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

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# 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-knowledge Mathematics

- ▸ MATLAB Learning Content

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

○ True

◉ False ✔

**Answer**
Correct:  False, $\sigma_{ij} = \rho_{ij}\sigma_i\sigma_j$

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 $m \times m$ 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?

○    $Q_{yy} = \begin{bmatrix} 4 & 1 \\ 1 & 4 \end{bmatrix}$

◉    $Q_{yy} = \begin{bmatrix} 4 & 4 \\ 4 & 4 \end{bmatrix}$ ✔

○    $Q_{yy} = \begin{bmatrix} 4 & \frac{1}{4} \\ \frac{1}{4} & 4 \end{bmatrix}$

○    $Q_{yy} = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$

### Explanation

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

Submit

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✔   Correct (1/1 point)

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## MATLAB EXERCISE: STOCHASTIC MODEL (EXTERNAL RESOURCE)

What is the covariance matrix?

## Your Solution

💾 Save        ↻ Reset        📖 MATLAB Documentation (https://www.mathworks.com/help/)

```matlab
 1 %% Complete the lines with ... (preceded by STEP 1 / 2 / 3)
 2
 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 var  = 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 j = 1:3
18         %% STEP 3: this is where you compute the (co)variances
19             Qyy(i,j) = beta^(abs(j-i))*std(i)*std(j)
20     end
21 end
22
23 %% this is to visualize the covariance matris
24 imagesc(Qyy)
25 colorbar
```

Run        Submit for Assessment

## Assessment Tests: Correct

✔  Are std and var correct

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