

CSE 312: Foundations of Computing II

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Lecture Topics: 5.3 Conditional Distributions

[**Tags:** Conditional Expectation, Law of Total Expectation]

1. Suppose $X \sim \text{Unif}(0,1)$ (continuous uniform). We repeatedly draw iid $Y_1, Y_2, Y_3, \dots \sim \text{Unif}(0,1)$ (continuous uniform) until the first random time T that $Y_T < X$. What is $E[T]$?

[**Tags:** PSet4 Q1a, Conditional Distributions]

2. Suppose $X \sim \text{Bin}(n, p)$ and $Y \sim \text{Bin}(m, p)$ are independent, and let $Z = X + Y$. What is the conditional PMF $P(X = k | Z = z)$? Actually, $X | Z = z$ is a parametrized distribution we know. What is its name and what are its parameter(s)? (Hint: You know the distribution of Z , and can look up its PMF!)

[**Tags:** Law of Total Probability/Expectation, Conditional Expectation]

3. Suppose the number of radioactive particles emitted in an hour are $X \sim \text{Poi}(\lambda)$. You have a device which records each particle emission with probability p (ideally close to 1), independent of other particles. Let Y be the number of particles actually observed by the device. What is $E[Y]$?