Statistics Advance - 1

Assignment Questions

1. Explain the properties of the F-distribution.

2. In which types of statistical tests is the F-distribution used, and why is it appropriate for these tests?

3. What are the key assumptions required for conducting an F-test to compare the variances of two populations?

4. What is the purpose of ANOVA, and how does it differ from a t-test?

5. Explain when and why you would use a one-way ANOVA instead of multiple t-tests when comparing more than two groups.

6. Explain how variance is partitioned in ANOVA into between-group variance and within-group variance. How does this partitioning contribute to the calculation of the F-statistic?

7. Compare the classical (frequentist) approach to ANOVA with the Bayesian approach. What are the key differences in terms of how they handle uncertainty, parameter estimation, and hypothesis testing?

8. Question: You have two sets of data representing the incomes of two different professions:
- **Profession A:** $[48, 52, 55, 60, 62]$
- **Profession B:** $[45, 50, 55, 52, 47]$ Perform an F-test to determine if the variances of the two professions' incomes are equal. What are your conclusions based on the F-test?

Task: Use Python to calculate the F-statistic and p-value for the given data.

Objective: Gain experience in performing F-tests and interpreting the results in terms of variance comparison.

9. Question: Conduct a one-way ANOVA to test whether there are any statistically significant differences in average heights between three different regions with the following data:
- **Region A:** $[160, 162, 165, 158, 164]$
- **Region B:** $[172, 175, 170, 168, 174]$
- **Region C:** $[180, 182, 179, 185, 183]$
- **Task:** Write Python code to perform the one-way ANOVA and interpret the results.
- **Objective:** Learn how to perform one-way ANOVA using Python and interpret F-statistic and p-value.