Week 6. Analysis II

SOLUTIONS TO PREPARATORY QUESTIONS.

Q1. Consider a clinical trial designed to evaluate the effectiveness of a new drug for treating chronic pain. The researchers formulate their hypotheses as follows:

> *H0: The new drug is no more effective than the placebo.*
> *H1: The new drug is more effective than the placebo.*

What statistical test is most appropriate for comparing the mean effectiveness between the two groups, assuming normal distribution and equal variances?

A. Chi-Square test
B. Mann-Whitney U test
C. Independent samples t-test **[Correct]**
D. One-way ANOVA

Q2. You are analyzing data from a study comparing the effects of different diets on weight loss. There are three diet groups in the study: Diet A, Diet B, and Diet C. You want to determine if there is a significant difference in the mean weight loss among the three diet groups. Which statistical test is most appropriate for this analysis, and why?

A. Independent samples t-test
B. Paired samples t-test
C. ANOVA. **[Correct]** *(because it allows for comparison of means across more than two groups.)*
D. Chi-square test.

Q3. When preparing data for a parametric test, it's important to ensure certain assumptions are met for the validity of the test results. Which of the following is NOT an assumption of parametric tests?

A. The data must follow a normal distribution.
B. Observations must be independent.
C. Variances within groups must be equal (homoscedasticity).
D. The dependent variable must be measured on an ordinal scale. **[Correct]**

Q4. Why is it important to check for the normality of data before conducting a parametric test?

A. Non-normal data can artificially inflate the Type I error rate. **[Correct]**
B. Parametric tests are more robust to outliers in non-normal distributions.
C. Checking for normality is only a formal requirement and has no impact on the test outcome.
D. Normality is not important; homoscedasticity is the only necessary assumption.

Q5. In an experiment to assess the impact of a new teaching method on student performance, the researcher decides to perform a Shapiro-Wilk test on the pre-test scores. What is the purpose of this test in this context?

A. To determine if the scores are homoscedastic.
B. To check the linearity of the scores.
C. To assess the normality of the distribution of scores. **[Correct]**
D. To compare the mean scores of different groups.

Q6. In a study comparing the mean IQ scores of individuals in two distinct occupations, the researcher performs a Levene's test for equality of variances and obtains a p-value of 0.045. Considering an alpha level of 0.05, which of the following statements is true?

A. The variances are significantly different, indicating heteroscedasticity. **[Correct]**
B. The variances are significantly, thus the condition of equal variances assumed.
C. Results suggest that non-parametric tests are unsuitable for further analysis.
D. The p-value is irrelevant to the assumptions of the t-test.

Q7. A researcher wants to compare the scores of two independent groups on a psychological well-being scale. Before choosing the appropriate statistical test, the researcher checks the score distribution and finds it to be heavily skewed. Which test is most appropriate for this scenario?

A. Independent samples t-test
B. Paired samples t-test
C. Mann-Whitney U test **[Correct]**
D. ANOVA

Q8. In statistical analysis, why is it crucial to ensure that the assumptions underlying a chosen statistical test (e.g., normality for parametric tests, homoscedasticity, independence of observations) are met before proceeding with the test? What are the potential consequences of not meeting these assumptions.

Meeting the assumptions underlying a statistical test is crucial for several reasons. Firstly, the validity of the test results depends significantly on these assumptions. For example, parametric tests assume normality of the data; if this assumption is violated, the test may produce inaccurate p-values, leading to incorrect conclusions about the statistical significance of the findings. Similarly, the assumption of homoscedasticity (equal variances) is essential for tests like ANOVA to ensure that the test accurately assesses differences across groups without being biased by unequal spread of data points. Not meeting these assumptions can result in a higher risk of Type I (false positive) or Type II (false negative) errors, misguiding the interpretation of the data and potentially leading to erroneous scientific or practical decisions. Therefore, checking and confirming these assumptions is a fundamental step to ensure the reliability and accuracy of statistical inferences made from the data.