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

[**Tags:** <u>**PSet4 Q1a**</u>, Conditional Distributions]

2. Suppose $X \sim Bin(n,p)$ and $Y \sim Bin(m,p)$ 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 $X \sim Poi(\lambda)$. 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 $E[Y]$?