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## 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  $0 \le x \le 1$ ,  $0 \le \theta \le x$ .

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.

x^2/12 **✓ Answer:** x^2/12

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

1/24 **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



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

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You have used 3 of 3 attempts

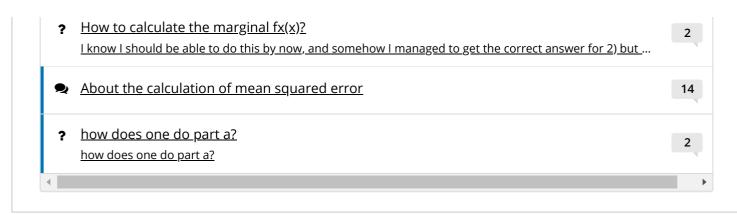
**1** Answers are displayed within the problem

## Discussion

**Hide Discussion** 

**Topic:** Unit 7: Bayesian inference:Lec. 16: Least mean squares (LMS) estimation / 10. Exercise: Mean squared error

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? Area of	triangle ulated the area of triangle as (1/2)*(x)*(Theta) = (1/2) * (Theta^2), then calculate joint P	1 new_ DF and m
, ,	e of Conditional Mean Squared Error of LMS estimator as a function of $x$ ditional MSE of the LMS estimator is a function of $x$ as we got the answer in 4.a The vides	eo mentio
<u>Hint</u> <u>I recomr</u>	nend watching the solved problem: 5. Inference example (unit 7) for this question	2
	t 4 points! feels amazing. I always overcomplicate shit. Like, too much. For real.	2
	m I doing wrong?  Ight. For b) my marginal PDF is coming equal to joint PDF since doing an integral from	0 to 1. ls t
_	ned x was uniform on (0,1)! answer right, because f(x)=2x and f(x)=1/x both give the same answer in this case. But	I see that
	nere of you forgot how to get the marginal ecture 9, Parts 13, 14, 15.	7
? Part A	pression case sensitive in part a? I have b correct but not a.	3
	the difference between condtional and unconditional mean square error idn't get it. :( Which mean square error was found in lectures? And how can we get one	2



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