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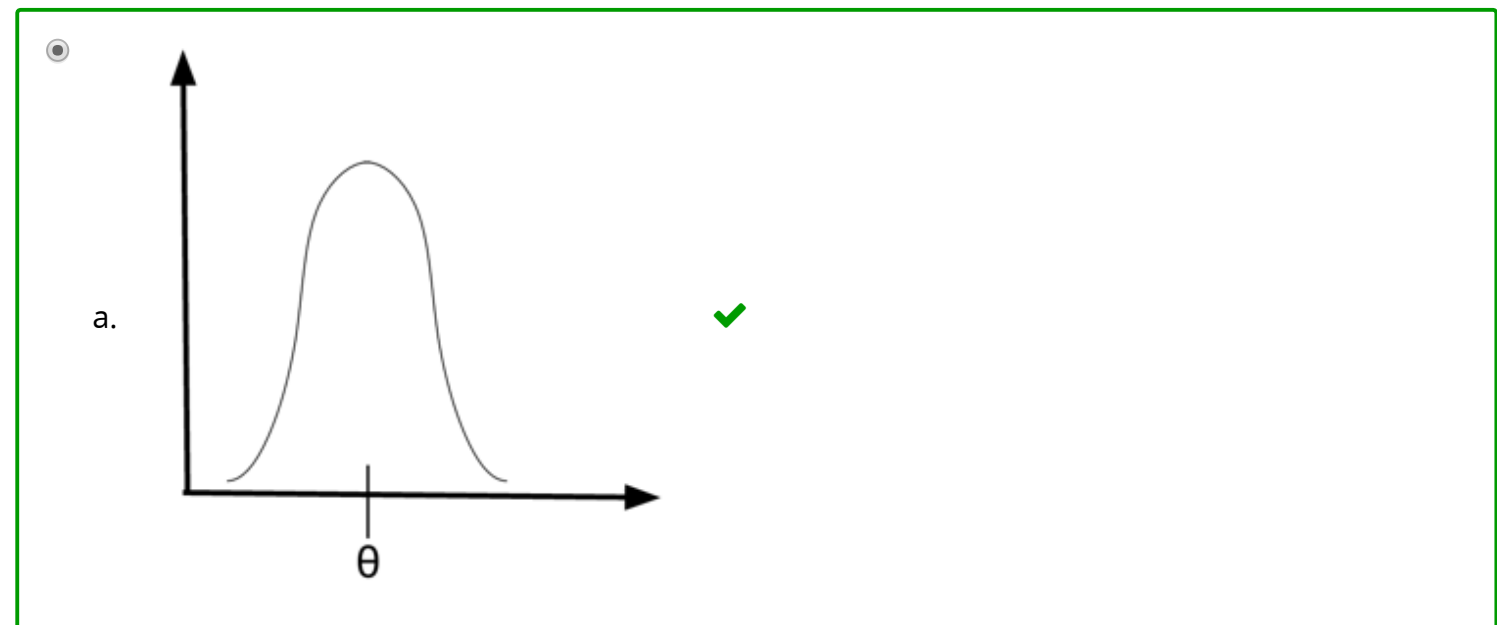
## Efficient Estimators - Quiz

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### Question 1


1.0/1.0 point (graded)

Assuming that the scale of these axes is consistent, select the unbiased estimator  $\hat{\theta}$  that is **most efficient**. Recall that we have only defined efficiency for unbiased estimators. These graphs show PDFs of  $\hat{\theta}$ .




- ▶ Module 5: Moments of a Random Variable, Applications to Auctions, & Intro to Regression
- ▶ Module 6: Special Distributions, the Sample Mean, the Central Limit Theorem, and Estimation
- ▼ Module 7: Assessing and Deriving Estimators - Confidence Intervals, and Hypothesis Testing


