Conditional Example

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August 31, 2022

Particle Counter

A particle counter is imperfect and independently detects each incoming particle with probability p. If the distribution of the number of incoming particles in a unit of time is a Poisson distribution with parameter λ, what is the distribution of the number of counted particles?

Let $N = \#$ of incoming particles and $X = \#$ counted.

1. What is $P(X = k|N = n) = ?$
2. What is $P(N = n)$?
3. Compute $P(X = k)$.