

## Example random variable

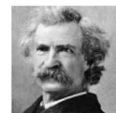
Consider 5 flips of a coin which comes up heads with probability  $p$ . Each coin flip is an independent trial. Let  $Y = \#$  of heads on 5 flips.

1. What is the **support of  $Y$** ? In other words, what are **the values that  $Y$  can take on with non-zero probability**?  $\{0, 1, 2, 3, 4, 5\}$
2. Define the event  $Y = 2$ . What is  $P(Y = 2)$ ?  $P(Y = 2) = \binom{5}{2} p^2 (1 - p)^3$
3. What is the **PMF** of  $Y$ ? In other words, what is  $P(Y = k)$ , for  **$k$  in the support of  $Y$** ?  $P(Y = k) = \binom{5}{k} p^k (1 - p)^{5-k}$

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## Lying with statistics



A school has 3 classes with 5, 10, and 150 students.  
What is the average class size?

### 1. Interpretation #1

- **Randomly choose a class with equal probability.**
- $X =$  size of chosen class

$$\begin{aligned} E[X] &= 5 \left( \frac{1}{3} \right) + 10 \left( \frac{1}{3} \right) + 150 \left( \frac{1}{3} \right) \\ &= \frac{165}{3} = 55 \end{aligned}$$

### 2. Interpretation #2

- **Randomly choose a student with equal probability.**
- $Y =$  size of chosen class

$$\begin{aligned} E[Y] &= 5 \left( \frac{5}{165} \right) + 10 \left( \frac{10}{165} \right) + 150 \left( \frac{150}{165} \right) \\ &= \frac{22635}{165} \approx 137 \end{aligned}$$

What alumni relations usually reports

Average student perception of class size

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