

# Probability and Odds

definition of probability: chance of an event occurring

$$P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{total number of outcomes}}$$

\* assume order doesn't matter \*

BASIC: 3 baseballs, 7 softballs, 11 tennis balls are in a box.

$$P(\text{baseball}) = \frac{\# \text{ of baseballs}}{\text{total}} = \frac{3}{21} = \frac{1}{7}$$

MEDIUM: Two cards are randomly selected from a deck of 52 cards. What is the probability of choosing two hearts

$$P(2 \text{ hearts}) = \frac{\text{ways to choose 2 hearts}}{\text{ways to choose 2 cards}}$$

$$\begin{array}{l} 13 \text{ hearts, pick 2} \\ 52 \text{ cards, pick 2} \end{array} \quad \frac{C(13, 2)}{C(52, 2)} \text{ OR } \frac{{}_{13}C_2}{{}_{52}C_2} = \frac{1}{17}$$

ADVANCED: Six freshman, four sophomores, five juniors, and three seniors participate in a raffle. ..

What is the probability the winners are one freshman and two juniors?

$$P(1 \text{ fresh, } 2 \text{ junior}) = \frac{\text{ways to choose 1 freshman} \cdot \text{ways to choose 2 juniors}}{\text{ways to choose 3 winners}}$$

$$\frac{{}^6C_1 \cdot {}^5C_2}{{}^{18}C_3} = \frac{5}{68}$$

An urn contains 6 red and 4 green balls. Seven balls are selected at random. What is the probability of ...

① 3 red, 4 green

$$\frac{{}^6C_3 \cdot {}^4C_4}{{}^{10}C_7} = \frac{20}{120} = \frac{1}{6}$$

② all red

$$\frac{{}^6C_7}{{}^{10}C_7} = 0$$

\* at least 4 red

(4 red, 3 green) + (5 red, 2 green) + (6 red, 1 green)

$$\frac{{}^6C_4 \cdot {}^4C_3}{{}^{10}C_7} + \frac{{}^6C_5 \cdot {}^4C_2}{{}^{10}C_7} + \frac{{}^6C_6 \cdot {}^4C_1}{{}^{10}C_7} =$$

definition of odds : ratio of success to failure

\* does not compare to total \*

compares complementary events

BASIC : What are the odds of randomly

selecting a girl from the class?

7 girls  
14 boys  
21 people

$$\text{odds}(\text{girl}) = \frac{\text{girls}}{\text{not girls}} = \frac{7}{14} = \frac{1}{2}$$

MEDIUM: The basketball team played 56 games last year. They only lost 12 games. What were the odds of them winning?

44 win  
12 lost  
56 games

$$\text{odds}(\text{win}) = \frac{\text{wins}}{\text{losses}} = \frac{44}{12} = \frac{11}{3}$$

$$\text{odds}(\text{loss}) = \frac{3}{11}$$

The odds of FSU beating Duke are 7:1. What is the probability Duke will win?

7 FSU win  
1 FSU lose  
8

$$P(\text{Duke wins}) = \frac{1}{8}$$

$$P(\text{FSU win}) = \frac{7}{8}$$