

1. The amount of money spent on textbooks per student each semester has mean \$120 and standard deviation \$30. It's probably not normally distributed because some students don't have buy any texts. Suppose a random sample of 50 students are asked how much they spent on textbooks this semester.
 - a) Consider the sampling distribution of the sample mean. What's the mean and standard deviation? Describe the shape.
 - b) Find the probability that the sample mean is greater than 125.
 - c) What sample size would you need to make this probability equal to 0.05?
2. Consider a random sample of size n from a distribution with density

$$f(x|\theta) = \theta^2 x \exp(-\theta x)$$

for $x > 0$, and $\theta > 0$. For this distribution, $EX = 2/\theta$.

- a) What's the likelihood function for θ ?
 - b) Find a sufficient statistic.
 - c) Calculate the maximum likelihood estimator of θ .
 - d) Calculate the method of moments estimator of θ .
3. Like 9-51.
 4. Consider a random sample of size n from a $\text{Poi}(\lambda)$ distribution, with probability function

$$f(x|\lambda) = \frac{\lambda^x}{x!} e^{-\lambda},$$

for $x = 0, 1, 2, \dots$, and $\lambda > 0$. For this distribution, $EX = \text{Var } X = \lambda$, and the MLE for λ is \bar{x} .

- a) Find the MSE of \bar{x} by finding the bias and the variance.
- b) Is \bar{x} consistent for λ ?
- c) Determine if \bar{x} is efficient by calculating the Cramer-Rao lower bound.

5. Multiple choice; questions given but not potential answers.

- As the sample size increases, the sampling distribution of the sample mean looks more like _____.
- As the sample size increases, the standard deviation of the sample mean _____.
- A sample of size 100 is taken from population A, which has a standard deviation of 5. What's the standard deviation of the sample mean?
- We now desire to estimate the mean of Population B, which has a standard deviation of 10. To get the same standard deviation of our estimate of the population mean, the sample size from B should be _____ than the sample size from A.
- Which of these statements does not follow from the central limit theorem?
- Which of these statements would be made by a Bayesian, and which by a Frequentist?

6. The top left plot is the density function for a given population.

- Which graph (A-E) represents a sampling distribution of sample means for samples of size 1 from this population? Justify your choice.
- Which graph (A-E) represents a sampling distribution of sample means for samples of size 10 from this population? Justify your choice.

