Last lecture

Probability with equally likely outcomes (Ch 1.4)

- Poker hands

Random Variables (RV) (Ch 2.1)

- Definition
- Probability Mass Function (pmf)

Agenda

Random Variables (RV)

- Probability Mass Function (pmf)
- Mean and Variance (Ch 2.2)

Probability Mass Function (PMF)

- Let S be the sum of rolling two dice
  - $p_S =$

- Let M be the max number of rolling two dice
  - $p_M =$

Probability Mass Function (PMF)

- Let N be the # of toss until getting first tail

- Let M be the # of heads observed until getting first tail

Mean and Variance (Ch 2.2)

Mean

Do we need detailed p_{height}?

- In many cases, we just need mean μ_X instead of p_X
- $\mu_X = E[X] = \sum_i x_i p_X(x_i)$

- X is the number for a die roll

- $Y = 2X$

- $Z = |X - 3|$

Function of RV - LOTUS

X is RV uniformly sampled from $\{-1, 0, 1, 2, 3\}$

- $p_X(x) =$

$Y = X^2$

- $\mu_y = E[Y] =$

Function of RV - LOTUS

X is RV uniformly sampled from $\{-1, 0, 1, 2, 3\}$, $Y = X^2$
But we can also compute $E[Y]$ from p_X!

Mean of RV function $g(X)$ is

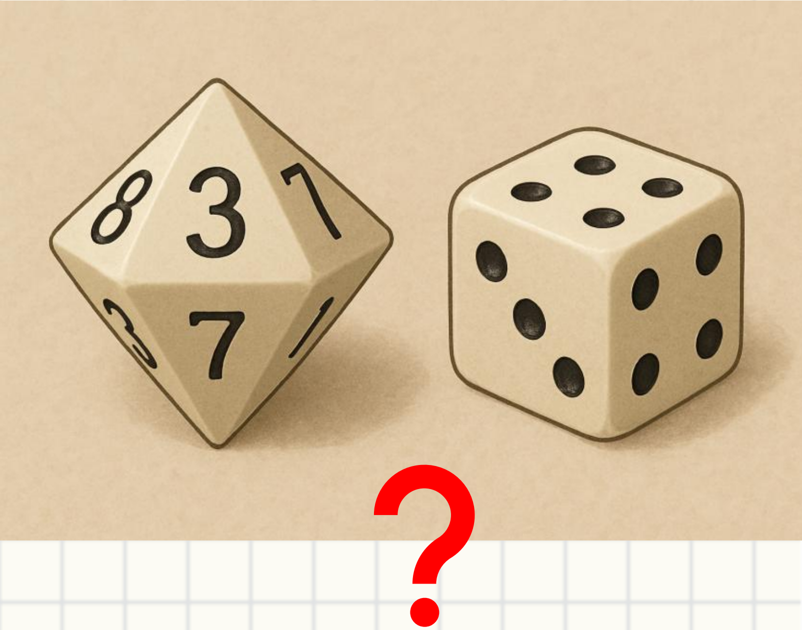
$$E[g(X)] =$$

Law of the unconscious statistician (LOTUS)

LOTUS examples

X is rolling a D6, Y is rolling a D8 (8-sided die)

$E[XY] = ?$



Variance and Standard Deviation

Do you want your salary to be
$p_X(10K) = 1$ or
$p_Y(0) = 0.99, p_Y(1000K) = 0.01$

Mean is important… but not complete enough

- Variance $Var(X)$ is how PMF spreads apart from μ_X
- $Var(X) \triangleq E[(X - \mu_x)^2] =$

Variance and Standard Deviation

Standard deviation $\sigma_X \triangleq \sqrt{Var(X)}$; $Var(X) = \sigma_X^2$

σ_X is of the same unit as X

$Var(X + c) =$

$Var(aX + c) =$

Standardized RV

For any RV X

- $\frac{X-\mu_X}{\sigma_X}$ is a RV – Mean 0, variance 1