



## 10. Exercise: Mean squared error

Exercises due Apr 15, 2020 05:29 IST Completed

### Exercise: Mean squared error

4.0/4.0 points (graded)

As in an earlier exercise, we assume that the random variables  $\Theta$  and  $X$  are described by a joint PDF which is uniform on the triangular set defined by the constraints  $0 \leq x \leq 1$ ,  $0 \leq \theta \leq x$ .

a) Find an expression for the conditional mean squared error of the LMS estimator given that  $X = x$ , valid for  $x \in [0, 1]$ . Express your answer in terms of  $x$  using standard notation.

✓ Answer:  $x^2/12$

b) Find the (unconditional) mean squared error of the LMS estimator.

✓ Answer: 0.04167

STANDARD NOTATION

### Solution:

a) We saw that the conditional PDF of  $\Theta$  is uniform on the range  $[0, x]$ . Hence, the conditional variance is  $x^2/12$ .

b) This is given by the integral of the conditional variance, weighted by the PDF of  $X$ . The PDF of  $X$  is found using the formula for going from the joint to the marginal, and is  $f_X(x) = 2x$ , for  $x \in [0, 1]$ . Thus, the mean squared error is



$$\int_0^1 \frac{x^2}{12} \cdot 2x \, dx = \frac{1}{6} \int_0^1 x^3 \, dx = \frac{1}{24}.$$

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You have used 3 of 3 attempts

**i** Answers are displayed within the problem

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? [Area of triangle](#)

1 new\_

Hi, I calculated the area of triangle as  $(1/2) \cdot (x) \cdot (\text{Theta}) = (1/2) \cdot (\text{Theta}^2)$ , then calculate joint PDF and m...

💬 [Average of Conditional Mean Squared Error of LMS estimator as a function of x](#)

1

The conditional MSE of the LMS estimator is a function of x as we got the answer in 4.a The video mentio...

💬 [Hint](#)

2

I recommend watching the solved problem: 5. Inference example (unit 7) for this question

💬 [Just lost 4 points! ...](#)

2

... and it feels amazing. I always overcomplicate shit. Like, too much. For real.

? [What am I doing wrong?](#)

12

I got a) right. For b) my marginal PDF is coming equal to joint PDF since doing an integral from 0 to 1. Is t...

💬 [I assumed x was uniform on \(0,1\)!](#)

1

I got the answer right, because  $f(x)=2x$  and  $f(x)=1/x$  both give the same answer in this case. But I see that ...

💬 [Check here if you forgot how to get the marginal](#)

7

Unit 5, Lecture 9, Parts 13, 14, 15.

? [Part A](#)

3

Is the expression case sensitive in part a? I have b correct but not a.

? [What is the difference between condtional and unconditional mean square error?](#)

2

Guys, I didn't get it. :( Which mean square error was found in lectures? And how can we get one from an.



? How to calculate the marginal  $f_X(x)$ ?

2

I know I should be able to do this by now, and somehow I managed to get the correct answer for 2) but ...

🗨 About the calculation of mean squared error

14

? how does one do part a?

2

how does one do part a?

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