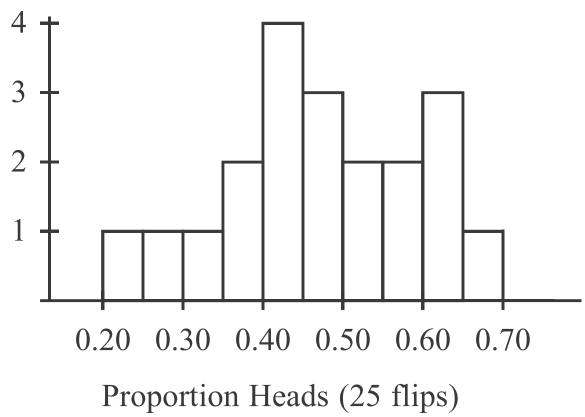
NOTE: We present a model solution with some trepidation. This is not a scoring key, just an example. Many other approaches could fully satisfy the requirements outlined in the scoring rubric. That (not this) is the standard by which student responses should be evaluated.

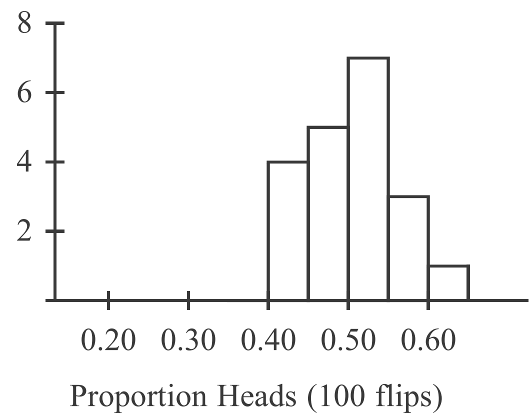
Model Solution - Investigative Task A – Simulated Coins

In order to investigate the sampling distribution and model for the proportion of heads that may show up when a coin is tossed repeatedly, I will use simulation. I will examine the similarities and differences between the sampling distributions of the proportions of heads in 25 flips and 100 flips.

Component – One coin toss is a component. Generate random digits 0-1, with 0 = tails and 1 = heads.
Trial – A trial consists of 25 simulated flips for the first simulation, then 100 flips for the second simulation.
Response variable – The response variable is the number of heads.
Statistic – The statistics calculated is the proportion of heads. This will be calculated by dividing the number of heads by 25 or 100, depending on which simulation is being conducted.

The results of the simulations are summarized in the following histograms.





Both distributions of proportions are at least roughly unimodal and symmetric. The distribution of 25 simulated flips has a mean proportion of heads of 0.464, while the distribution of 100 simulated flips has a mean proportion of heads of 0.505, both fairly close to the expected proportion of 0.5. The distribution of 25 simulated flips is much more spread out than the distribution of 100 simulated flips, with standard deviations of 0.122 and 0.057, respectively.

Coin flips are independent of one another, and 100 flips is a sufficiently large sample size. Furthermore, we know that coin flips follow a binomial model, which is unimodal and symmetric. The sampling model is Normal, with mean 0.50 and standard deviation,

$$SD(\hat{p}) = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.5)(0.5)}{100}} = 0.05.$$