Extra Credit 9

In a box there are two coins: a standard coin with head and tail and a 2-headed coin.

You randomly pick one of the coins, toss it and see a head.

What is the probability that the other side of this coin is a head?

The outcomes are:

1. Fair coin, 𝐻
2. Fair coin, 𝑇
3. Unfair coin, 𝐻
4. Unfair coin, 𝐻 (the other one)

Each of these is equally likely, so each has a probability of ¼, meaning that 𝑃(H) = ¾ .

We want to know 𝑃(Unfair|𝐻).

This is a job for Bayes' Theorem: 𝑃(𝐵|𝐴) = 𝑃(𝐴|𝐵)𝑃(𝐵) / 𝑃(𝐴) .

Our 𝐵 is the unfair coin, and our 𝐴 is heads.

𝑃(Unfair|𝐻) = 𝑃(𝐻|Unfair) × 𝑃(Unfair) / 𝑃(𝐻)=1 × ½ / ¾ = 2/3

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