

Part 7.3: Probability it is More Than

In the last section we look at the probability that up to, or less than a particular number occurred, now we want to know the probability that more than a certain number occurred. To do this we capitalise on the fact that probabilities always add up to one, so we calculate the probability of the bit we don't want (using the up to method) and then subtract it from 1. Let's look at an example.

Example

I roll a dice 8 times, what is the probability I get a 3 at least 5 times?

Answer

Again, the first thing I always do is draw a number line and highlight the numbers I want, this helps avoid making silly mistakes... remember the number line starts at zero.

0 1 2 3 4 **5 6 7 8**

(Graphics Calculator)

As you can see we want 5-8... the calculator doesn't work this out, so we need to work out up to and including 4 and then subtract this from 1.

We go into STATS (2) → DIST (F5) and this time we go into BINM (F5) and when we are working out the probability it is up to we use Bcd (Binomial Cumulative Distribution). In this case $x = 4$ (the number we want up to), Numtrial = 8 and $p = 1/6$. This would look like this:

```
Binomial C.D
Data      :Variable
x         :4
Numtrial  :8
P         :0.16666666
```

This gives us an answer of 0.99539.

We then subtract this off one to get 0.00461

(Formula)

We can see that $x = 5, 6, 7$ or 8 , $n = 8$ and $\pi = \frac{1}{6}$. This means we need to substitute into the formula 3 times, once for each value of x ... we get

$$P(X = 5) = \binom{8}{5} \left(\frac{1}{6}\right)^5 \left(1 - \frac{1}{6}\right)^{8-5} = 0.0041676$$

$$P(X = 6) = \binom{8}{6} \left(\frac{1}{6}\right)^6 \left(1 - \frac{1}{6}\right)^{8-6} = 0.0004168$$

$$P(X = 7) = \binom{8}{7} \left(\frac{1}{6}\right)^7 \left(1 - \frac{1}{6}\right)^{8-7} = 0.0000238$$

$$P(X = 8) = \binom{8}{8} \left(\frac{1}{6}\right)^8 \left(1 - \frac{1}{6}\right)^{8-8} = 0.0000006$$

We then add these up giving 0.00461.

As you can see these two answers match up.

Exercise 7.3

- The probability of catching a Frisbee when a long throw is made is 0.4. If two players make 10 throws, what is the probability that:
 - More than 3 of them are caught?
 - More than 6 of them are caught?
 - 6 or more of them are caught?
 - Exactly 4 were caught?
- The probability of winning a tennis match is 0.7. If the player plays 10 matches, calculate the probability he:
 - Wins at least half of them.
 - Wins 6 or more of them.
 - Wins all of them.
 - Loses all of them?
- The probability of a part being faulty is 1%. If 10 parts are chosen at random for inspection, what is the probability
 - None of them are faulty?
 - At least 1 of them is faulty?
 - More than 5 of them are faulty?
 - Less than 3 are faulty?
- I flip a coin a number of times and record my results. What is the probability I get
 - More than 3 heads if I flip it 5 times?
 - Less than 2 heads if I flip it 3 times?
 - 2 heads if I flip it 4 times?
 - Between 3 and 5 heads (inclusive) if I flip it 8 times?