

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

Help

■Bookmarks

- 0. Getting Started
- 1. Introduction to Observation Theory
- ▼ 2. Mathematical model

Warming Up

- 2.1 Functional Model
- 2.2 Properties of Functional Models
- 2.3 Stochastic Model

Assessment

Graded Assignment due Feb 8, 2017 17:30 IST

Q&A Forum

Feedback

3. Least Squares Estimation (LSE) 2. Mathematical model > 2.3 Stochastic Model > Exercises: Stochastic model (cont'd)

Exercises: Stochastic model (cont'd)

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True/False

4/4 points (ungraded)

- a) Two correlated observations carry less information than two uncorrelated observations (assume that the two observations have same precision in both cases).
- True
- False
- b) The functional model contains information about the uncertainty of the measurements .
 - True
 - False ✔

Answer

Correct: False, it is the stochastic model which contains information about the uncertainty.

- 4. Best Linear Unbiased Estimation (BLUE)
- Pre-knowledgeMathematics
- MATLAB Learning Content

c) The covariance of two observables does not depend on the precision of those observables

True

False

Answer

Correct: False, $\sigma_{ij} =
ho_{ij}\sigma_i\sigma_j$

d) The stochastic model is given by the covariance matrix, which is a $n \times n$ square matrix, with n the number of unknowns.

True

● False ✔

Answer

Correct: False, since it is the covariance matrix of the observables, it is a m imes m square matrix

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✓ Correct (4/4 points)

Cheating surveyor

1/1 point (ungraded)

A surveyor is asked to take two measurements of the width of a canal. The surveyor is a bit lazy though, and decides to take only one measurements, and present this same measurement twice, i.e. $y_1=y_2$. The precision of the measurement is equal to $sigma_1=2$.

If you would know that the surveyor cheated, what is then the correct stochastic model?

$$egin{array}{c} O_{yy} = egin{bmatrix} 4 & 1 \ 1 & 4 \end{bmatrix}$$

$$egin{array}{ccc} lackbox{0} & Q_{yy} = egin{bmatrix} 4 & 4 \ 4 & 4 \end{bmatrix} lacksquare$$

$$Q_{yy} = egin{bmatrix} 4 & rac{1}{4} \ rac{1}{4} & 4 \end{bmatrix}$$

$$egin{array}{c} Q_{yy} = egin{bmatrix} 2 & 1 \ 1 & 2 \end{bmatrix}$$

Explanation

We have that the correlation coefficient $ho_{12}=1$ and thus the covariance will be $\sigma_{12}=
ho_{12}\sigma_1\sigma_2=1\cdot 2\cdot 2$.

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✓ Correct (1/1 point)

MATLAB EXERCISE: STOCHASTIC MODEL (EXTERNAL RESOURCE)

What is the covariance matrix?

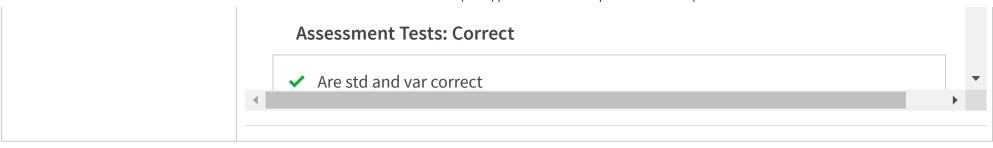
Your Solution

Save C Reset MATLAB Documentation (https://www.mathworks.com/help/)

```
1 % Complete the lines with ... (preceded by STEP 1 / 2 / 3)
3 % STEP 1: specify the vector with standard deviations of the consecutive measure
4 std = [0.3 \ 0.3 \ 0.3 \ 0.1 \ 0.1 \ 0.1]
5 % STEP 2: specify the vector with variances of the consecutive measurements
6 \text{ var} = \text{std.}^2
 7
8 % first create a diagonal matrix with variances on the diagonal
9 Qyy = diag(var);
10
11 % this is the value for beta
12 beta = 0.6:
13
14 % here we will fill in the values for the
15 % variance and covariances of the first 3 observations
16 for i = 1:3
17
       for i = 1:3
           % STEP 3: this is where you compute the (co)variances
18
             Qyy(i,j) = beta^(abs(j-i))*std(i)*std(j)
19
20
       end
21 end
22
23 % this is to visualize the covariance matris
24 imagesc(Qyy)
25 colorbar
```

Run

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