

## Conditional Probability

The CONDITIONAL PROBABILITY of event  $E$  given event  $F$  is

$$P(E|F) = \frac{n(E \cap F)}{n(F)} = \frac{n(E \cap F)/n(S)}{n(F)/n(S)} = \frac{P(E \cap F)}{P(F)}$$

### *Example*

At a party, 1/3 of the guests are women. 75% of the women wore sandals and 25% of the men wore sandals.

What is the probability that a person chosen at random at the party is a man wearing sandals?

What is the probability that a randomly chosen guest is wearing sandals?

INDEPENDENT EVENTS:  $P(E|F) = P(E)$

$$P(E|F) = \frac{P(E \cap F)}{P(F)} = P(E) \Rightarrow$$

$P(E \cap F) = P(E) \cdot P(F)$  iff  $E$  and  $F$  are independent

### *Example*

A medical experiment showed the probability that a new medicine was effective was 0.75, the probability of a certain side effect was 0.4 and the probability for both occurring is 0.3. Are these events independent?

## Bayes' Theorem

### *Example*

We are to choose a marble from a cup or a bowl. We need to flip a coin to decide to choose from the cup or the bowl. The bowl contains 1 red and 2 green marbles. The cup contains 3 red and 2 green marbles. What is the probability that a marble came from the cup given that it is red?

### *Example*

Approximately 4.25% of the population is color blind and 50% of the population is female. If the probability of being color blind or female is 54%, what is the chance that a color blind person is male?

*Example*

Urn A contains 4 red, 4 green, and 5 white marbles. Urn B contains 2 green, and 5 white marbles. One marble is drawn from Urn A and if it is green, it is placed in Urn B. Next, a marble is drawn from Urn B.

- A.** Draw a probability tree representing this experiment. Define any labels or abbreviations used the tree.
  
- B.** If the marble drawn from Urn B is white, what is the probability that the marble drawn from Urn A was white?
  
- C.** If the marble drawn from Urn A was green, what is the probability that the marble drawn from Urn B is green?