Dodgy Probability

Laplace once said that probability is just common sense reduced to calculation.

Well I find probability difficult. Here are some questions and my attempts to answer them.

Question 1

Spin two coins. What is the probability you get two heads?

Answer

When you spin two coins you can get: two heads or two tails or one of each.

So answer is   1/3

Question 2

Spin three coins. What is the probability you get either three heads or three tails?

Answer

When you spin three coins, two must land the same way. The other coin is equally likely to be the same or to be different from these two.

So answer is   1/2

Question 3

Spin 2 coins. Given that one of the coins lands heads, what is the probability that both coins land heads?

Answer

One of the coins lands heads. Consider the other coin. It is equally likely to land heads or tails.

So answer is   1/2

Question 4

Spin a coin repeatedly, until you get a head followed by a head or a tail followed by a head. Which is more likely?

Answer

HH and TH are all equally likely.

So answer is   1/2

Question 5

Roll a pair of dice. What is the probability the scores on the dice add up to 8?

Answer

There are 3 ways I can get a total of 8:

      2 and 6        3 and 5        double 4

There are 21 possible outcomes

| double 1 | 1 and 2 | 1 and 3 | 1 and 4 | 1 and 5 | 1 and 6 |
|---|---|---|---|---|---|
| | double 2 | 2 and 3 | 2 and 4 | 2 and 5 | 2 and 6 |
| | | double 3 | 3 and 4 | 3 and 5 | 3 and 6 |
| | | | double 4 | 4 and 5 | 4 and 6 |
| | | | | double 5 | 5 and 6 |
| | | | | | double 6 |

So answer is: $\dfrac{3}{21}$

## Question 6

A bag contains a ball. It is equally likely to be red or green. A red ball is added to the bag. Then a ball is taken from the bag. It is a red ball.

What is the probability that the other ball in the bag is red?

Answer

We have put in a red ball and then taken out a red ball, so we are back to where we started.

So answer is   1/2

## Question 7

A bag contains three cards. One card is red on both sides, one card is green on both sides, and one card is red on one side and green on the other side. A card is taken from the bag, and placed down on the table, so that only one side can be seen. This side is red.

What is the probability that its other side is red?

Answer

We know that the card on the table is not the green-green card. It is equally likely to be either of the other two cards.

So answer is   1/2

## Question 8 (this is the notorious Monty Hall Problem)

In a game show, the contestant is shown three closed doors. Behind one of these doors is a new car and behind each of the other two doors is a goat. The contestant points to a door. The host then opens one of the other doors, revealing a goat. The contestant is now given the opportunity to stick

with their original choice of door or switch to the other closed door. Assuming the contestant is hoping to choose the door with the car behind it, is it best to switch doors or stick with the original choice?

Answer

The contestant ends up facing two doors. One has a goat behind it, the other a car. The contestant can choose either door. Switch or stick, it makes no difference.

Question 9

There are 23 people in a room. What is the probability that no 2 people have the same birthday?

Answer

There are $\left(365\,C\,23\right)$ ways you can pick 23 different dates in the year.

There are $\left(365\right)^{23}$ ways you can pick 23 dates in the year.

So answer is $\dfrac{\left(365\,C\,23\right)}{\left(365\right)^{23}}$

So how did I get on? It turns out that I got them all wrong!

See the section: Probability Exercise 7