



# Multiplication Rules

- Multiplication rule for two events  $E_1$  and  $E_2$ :  
*spade*  $E_1$  and *ace*  $E_2$

$$P(E_1 \text{ and } E_2) = P(E_1) P(E_2 | E_1)$$

*spade*  $E_1$  and *ace*  $E_2$

*x*

Rule 8

**Note:** If  $E_1$  and  $E_2$  are independent, then  $P(E_2 | E_1) = P(E_2)$  and the multiplication rule simplifies to

$$P(E_1 \text{ and } E_2) = P(E_1) P(E_2)$$

*repub*  $E_1$  and *Hates chicken soup*  $E_2$

*x*

Rule 9

Rule 8 example: In a deck of 52 cards, 13 are spades and four are aces.

You pick a card blindly. What is the probability that it is a spade and an ace?

$$P(E_1)$$

$$P(E_2|E_1)$$

$$\frac{1}{52} = .019231$$

$$\frac{13}{52} \times \frac{1}{13} = \frac{1}{52} = .019231$$

Rule 9 example:

In the town of Mooseland, 45% of the adults are republicans, 50% are democrats, 90% like chicken soup, and 10% hate chicken soup

You pick an adult at random. What is the probability that your choice is a republican who hates chicken soup?

$$P(E_1) \times P(E_2)$$
$$.45 \times .10 = .045$$
$$4.5\%$$