

Practice Problems for *Statistics Review*

1. Maximum Likelihood Estimation

Suppose that X_1, \dots, X_n form a random sample from a uniform distribution on the interval $(0, \theta)$, where $\theta > 0$ but is unknown. Find the MLE of θ .

2. Confidence Intervals

You want to rent an unfurnished one-bedroom apartment in London next year. The mean monthly rent for a random sample of 60 apartments advertised on RightMove (a website that lists apartments and houses for buy or rent) is £1300. Assume a normal population with standard deviation of £200.

- (a) Construct a 95% confidence interval of the average monthly rent.
 - (b) How large a sample of one-bedroom apartments above would be needed to estimate the population mean within a margin of error of £50 with 90% confidence?
 - (c) True or false: With all else constant, an increase in population standard deviation will shorten the length of a confidence interval.
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3. Hypothesis Testing

- (a) (**Two-tailed test**) An inventor has developed a new, energy-efficient lawn mower engine. He claims that the engine will run continuously for 5 hours (300 minutes) on a single gallon of regular gasoline. From his stock of 2000 engines, the inventor selects a simple random sample of 50 engines for testing. The engines run for an average of 295 minutes, with a standard deviation of 20 minutes. Test the null hypothesis that the mean run time is 300 minutes against the alternative hypothesis that the mean run time is not 300 minutes. Use a 0.05 level of significance. (Assume that run times for the population of engines are normally distributed.)
- (b) (**One-tailed test**) Bon Air Elementary School has 1000 students. The principal of the school thinks that the average IQ of students at Bon Air is at least 110. To prove her point, she administers an IQ test to 20 randomly selected students. Among the sampled students, the average IQ is 108 with a standard deviation of 10. Based on these results, should the principal accept or reject her original hypothesis? Assume a significance level of 0.01. (Assume that test scores in the population of engines are normally distributed.)