimate the proportion of guests who were satisfied with their recent stay. Guests are asked to rate their overall satisfaction on a scale from 1 to 5. The hotel chain aims to maintain a satisfaction rate of at least 80%. A one-sample proportion test is used to assess whether the observed proportion of satisfied guests differs significantly from the hypothesized value of 80%, helping the company gauge the effectiveness of its service delivery.

v. Educational Assessments - Exam Pass Rates:
A school district wants to evaluate the proportion of students who pass a standardized exam in mathematics. Exam results are collected from a random sample of students, and the district aims to maintain a pass rate of at least 70%. A one-sample proportion test is conducted to determine if the observed pass rate differs significantly from the hypothesized value of

70%, providing feedback on the effectiveness of teaching methods and curriculum.

13. Two-sample proportion test:
    a. Description: A statistical test used to determine if there is a significant difference between the proportions of successes in two independent samples.

    b. Use Cases:
        i. Clinical Trials - Treatment Comparison:
        A pharmaceutical company conducts a clinical trial to compare the effectiveness of two different drug treatments for a specific medical condition. Patients are randomly assigned to receive either Treatment A or Treatment B, and their response to treatment (e.g., recovery vs. no recovery) is recorded. A two-sample proportion test is conducted to determine if there is a significant difference in the proportions of patients who respond positively to Treatment A compared to Treatment B, helping to identify the more effective treatment option.

        ii. Market Research - A/B Testing:
        A marketing team wants to compare the effectiveness of two different email marketing campaigns (Version A vs. Version B) in generating click-throughs to a website. The team randomly assigns subscribers to receive either Version A or Version B of the email and tracks the number of recipients who click on the provided links. A two-sample proportion test is used to determine if there is a significant difference in the proportions of click-throughs between the two versions, guiding the team in selecting the more effective campaign for future promotions.

        iii. Educational Research - Teaching Methods Comparison:
        A school district wants to compare the effectiveness of two different teaching methods (Method A vs. Method B) in improving students' proficiency in a specific subject area. Students are randomly assigned to classrooms where either Method A or Method B is implemented, and their performance on standardized tests is assessed at the end of the academic year. A two-sample proportion test is conducted to determine if there is a significant difference in the proportions of students who achieve proficiency between the two teaching methods, aiding the district in curriculum planning and instructional strategies.

        iv. Public Health - Disease Prevention Programs:
        A public health organization launches two different disease prevention programs (Program A vs. Program B) aimed at reducing the incidence of a particular infectious disease in a community. Participants are enrolled in either Program A or Program B, and their vaccination status or adherence

to preventive measures is monitored over time. A two-sample proportion test is used to determine if there is a significant difference in the proportions of participants who remain disease-free between the two programs, informing future public health interventions.

v. Customer Satisfaction - Service Comparison:
A retail company wants to compare customer satisfaction levels between two different store locations (Store A vs. Store B). Customers at each location are surveyed about their shopping experience, including factors such as staff friendliness, product availability, and overall satisfaction. A two-sample proportion test is conducted to determine if there is a significant difference in the proportions of satisfied customers between the two stores, helping the company identify areas for improvement and optimize customer service strategies.