CSE 107
Lab Assignment 1

In this assignment you will simulate the experiment described in hw1 problem # 5, which says:

> Alice and Bob have $2n + 1$ coins, each with probability of a head equal to $1/2$. Bob tosses $n + 1$ coins, while Alice tosses the remaining n coins. Show that the probability that after all the coins have been tossed, Bob will have gotten more heads than Alice is $1/2$.

Write a program, in any language, that runs this experiment with n equal to 5, 10, 50 and 100, respectively. For each value of n, do 1000 trials, and compute the relative frequency of Bob tossing more heads than Alice.

$$\text{relative frequency} = \frac{\text{number of trials in which Bob tossed more heads}}{\text{total number of trials}}$$

Verify that your relative frequency is very close to 0.5, independent of the value of n.

Now suppose that we do the same sequence of experiments for $n \in \{5, 10, 50, 100\}$, with $2n + 1$ *loaded* coins. Suppose the probability of heads is equal to p, for $p \in \{0.2, 0.3, 0.4, 0.6, 0.7, 0.8\}$. This should be possible by editing just a few lines of code (replacing $1/2$ by a variable p which you initialize at the beginning of the program.) Does the probability that Bob tosses more heads than Alice now seem to depend on n? Does that probability seem to approach a limiting value as n becomes large? Form a conjecture regarding this probability.

Create a text file called `Report` with your results. Give your relative frequencies for $p = 1/2$ and $n \in \{5, 10, 50, 100\}$. Do the same for $p \in \{0.2, 0.3, 0.4, 0.6, 0.7, 0.8\}$. State your conjecture as to the limiting value (if any) for $P(\text{Bob tosses more heads than Alice})$ as n becomes large.

Submit both your source code file, and the `Report` file to Gradescope before the due date.