Module 6 Assessment - Part 1

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The following questions are part of the graded assignments for the assessment of module 6. The number of points per question is indicated. The total number of points you can earn in this module is 16.

Note, the second part of the assessment includes a MATLAB exercise (next unit).

Calculating the critical value

2/2 points (graded)

Assume we have have a linear model with Gaussian observables. The number of observations is m and the number of unknown is n. The BLU estimate of residual vector has been given as $\hat{e}$.

For each of the following situation, compute the critical value for the overall model test, and determine whether the test is accepted or not.

Case 1:

$m = 95$, $n = 5$, $\alpha = 0.025$, and $\hat{e}^T Q_{yy}^{-1} \hat{e} = 120$.

What is the OMT critical value K_α (upto 2 decimal places)?

118.14 ✔

118.14

Is the OMT accepted or not?

- ○ Accepted
- ◉ Rejected ✔

Answer
Correct: $120 \not< k_\alpha = 118.14$, so the test is rejected

Case 2:
$m = 95$, $n = 5$, $\alpha = 0.001$, $Q_{yy} = 10I_m$ (I_m is the identity matrix) and $\hat{e}^T \hat{e} = 1300$.

What is the OMT critical value K_α (upto 2 decimal places)?

137.21 ✔

137.21

Is the OMT accepted or not?

- ◉ Accepted ✔

Rejected

Answer
Correct: $T = \frac{1300}{10} = 130$, so $T \leq k_\alpha = 137.21$. The test is accepted

Submit You have used 1 of 1 attempt

✔ Correct (2/2 points)

Effect of an optimistic stochastic model

1/3 points (graded)
Three independent observations of a certain unknown distance l are made and the standard deviations are assumed to

be 1 cm. The observations are assumed to be normally distributed. Distance l is to be estimated.

It is found out that the assumed standard deviation was too optimistic, and should have been 2 cm. Then

The overall model test statistic will be too large by a factor S (i.e., $S > 1$) ✔

The overall model test statistic will be too small by a factor S (i.e., $1 > S$) ✖

- The overall model test statistic will be unchanged (i.e., $S = 1$)

What will be the value of the factor S?

1/4 ✖ **Answer:** 4

$\frac{1}{4}$

It means that there is a _____ probability that the overall model test is rejected than if the correct standard deviation would have been used.

- higher ✔
- smaller
- equal

Feedback

$S = \frac{\frac{1}{1}\hat{e}^{\mathrm{T}}\hat{e}}{\frac{1}{4}\hat{e}^{\mathrm{T}}\hat{e}} = 4$. The probability that the test is rejected is higher.

Submit You have used 1 of 1 attempt

✱ Partially correct (1/3 points)

Level of significance

1/1 point (graded)

True or False?

The smaller the level of significance α, the higher the chance to falsely accept the overall model test.

- ◉ True ✔
- ○ False

Answer

Correct:

α is the probability of false rejection of the test. The smaller the α, the lower the chance to falsely reject the test, and the higher the chance to falsely accept the test.

Submit You have used 1 of 1 attempt

✔ Correct (1/1 point)

Reason of OMT rejection

1/1 point (graded)

True or false?

If the overall model test is rejected, it means there is an error in the functional model.

- True
- False ✔

Answer

Correct: There could be othere reasons, for example a wrong stochastic model.

Submit You have used 1 of 1 attempt

✔ Correct (1/1 point)

OMT test statistics

1/1 point (graded)

True or false?

The overal model test ststistic follows the χ^2-distribution for all kinds of observables.

- True
- False ✔

Answer
Correct: It follows χ^2-distribution only if observables are normally distributed.

Submit You have used 1 of 1 attempt

✔ Correct (1/1 point)

OMT with no redundancy

0/1 point (graded)
Assume a linear observation-equations system $\mathbf{E}\{\underline{y}\} = \boldsymbol{A}\boldsymbol{x}$, where observables are normally distributed, with m observations and n unknowns. Matrix $\boldsymbol{A}$ is full rank.

If $m = n$ then

- The overall model test is always accepted ✖
- The overall model test is always rejected

- The overall model test is un-defined (it is not possible to apply the overall model test)

Answer
Incorrect:
In this case, the system is determined and consistent, theere are zero degrees of freedom. The residual vector, and so the test ststistic will be zero as well. But the χ^2-distribution can not be defined for 0 degrees of freedom. In principle, with no redundacy, it is not possible to apply the testing.

Submit You have used 1 of 2 attempts

✖ Incorrect (0/1 point)