

Papoulis Question 8.14

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Question

A coin is tossed once, and heads shows. Assuming that the probability p of heads is the value of a random variable \mathbf{p} uniformly distributed in the interval $(0.4, 0.6)$, find its bayesian estimate.

Solution

We know,

$$f(p|M) = \frac{p^k q^{n-k} f(p)}{\int_0^1 p^k q^{n-k} f(p) dp} \quad (1)$$

In our case $k = 1$ we get,

$$f(p) = \begin{cases} 0.5, & 0.4 \leq p \leq 0.6 \\ 0, & \text{otherwise} \end{cases} \quad (2)$$

$$f(p|1) = \begin{cases} 10p, & 0.4 \leq p \leq 0.6 \\ 0, & \text{otherwise} \end{cases} \quad (3)$$

$$\implies \hat{p} = 0.5067 \quad (4)$$