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## Problem 6: Estimating the parameter of a uniform r.v.

(3/5 points)

The random variable  $\mathbf{X}$  is uniformly distributed over the interval  $[\theta, 2\theta]$ . The parameter  $\theta$  is unknown and is modeled as the value of a continuous random variable  $\Theta$ , uniformly distributed between zero and one.

1. Given an observation  $x$  of  $\mathbf{X}$ , find the posterior distribution of  $\Theta$ . Express your answers below in terms of  $\theta$  and  $x$ . Use 'theta' to denote  $\theta$  and 'ln' to denote the natural logarithm function. For example,  $\ln(\theta)$  should be entered as 'ln(theta)'.

For  $0 \leq x \leq 1$  and  $x/2 \leq \theta \leq x$ ,  $f_{\Theta|X}(\theta | x) =$



2. Find the MAP estimate of  $\Theta$  based on the observation  $\mathbf{X} = x$  and assuming that  $0 \leq x \leq 1$ . Express your answer in terms of  $x$ .

For  $0 \leq x \leq 1$ ,  $\hat{\theta}_{\text{MAP}}(x) =$



3. Find the LMS estimate of  $\Theta$  based on the observation  $\mathbf{X} = x$  and assuming that  $0 \leq x \leq 1$ . Express your answer in terms of  $x$ .

For  $0 \leq x \leq 1$ ,  $\hat{\theta}_{\text{LMS}}(x) =$



4. Find the linear LMS estimate  $\hat{\theta}_{\text{LLMS}}$  of  $\Theta$  based on the observation  $\mathbf{X} = x$ . Specifically,  $\hat{\theta}_{\text{LLMS}}$  is of the form  $c_1 + c_2 x$ . Find  $c_1$  and  $c_2$ .

$c_1 =$




$c_2 =$




You have used 2 of 2 submissions


**Unit overview****Lec. 14:  
Introduction to  
Bayesian inference**

Exercises 14 due Apr  
06, 2016 at 23:59 UTC 


**Lec. 15: Linear  
models with  
normal noise**

Exercises 15 due Apr  
06, 2016 at 23:59 UTC 


**Problem Set 7a**

Problem Set 7a due  
Apr 06, 2016 at 23:59  
UTC 


**Lec. 16: Least  
mean squares  
(LMS) estimation**

Exercises 16 due Apr  
13, 2016 at 23:59 UTC 

**Lec. 17: Linear  
least mean  
squares (LLMS)  
estimation**

Exercises 17 due Apr  
13, 2016 at 23:59 UTC 

**Problem Set 7b**

Problem Set 7b due  
Apr 13, 2016 at 23:59  
UTC 

**Solved problems****Additional  
theoretical  
material****Unit summary**

- ▶ Unit 8: Limit theorems and classical statistics

**DISCUSSION**

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