### **Assessing and Deriving Estimators**

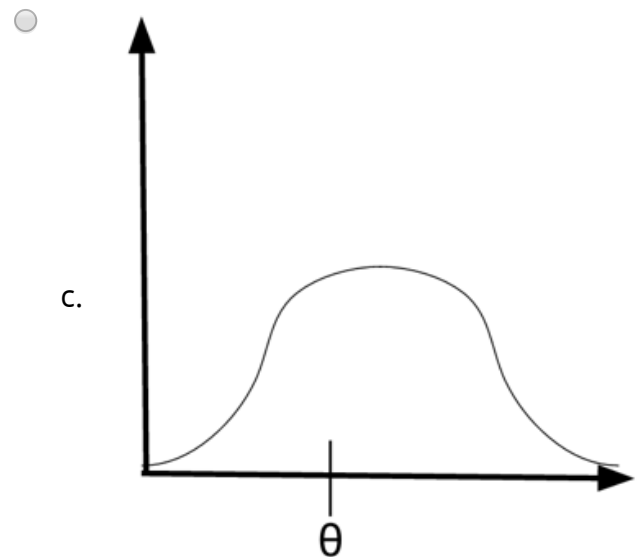
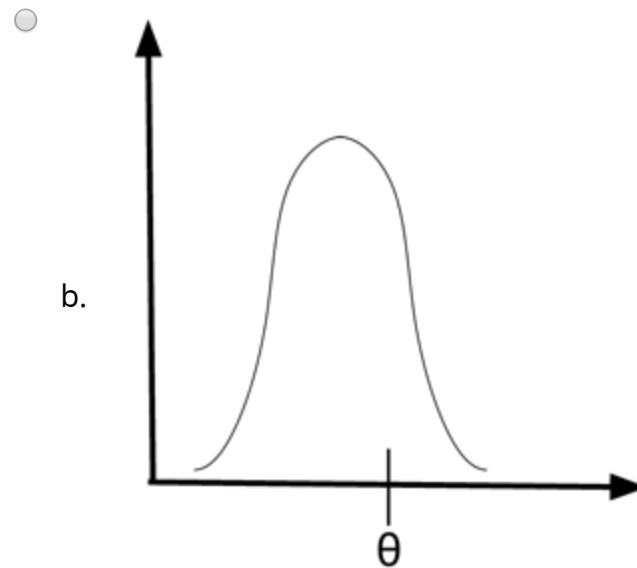
Finger Exercises due Nov 14, 2016  
at 05:00 IST 

### **Confidence Intervals and Hypothesis Testing**

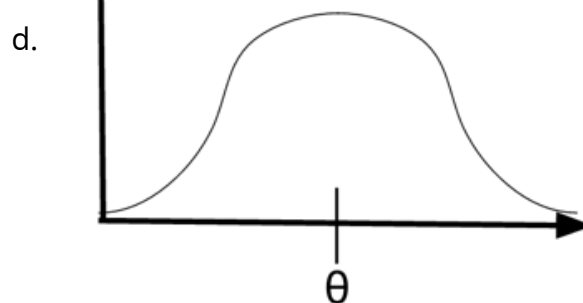
Finger Exercises due Nov 14, 2016  
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### **Module 7: Homework**

Homework due Nov 07, 2016 at  
05:00 IST 



► [Exit Survey](#)



### Explanation

The estimators that are unbiased are (a) and (d). Of the two, (a) is more tightly distributed and therefore more efficient.

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You have used 1 of 2 attempts

### Question 2

1.0/1.0 point (graded)

How might we choose an estimator that gives us the best trade off between bias and efficiency?

- ☐ a. Maximize the mean squared error.
- ☒ b. Minimize the mean squared error. ✓
- ☐ c. Maximize the median squared error.
- ☐ d. Minimize the median squared error.

### Explanation

The mean squared error  $MSE[\hat{\theta}] = \text{Var}(\hat{\theta}) + (E[\hat{\theta}] - \theta)^2$  can be thought of as the sum of the estimator's variance and the square of the estimator's bias. In order to pick an estimator that has a low variance and bias, we want to minimize this sum.

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### Question 3

1.0/1.0 point (graded)

Which of the following is true about consistent estimators? (Select all that apply.)

- ☐ a. They are always unbiased.
- ☐ b.  $\lim_{n \rightarrow \infty} P(|\theta - \hat{\theta}| < \delta) = 1$

☒ c.  $\lim_{n \rightarrow \infty} P(|\theta - \hat{\theta}| < \delta) = 1$

☒ d. The distribution of the estimator collapses to a single point as  $n$  goes to infinity.



### Explanation

The definition of a consistent estimator is given by (c). As  $n$  goes to infinity, the distribution becomes more and more concentrated, collapsing to a single point. (a) is false because (c) could be true even if the estimator is biased.

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### Question 4

1.0/1.0 point (graded)

Which of the following is true about estimating the parameter  $\theta$  of a  $U[0, \theta]$  distribution?

☐ a. Estimating  $\theta$  by doubling the sample mean is both more biased and more efficient than estimating  $\theta$  using the  $n^{th}$  order statistic.

☒ b. Estimating  $\theta$  by doubling the sample mean results in an unbiased estimator, but this method is less efficient than estimating  $\theta$  using the  $n^{th}$  order statistic. ✓

- ☐ c. Estimating  $\theta$  by doubling the sample mean results in a biased estimator, but we might still use this method because it is more efficient than estimating  $\theta$  using the  $n^{th}$  order statistic.
- ☐ d. Estimating  $\theta$  by doubling the sample mean results in a unbiased estimator that is more efficient than estimating  $\theta$  using the  $n^{th}$  order statistic.

### Explanation

As we saw in the first lecture segment, doubling the sample mean is an unbiased estimator of  $\theta$  in a  $U[0, \theta]$  distribution. This rules out (a) and (c). In this lecture segment, we learnt that the  $n^{th}$  order statistic is more tightly distributed (i.e. more efficient) than the sample mean as an estimator. Therefore (b) is correct.

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### Discussion

**Topic:** Module 7 / Efficient Estimators - Quiz[Show Discussion](#)

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