MA/CS109
Probability

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Independence

- If we have two events A and B
  - Ex. Rolling a die and getting 3
  - Ex. Flipping a coin and getting heads

- What does it mean for two events (A & B) to be independent of one another?
  \[ P(A \text{ And } B) = P(A)P(B) \]
Independence

- If I have 3 objects in a bag: blue square, blue rectangle, blue triangle, and:
  - A = Pulling a blue object
  - B = Pulling a square

- \( P(A) = 1 \)
- \( P(B) = \frac{1}{3} \)
- \( P(A \text{ and } B) = \frac{1}{3} \)
- \( P(A)P(B) = (1)\times(\frac{1}{3}) = \frac{1}{3} \)

- Since \( P(A \text{ And } B) = P(A)P(B) \), these events are independent

- How can we modify this example so that they are not?
Independence

- If I have 3 objects in a bag: blue square, green rectangle, red triangle, and:
  - A = Pulling a blue object
  - B = Pulling a square

- \( P(A) = \frac{1}{3} \)
- \( P(B) = \frac{1}{3} \)
- \( P(A \text{ and } B) = \frac{1}{3} \)
- \( P(A)P(B) = \left(\frac{1}{3}\right)\left(\frac{1}{3}\right) = \frac{1}{9} \)

- Since \( P(A \text{ And } B) \neq P(A)P(B) \), these events are dependent