

# **DelftX:** OT.1x Observation theory: Estimating the Unknown

Help

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Warming up

# 4.1. Estimates vs Estimators

4.2. Best Linear Unbiased Estimation (BLUE)

### Assessment

Graded Assignment due Feb 8, 2017 17:30 IST

4. Best Linear Unbiased Estimation (BLUE) > 4.1. Estimates vs Estimators > Exercises: Estimator properties

# **Exercises: Estimator properties**

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# Theory on estimators of linear models

4/4 points (ungraded)

Assume a linear model  $E\{\underline{y}\}=Ax$ , and the WLS estimator  $\hat{\underline{x}}_{\mathrm{WLS}}=(A^TWA)^{-1}A^TW\underline{y}$ 

For each of the following statements, select whether the statement is true or false.

 $\hat{m{x}}_{ extbf{LS}}$  is a non-linear estimator.



✓ Answer: False

### **Answer**

Correct: The WLS estimator is a linear function of  $m{y}$  as  $m{L}m{y}$ , where  $m{L}=(m{A}^Tm{W}m{A})^{-1}m{A}^Tm{W}$ 

 $\hat{m{x}}_{ extsf{LS}}$  is always normally distributed.



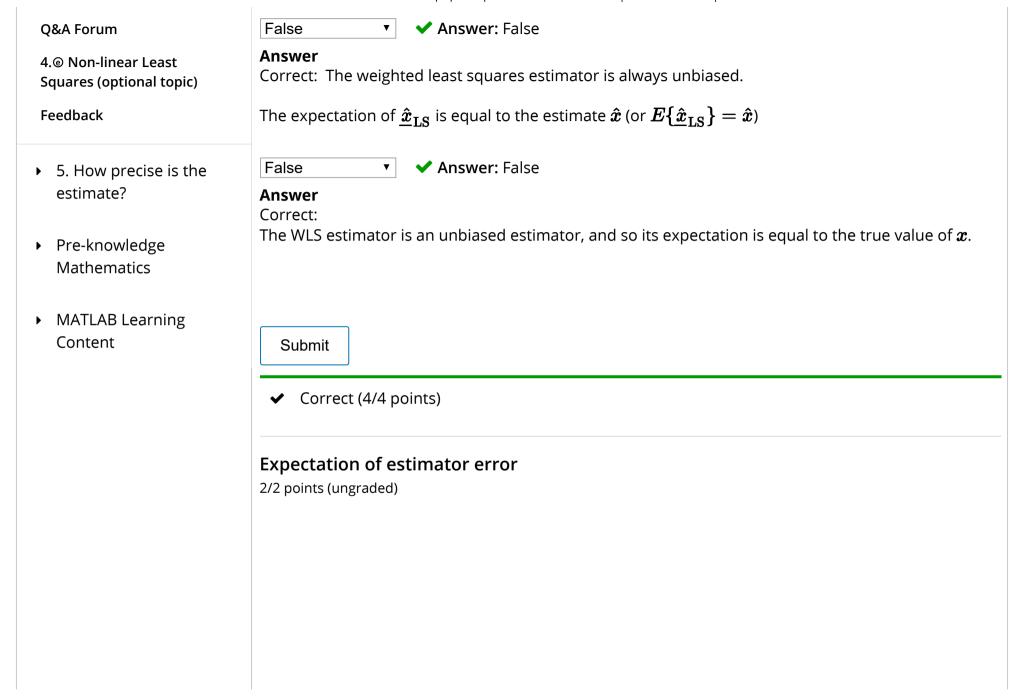
✓ Answer: False

# Answer

Correct:

It is true only if  $\underline{y}$  is normally distributed. For non-Gaussian observations, this statement is not correct.

 $\hat{m{x}}_{ ext{LS}}$  may or may not be biased, depending on the chosen weight matrix.



Assume the canal width problem, with vector of observables  $\underline{\underline{y}}=\begin{bmatrix} \underline{\underline{y}}_1\\ \underline{\underline{y}}_2\\ \underline{\underline{y}}_3\\ \underline{\underline{y}}_4\\ \underline{y}_r \end{bmatrix}$  , and a set of observations

$$y=egin{bmatrix} 10.1\ 10.15\ 9.9\ 10.2\ 10.1 \end{bmatrix}$$
 . The least squares estimate is given as  $\hat{x}=10.09.$ 

What is the expectation of the estimator  $\hat{\boldsymbol{x}}$ ?

- O
- 0 10.09
- 0 10
- Unknown

# Answer

Correct:

The LS estimator is unbiased, and so its expectation is equal to the true value of the canal width which is unknown.

Exercises: Estimator properties   4.1. Estimates vs Estimators   OT.1x Courseware   edX What is the expectation of the estimation error $\underline{\epsilon} = \underline{\hat{x}} - x$ ? ( $x$ is the true value of the canal width)?
0 10.09
10
Unknown
<b>Answer</b> Correct: The LS estimator is unbiased, and so the expectation of the estimation error is zero.
Submit
✓ Correct (2/2 points)

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