Statistics

ASSIGNMENT 1

There are two questions: question (A) concerns a broad subject and requires a general exposition describing the main definitions and results and emphasizing the important connections. Question (B) concerns a specific example within the same topic.

(A) Discuss the problem concerning the comparison of two proportions given two independent samples. Give details about the methods for testing the hypothesis of equal success probabilities.

Discuss the available association measures for 2×2 tables and the related sampling distributions.

Explain some connections with the linear logistic model.

(B) Given two independent samples of size 100 with observed number of successes 5 and 10, provide (without developing all calculations) an approximate 95% confidence interval al 95% for the difference of the probabilities and for the log odds-ratio.

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ASSIGNMENT 2

There are two questions: question (A) concerns a broad subject and requires a general exposition describing the main definitions and results and emphasizing the important connections. Question (B) concerns a specific example within the same topic.

(A) Define the general problem of interval estimation discussing the distinctions between the Frequentist and Bayesian approaches. Then discuss the main methods of interval estimation and explain the interpretation of the results and the main properties of the procedures.

(B) 1) Find a confidence interval for a proportion from a random sample of size 28, where the sample proportion is 0.25.

2) Let $(X_1, \ldots, X_n)$ be a random sample from the normal distribution with unknown mean μ and unknown variance σ^2, and let the random variable L denote the length of the shortest confidence interval for μ that can be constructed from the observed values in the sample. Find the value of the expectation $E(L^2)$ knowing that the sample size is $n = 200$ and the confidence coefficient is 0.95.

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Assigment 3

There are two questions: question (A) concerns a broad subject and requires a general exposition describing the main definitions and results and emphasizing the important connections. Question (B) concerns a specific example within the same topic.

(A) Define the concept of sufficient statistic explaining its role in Statistical Inference. Give the statement of the factorization theorem (Neyman-Fisher) and prove it. Summarize the relevance of sufficient statistics in likelihood theory and within the Bayesian paradigm.

(B) Verify that given a random sample $(x_1, \ldots, x_n)$ from $X \sim \text{Poisson}(\lambda)$ in the given population, $T = \sum_{i=1}^n x_i$ is a sufficient statistic for λ.