



QUESTION WORKBOOK

Estimators, standard error and confidence intervals

Further Statistics 2 · Year FM

6 questions · 22 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 Define an unbiased estimator, and name one unbiased estimator of a population variance. [2]

A2 A sample of 36 from a normal population with $\sigma = 12$ has mean 48. Find a 95% confidence interval for the population mean. [3]

SECTION B · Standard

B1 A random sample of 36 observations from a normal population with $\sigma = 12$ has mean 48. Find a 99% confidence interval for the population mean, and compare it with the 95% interval (44.08, 51.92). [4]

- B2** A normal population has $\sigma = 12$. Find the smallest sample size for which a 95% confidence interval for the mean has total width at most 4. [4]

- B3** A student says that a 95% confidence interval has a 95% probability of containing the population mean. Explain what is wrong with this, and give the correct interpretation. [3]

SECTION C · Stretch

- C1** A random sample of 4 observations has mean $\bar{X}$, and an independent random sample of 6 observations has mean $\bar{Y}$. Both come from a population with mean μ and variance σ^2 . The estimator $T = \lambda\bar{X} + (1 - \lambda)\bar{Y}$ is proposed, where λ is a constant. Show that T is unbiased for μ for every λ , find the value of λ that minimises $\text{Var}(T)$, and state that minimum variance. [6]