**Quantitative Methods – I**

**NMIMS Centre for Distance and Online Education (NCDOE)**

**Internal Assignment Applicable for April 2025 Examination**

PLEASE NOTE: This assignment is application based; you have to apply what you have learnt in this subject into real life scenario. You will find most of the information through internet search and the remaining from your common sense. None of the answers appear directly in the textbook chapters but are based on the content in the chapter

**Q1. Propose a method to use Excel for solving a binomial distribution problem, and discuss the advantages and limitations of using Excel for such statistical analyses? Solve the below problem using excel or manual method.**

**A company manufactures light bulbs, and it is known that 5% of the light bulbs are defective. If a quality control inspector randomly selects 20 light bulbs from a production batch, what is the probability that exactly 2 of them are defective?**

**Answer:**

**Introduction:**

A binomial distribution is a statistical model that describes the number of successes in a fixed number of trials, where each trial has two possible outcomes (success or failure). The binomial distribution is characterized by two parameters: the number of trials (n) and the probability of success (p) in each trial. In this problem, we are dealing with a scenario where a company manufactures light bulbs, and we are interested in determining the probability that exactly 2 out of 20 randomly selected light bulbs are defective. Since 5% of the light bulbs are defective, we can use the binomial distribution formula to calculate this probability.

**This is partially solved sample answer**

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**Q2. A cereal company claims that the average weight of its cereal boxes is 500 grams. A quality control manager doubts this claim and randomly selects a sample of 50 boxes. The sample has a mean weight of 495 grams and a standard deviation of 10 grams. Formulate the null hypothesis (H0) and the alternate hypothesis (H1). - Perform a statistical to determine if the mean weight of the cereal boxes is significantly different from 500 grams at a significance level of 0.05.**

**Answer:**

**Introduction:**

Hypothesis testing is a statistical method used to make inferences about population parameters based on sample data. In hypothesis testing, two competing hypotheses are formulated: the null hypothesis (H0), which represents a statement of no effect or no difference, and the alternative hypothesis (H1), which suggests that there is a significant effect or difference. The objective is to use sample data to decide whether to reject the null hypothesis. In this case, a cereal company claims that the average weight of its cereal boxes is 500 grams. The quality control manager suspects that the actual weight might be different, and we aim to test if there is enough evidence to support this claim.

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**Q3(A) Evaluate the importance of understanding the null and alternate hypotheses in the context of hypothesis testing and its impact on research outcomes?**

**State Null and Alternate Hypothesis for below scenarios**

**A health organization claims that the average sodium content in a specific brand of soup is at least 400 mg per serving. A nutritionist doubts this claim and wants to verify if the average sodium content is less than 400 mg. State Null and Alternate Hypothesis**

**A pharmaceutical company claims that their new drug reduces cholesterol by an average of 50 mg/dL. A medical researcher wants to verify if the average reduction is not equal to 50 mg/dL.**

**Answer:**

**Introduction:**

In hypothesis testing, understanding the null hypothesis (H0) and the alternative hypothesis (H1) is crucial for drawing valid conclusions from data. The null hypothesis represents a statement of no effect or no difference, and it serves as the starting point for testing. The alternative hypothesis represents a claim that contradicts the null hypothesis. By testing these hypotheses, researchers can make decisions about whether to reject the null hypothesis based on the sample data. The outcome of hypothesis testing has a significant impact on research conclusions, guiding whether claims about a population are supported or not.

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**Q3 (B) Given the following data points for variables X and Y:**

**X: 2, 4, 6, 8, 10**

**Y: 3, 5, 7, 9, 11**

**Calculate the Pearson correlation coefficient between X and Y. Given the following data points for variables X and Y:**

**X: 1, 2, 3, 4, 5**

**Y: 2, 4, 5, 4, 5**

**Determine the equation of the regression line (Y = a + bX)**

**Answer:**

**Introduction:**

Correlation and regression are statistical methods used to examine the relationship between two variables. The Pearson correlation coefficient measures the strength and direction of a linear relationship between two variables, ranging from -1 to +1. A coefficient close to +1 indicates a strong positive relationship, while a value close to -1 suggests a strong negative relationship. Regression analysis, on the other hand, focuses on modeling the relationship between a dependent variable (Y) and an independent variable (X) to predict future values. Understanding these concepts is vital for making data-driven decisions and predictions based on statistical analysis.

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