**Multiple Flips Of A Coin**

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*Example 6 From Basener and Brown 2022: Bayesian Machine Learning: Probabilistic Reasoning and Programming for Machine Learning with Applications in Python*

You find a coin and believe that it is either fair (Type A with ) or unfair (Type B with ) and that out of every 1000 coins one is Type B and the rest are Type A. You flip the coin 100 times and get 68 heads and 32 tails. What is the probability that the coin is Type A and the probability that the coin is Type B?

We want to use Bayes’s Theorem to compute the probability that the coin is Type A. The data is the number of heads in 100 flips of the coin, which we model using a binomial distribution.

The binomial distribution involves independent Bernoulli trials, each of which has a probability of success (heads) and a probability of failure (tails). The probability that exactly of the trials produce success given that the number of Bernoulli trials is equal to and the probability of success in each trial is equal to

Using the binomial distribution, we find likelihoods

The prior probabilities for Type A and B

The total probability

Bayes’s Theorem provides the formulas for the probabilities that probability of success and

*Example 7c*

Provide an interval such that the probability that the actual value of in this interval is percent. This is called the percent credible interval for the parameter . This is sometimes called a confidence interval, but the term credible interval is preferred to indicate that this interval is quantifying uncertainty about a parameter from a posterior distribution.