

The meaning of “never”

a. How many ways are there to type 10^5 characters? $29^{100\,000}$.

How many of these are *Hamlet*? 1.

What is the probability that 10^5 characters are *Hamlet*?

$$\begin{aligned}\frac{1}{29^{100\,000}} &= 29^{-100\,000} && (\text{then use } a^b = 10^{b \log_{10} a}) \\ &= 10^{-100\,000 \log_{10} 29} \\ &\approx 10^{-146\,240}.\end{aligned}$$

b. Each monkey types (10 char/sec)(10^{18} sec) = 10^{19} characters.

So how many sets of 10^5 characters does he type out?

Is it $10^{19}/10^5 = 10^{14}$? NO!

Is it $10^{19} - 10^5 + 1 \approx 10^{19}$? Yes!

(Namely the set beginning with character 1, the set beginning with character 2, etc.)

Each monkey has 10^{19} chances to type *Hamlet*, so the probability that a specific monkey produces *Hamlet* is

$$10^{19} \times 10^{-146\,240} = 10^{-146\,221}.$$

There are 10^{10} monkeys, so the probability of typing *Hamlet* is

$$10^{10} \times 10^{-146\,221} = 10^{-146\,211}.$$