

Given a probability,  $p$ , of an event occurring, we know that the amount of information that you get from being told that a particular event occurred is  $\log_2(1/p)$ .

Using that information, let's try to answer the following questions.

Someone picks a name out of a hat known to contain the names of 5 women and 3 men, and tells you a man has been selected.

How much information have they given you about the selection?

The probability of a man being selected in this problem is  $3/8$ .

So the amount of information that you have been given is  $\log_2(1/(3/8)) = \log_2(8/3)$ .

Another way to think about this is that if you start off with  $N$  choices, and the additional information that you are given reduces your choices to  $M$ , then the amount of information that you have been given is  $\log_2(N/M)$ .

In this example  $N = 8$  because that is the original number of choices.

The reduced number of choices once you are told that a man has been selected is 3, so  $M = 3$ .

This means that the amount of information you received is  $\log_2(8/3)$ .

For the second question, you are asked to guess a random 4-bit 2's complement number.

I then tell you that the number is greater than 0.

How much information have you been given?

For this problem the original number of choices is the number of permutations of 4 binary bits which is 16, so  $N = 16$ .

Once you are told that the number is greater than 0, this reduces your choice to 7, so  $M = 7$ .

That means that the amount of information that you have been given is  $\log_2(16/7)$ .