

A box containing 27 black and 3 red balls. A random sample of 5 balls is drawn without replacement. What is the probability that the sample contains one red ball?

Okay so this one is also a bit different!

The key phrase in this problem statement that tips us off to the type of distribution that we need to use is “Sampling without replacement”.

What that means is that the results of the first sample (single unit) affects the probability of the second sample. Essentially, the trials are no longer independent events, which means we can't use the binomial or poisson distribution.

We now have to use the Hypergeometric distribution.

You can use the following equation to calculate the probability of occurrence with the hypergeometric distribution:

$$f(x) = \frac{\binom{A}{x} * \binom{N-A}{n-x}}{\binom{N}{n}} \text{ where } \binom{n}{x} = \frac{n!}{x!(n-x)!}$$

Where:

- N is the population quantity (30)
- n is the sample quantity (5)
- A is the number of items within the population (3)
- x is the number of items within the sample (1)

So if we plug in those variables, we get:

$$f(x) = \frac{\binom{3}{1} * \binom{30-3}{5-1}}{\binom{30}{5}} = \frac{3 * 17,550}{142,506} = 0.36946 \text{ or } 36.95\%$$