

STEP III, 1998, Q13

- 13 Write down the probability of obtaining k heads in n tosses of a fair coin. Now suppose that k is known but n is unknown. A *maximum likelihood estimator* (MLE) of n is defined to be a value (which must be an integer) of n which maximizes the probability of k heads.

A friend has thrown a fair coin a number of times. She tells you that she has observed one head. Show that in this case there are *two* MLEs of the number of tosses she has made.

She now tells you that in a repeat of the exercise she has observed k heads. Find the two MLEs of the number of tosses she has made.

She next uses a coin biased with probability p (known) of showing a head, and again tells you that she has observed k heads. Find the MLEs of the number of tosses made. What is the condition for the MLE to be unique?



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