

Theoretical Probability

Probability is used to predict the outcomes of various events. It is the chance of something happening.

Probability is used to make predictions about games of chance, the weather, results of elections.

Probabilities can be written in 3 ways:

		Example 1	Example 2		
i. as a fraction	$\frac{\text{\# of successful attempts}}{\text{total \# of attempts}}$	$\frac{1}{2}$	$\frac{6}{10} = \frac{3}{5}$		$\frac{\text{\# of successful attempts}}{\text{total \# of attempts}}$
ii. as a decimal	divide the fraction to convert to percent	0.5	0.6		use place value to convert to fraction # of decimals = # of zeros
iii. as a percent	multiply by 100 to convert to percent	50%	60%		divide by 100 to convert to decimal

When two or more things have the same probability of happening, they are considered to have **equally likely outcomes**.

Theoretical Probability is the chance of something happening in a perfect world. It can be calculated using the formula:

$$P = \frac{\text{\# of favourable outcomes}}{\text{\# of possible outcomes}}$$

Example 1

A number from 1 to 50 inclusive is chosen at random. What is the probability that the number . . .

a. is even?	50%	b. ends in a 3? 3, 13, 23, 33, 43	$\frac{5}{50} = 10\%$
c. is odd?	50%	d. does not end in a 3? OR $\frac{45}{50}$	$100 - 10\% = 90\%$
e. is greater than 13? $50 - 13 = 37$	$\frac{37}{50} = 74\%$	f. is prime? 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47	$\frac{15}{50} = 30\%$
g. is divisible by 5? 5, 10, 15, 20, 25, 30, 35, 40, 45, 50	$\frac{10}{50} = 20\%$	h. has 2 digits the same? 11, 22, 33, 44	$\frac{4}{50} = 8\%$

Example 2

The Toronto Maple Leafs are playing the Detroit Redwings in the 2003 Stanley Cup Finals. The probability of the Maple Leafs winning are $\frac{4}{11}$.

- a. What is the probability of each team winning a single game? Write your answers as percentages.

$$\text{Maple Leafs} = \frac{4}{11} = 36\% \qquad \text{Detroit Redwings} = \frac{7}{11} = 63\%$$

- b. If these teams were to play 6 games, how many is each expected to win?

$$\begin{aligned} \text{Maple Leafs } & 36\% \text{ of } 6 \\ & = 0.36(6) \\ & = 2 \text{ games} \end{aligned} \qquad \text{Detroit} = 4 \text{ games}$$

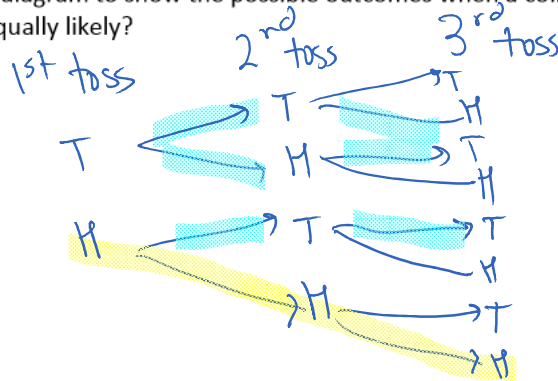
Example 3

Suppose you toss a coin three times.

- a. Which event do you think is more likely: you get 3 heads, or you get 1 head and 2 tails? Explain your thinking.

more likely
 since every time you toss a coin there's 50-50 chance it will be head or tail

- b. Draw a tree diagram to show the possible outcomes when a coin is tossed three times. Are the outcomes equally likely?



- c. Use your diagram to determine the probability of each event.

i. 3 heads

$$\frac{1}{8} = 12.5\%$$

ii. no heads

all 3 Tails
 $\frac{1}{8} = 12.5\%$

iii. 1 head and 2 tails

$$\frac{3}{8} = 37.5\%$$