

A deck of Poker Cards has 52 cards  
and 13 of these are hearts.

Pick 2 cards from the deck at random.

$A$  = 1st card is a heart

$B$  = 2nd card is a heart.

→ Draw cards without replacement.

$$P(A \text{ \& } B) = \overset{P(A)}{\left(\frac{13}{52}\right)} \overset{P(B|A)}{\left(\frac{12}{51}\right)} = \frac{1}{17} \approx 0.0588$$

↖  $A$  \&  $B$  are dependent  
(the probability of  $B$  depended on  $A$ ).

If  $A$  \&  $B$  are dependent  $P(A \text{ \& } B) = P(A) \cdot \underbrace{P(B|A)}_{\substack{\text{Probability of} \\ B \text{ given } A}}$

→ Draw cards with replacement,

$$P(A \text{ \& } B) = \overset{P(A)}{\frac{13}{52}} \cdot \overset{P(B)}{\frac{13}{52}} = \frac{1}{4} \cdot \frac{1}{4} = \frac{1}{16} \approx 0.0625$$

↖  $A$  \&  $B$  are independent  
 $P(A \text{ \& } B) = P(A) \cdot P(B)$

Rules: (for section 4.2)

$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ \& } B) \leftarrow (\text{Addition})$   
If  $A$  \&  $B$  can't both happen,  $P(A \text{ or } B) = P(A) + P(B) \leftarrow$

$P(A \text{ \& } B) = P(A) \cdot P(B)$  ( $A$  \&  $B$  independent) }  
 $P(A \text{ \& } B) = P(A) \cdot P(B|A)$  ( $A$  \&  $B$  dependent) }  $\leftarrow$  multiplication