

INTRODUCTORY PROBABILITY

A probability is written as a number between zero and one: $0 \leq \Pr(A) \leq 1$

$\Pr(A) = 0$ means that event A is impossible.

$\Pr(A) = 1$ means that event A is certain.

When considering a set of all possible outcomes an **event** is a particular outcome of interest. For example,

- In tossing a coin the particular event of interest might be 'obtaining a head'
- In considering the weather for Saturday the event of interest might be 'it doesn't rain'
- In planning a two child family the particular event of interest might be 'a boy and a girl'.

The probability of an event E can be found with the formula:

$$\Pr(E) = \frac{\text{number of ways E can occur}}{\text{total number of possible outcomes}}$$

[assuming all outcomes are equally likely]

Examples:

1. If two coins are tossed find the probability of obtaining two heads.

Let E be the event 'two heads'

The possible outcomes are HH HT TH TT

$$\begin{aligned} \therefore \Pr(E) &= \frac{\text{number of ways E can occur}}{\text{total number of possible outcomes}} \\ &= \frac{1}{4} \end{aligned}$$

2. If a die is thrown find the probability of obtaining an odd number

Let E be the event 'an odd number'

The possible outcomes are 1 2 3 4 5 6

$$\begin{aligned} \therefore \Pr(E) &= \frac{\text{number of ways E can occur}}{\text{total number of possible outcomes}} \\ &= \frac{3}{6} \\ &= \frac{1}{2} \end{aligned}$$

The multiplication principle

Two events, A and B, are independent if the fact that A occurs does not affect the probability of B occurring. Because successive tosses of a coin are independent events, an alternate way of calculating the probability in example one would be to use the multiplication principle.

$$\begin{aligned} &\text{If A and B are independent events then} \\ &\Pr(A \text{ and } B) = \Pr(A \cap B) = \Pr(A) \times \Pr(B) \end{aligned}$$

