

# Probability 15

## The dice problem

Suppose that we roll a pair of dice. The sample space is given by the 36 equally likely ordered pairs shown below.

1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

The probability of rolling a 12, (6, 6), is  $1/36$ . The probability of rolling a ten {(6, 4), (5, 5), or (4, 6)} is  $3/36 = 1/12$ .

## Coin problem

Suppose that we toss 5 coins. What is the probability of getting 3 heads?

The total number of possibilities is  $2 \times 2 \times 2 \times 2 \times 2 = 32$ . There are several ways we can get 3 heads; HHHTT, HTHTH, TTHHH, and so on.

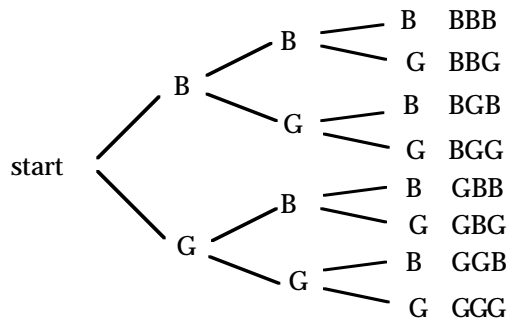
The number of possibilities can be found using the permutation formula. The number of possibilities is  $5!/(3! \times 2!) = 10$ .

The probability of getting 3 heads is  $10/32 = 5/16$ .

## Baby Problem

A couple wants to have three children. What is the probability that they will have exactly two boys?

We can solve this problem using a tree diagram.



There are eight possibilities. Three of these, have two boys and one girl. The probability that the couple will have two boys and one girl is  $\frac{3}{8}$ .

Using the permutation formula we can also solve this problem. The total number of possibilities is  $2 \times 2 \times 2 = 8$ . The number of favorable outcomes =  $\frac{3!}{(2! \times 1!)} = 3$ . The required probability =  $\frac{3}{8}$ .

Problems:

1) A pair of dice are rolled. Find the probabilities.

a) P(total is six)    b) P(at least one die shows a five)

c) P(nine or greater)    d) P(both show an even number)

2) Toss seven coins. Find the probabilities.

a) P(seven heads)    b) P(one head)

c) P(four heads)    d) P(at least five heads)

3) A couple want to have four children.

a) What is the probability that they will have one girl and three boys?

b) What is the probability that they will have two girls and two boys?

Answers: 1)a)  $\frac{5}{36}$ , b)  $\frac{11}{36}$ , c)  $\frac{5}{18}$     d)  $\frac{1}{4}$ , 2)a)  $\frac{1}{128}$ , b)  $\frac{7}{128}$ , c)  $\frac{35}{128}$ , d)  $\frac{29}{128}$ , 3)a)  $\frac{1}{4}$ , b)  $\frac{3}{8}$ .