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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



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Exercises: Estimate vs. Estimator

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Understanding random/stochastic variables

1/1 point (ungraded)

In module 4.1, new terminology was introduced.

Of the names of the variables below, please indicate which ones are used to indicate a random/stochastic variable.

☒ estimator☐ estimate☐ observation☒ observable

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Q&A Forum

4.© Non-linear Least Squares (optional topic)

Feedback

- ▶ 5. How precise is the estimate?
- ▶ Pre-knowledge Mathematics
- ▶ MATLAB Learning Content

✓ Correct (1/1 point)

Stochastic vs. deterministic variables

1/1 point (ungraded)

Theory:

It is proven in statistics that a linear function of a normally distributed variable/vector is again normally distributed. That is, if \underline{y} is normally distributed and \underline{z} is a linear function of \underline{y} (such as $\underline{z} = \underline{L}\underline{y}$), then \underline{z} is also normally distributed.

Based on this theory answer the following question.

Assume we observe the width of a canal five times and we want to estimate the width of the canal. The observables are $\underline{y}_1, \underline{y}_2, \underline{y}_3, \underline{y}_4$, and \underline{y}_5 , and all are normally distributed. For this estimation problem, the observable vector \underline{y} , and the design matrix \underline{A} can be written as

$$\underline{y} = \begin{bmatrix} \underline{y}_1 \\ \underline{y}_2 \\ \underline{y}_3 \\ \underline{y}_4 \\ \underline{y}_5 \end{bmatrix}, \quad \underline{A} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}.$$

Applying least squares estimation on this model provides us the estimator for the canal width as:

$$\underline{\hat{x}} = (\underline{A}^T \underline{A})^{-1} \underline{A}^T \underline{y}.$$

Which of the following statements is correct?

- ☒ \hat{x} is a stochastic variable, and it is normally distributed. ✓
- ☐ \hat{x} is a stochastic variable, but it is not necessarily normally distributed.
- ☐ \hat{x} is deterministic, and so it does not have any distribution

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✓ Correct (1/1 point)

Stochastic vs. deterministic variables (continued)

1/1 point (ungraded)

Now for the above question assume the observations are given as: $y_1 = 10.1\text{m}$, $y_2 = 10.15\text{m}$, $y_3 = 9.9\text{m}$, $y_4 = 10.2\text{m}$, and $y_5 = 10.1\text{m}$. Application of LS estimation gives the estimate \hat{x} as

$$\hat{x} = (A^T A)^{-1} A^T \begin{bmatrix} 10.1 \\ 10.15 \\ 9.9 \\ 10.2 \\ 10.1 \end{bmatrix} = 10.09$$

Which of the following statements is correct?

☐ $\hat{x} = 10.09$ is stochastic, and it is normally distributed.

☒ $\hat{x} = 10.09$ is deterministic, but it is a realization of the estimator $\underline{\hat{x}}$. ✓

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✓ Correct (1/1 point)

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