Data Science Interview Prep

Question 1

This problem was asked by Facebook.

There is a fair coin (one side heads, one side tails) and an unfair coin (both sides tails). You pick one at random, flip it 5 times, and observe that it comes up as tails all five times. What is the chance that you are flipping the unfair coin?

Solution:

This problem can be solved using Bayes Rule. We are asked to calculate the following quantity: $P(\text{Unfair} \mid \text{TTTTT})$.

We have that

$$
\begin{aligned}
P(\text{Unfair} \mid \text{TTTTT}) &= \frac{P(\text{TTTTT} \mid \text{Unfair}) \cdot P(\text{Unfair})}{P(\text{TTTTT})} \\
&= \frac{P(\text{TTTTT} \mid \text{Unfair}) \cdot P(\text{Unfair})}{P(\text{TTTTT} \mid \text{Unfair}) \cdot P(\text{Unfair}) + P(\text{TTTTT} \mid \text{Fair}) \cdot P(\text{Fair})} \\
&= \frac{1^5 \cdot 0.5}{1^5 \cdot 0.5 + 0.5^5 \cdot 0.5} \\
&= \frac{0.5}{0.5 + 0.015625} \\
&= \boxed{0.9697}
\end{aligned}
$$

Question 2