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Bookmark

Problem 2: Estimating the parameter of a geometric r.v.

(3/3 points)

We have k coins. The probability of Heads is the same for each coin and is the realized value q of a random variable Q that is uniformly distributed on $[0, 1]$. We assume that conditioned on $Q = q$, all coin tosses are independent. Let T_i be the number of tosses of the i^{th} coin until that coin results in Heads for the first time, for $i = 1, 2, \dots, k$. (T_i includes the toss that results in the first Heads.)

You may find the following integral useful: For any non-negative integers k and m ,

$$\int_0^1 q^k (1 - q)^m dq = \frac{k!m!}{(k + m + 1)!}.$$

1. Find the PMF of T_1 . (Express your answer in terms of t using standard notation.)

For $t = 1, 2, \dots$, we have $p_{T_1}(t) =$



2. Find the least mean squares (LMS) estimate of Q based on the observed value, t , of T_1 . (Express your answer in terms of t using standard notation.)

$\mathbf{E}[Q \mid T_1 = t] =$




3. We flip each of the k coins until they result in Heads for the first time. Compute the maximum a posteriori (MAP) estimate \hat{q} of Q given the number of tosses needed, $T_1 = t_1, \dots, T_k = t_k$, for each coin. Choose the correct expression for \hat{q} .

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

☐ $\hat{q} = \frac{k-1}{\sum_{i=1}^k t_i}$

☒ $\hat{q} = \frac{k}{\sum_{i=1}^k t_i}$ ✓

☐ $\hat{q} = \frac{k+1}{\sum_{i=1}^k t_i}$

☐ none of the above

You have used 1 of 2 submissions

DISCUSSION

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