

Prob Stats L03

# Independence

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Two events  $A, B$

$A$  independent of  $B$  when

$$P_r(A|B) = P_r(A)$$

$$P_r(A|B) = \frac{P_r(A \cap B)}{P_r(B)}$$

if  $P_r(A|B) \neq P_r(A)$

then  $A$  dependent on  $B$

$$P_c(A|B) = P_c(A)$$

$$\Leftrightarrow \frac{P_c(A \cap B)}{P_c(B)} = P_c(A)$$

$$\Leftrightarrow P_c(A \cap B) = P_c(A) \cdot P_c(B)$$

$$\Leftrightarrow \frac{P_c(A \cap B)}{P_c(A)} = P_c(B)$$

$$\Leftrightarrow P_c(B|A) = P_c(B)$$

# Fair Die, throw 2 times

A: sum of values is 5

B: at least one throw is 2

$$A = \{ (1, 4), \underline{(2, 3)}, \underline{(3, 2)}, (4, 1) \}$$

$$B = \{ (2, 1), \underline{22}, 23, 24, 25, 26, 12, \underline{22}, 32, 42, 52, 62 \}$$

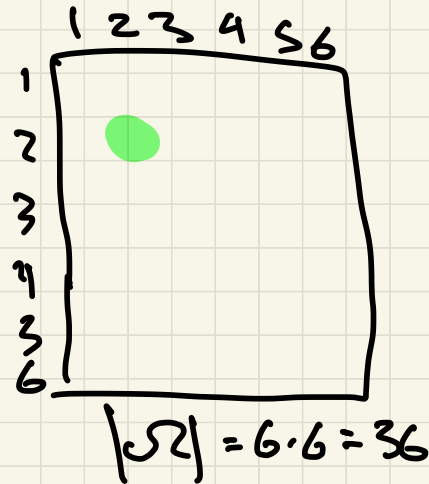
$$P(A \cap B) = \frac{2}{36}$$

$$P(A) = \frac{4}{36}$$

$$P(B) = \frac{11}{36}$$

$$\frac{1}{18} = \frac{2}{36} \neq \frac{4}{36} \cdot \frac{11}{36} = \frac{1}{9} \cdot \frac{11}{36} = \frac{11}{324}$$

NOT independent  $P(A \cap B) \neq P(A) \cdot P(B)$



2 urns, select 1 urn (equal prob), 1 ball.

