CSE 312: Foundations of Computing II
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Lecture Topics: 5.1 Joint Discrete Distributions

[**Tags:** Joint PMFs, Marginal PMFs, Expectation]
1. Suppose we flip a fair coin three times independently. Let X be the number of heads in the first two flips, and Y be the number of heads in the last two flips (there is overlap).
   a. What distribution do X and Y have marginally, and what are their ranges?
   b. What is $p_{X,Y}(x, y)$? Hint: Fill in the margins first representing the marginal distributions!
   c. What is $\Omega_{X,Y}$?
   d. Write a formula for $E[\cos{(XY)}]$.
   e. Are X and Y independent?

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2. Let X be the roll of a fair 3-sided die. We then flip a fair coin X times independently; let Y be the number of heads.
   a. What are Ω_X and Ω_Y? What is $\Omega_{X,Y}$? What is X's marginal distribution?
   b. What is $p_{X,Y}(x, y)$? Hint: Fill in the margins for X!
   c. What is $p_Y(y)$?
   d. Write a formula for $E\left[\frac{X}{Y^2+1}\right]$.
   e. Are X and Y independent?