Name _____

Period_____

Investigative Task
Simulated Coins

In this Task you will investigate the sampling distribution and model for the proportion of heads that may show up when a coin is tossed repeatedly. Toss the coins if you want, but it's much easier and faster to do a simulation!

1. Set up the calculator's or random number generator to simulate tossing a coin 25 times. See the note at the bottom of the page if you want to try to use the tables to do this*. Dividing the number of heads by the number tosses will get you the proportion of heads that we will call $\hat{p}$.
2. Run 20 trials, recording all the sample proportions and make a histogram of the results.
3. Repeat your simulation, this time tossing the coin 100 times. Again make a histogram of twenty sample proportions.
4. Compare you two distributions of the proportions of heads observed in your simulations.
5. What should have happened? describe the sampling model for 100 tosses.
6. Compare the actual distribution of your sample proportions for 100 tosses to what the sampling model predicts.
7. Describe how your results might differ if you had run 1000 trials of the simulation instead of only 20.

<u>Components are scored as **E**ssentially correct, **P**artially correct, or **I**ncorrect</u>

1: Simulations and Histograms
- **E** – have all 3 features
- **P** – Graphs constructed or labeled poorly, have different scales, or not 20 trials
- **I** – Graphs are inappropriate or incorrect

2: Comparison of Histograms
- **E** – Correctly compares shapes, centers, and spreads
- **P** – Correctly compares on two of the three features
- **I** – At most one comparison is correct

3: The Model
- **E** – Checks conditions, then correctly describes the shape, center, and spread
- **P** – Fails to check conditions, or some aspect of description is incorrect
- **I** – Makes several mistakes in verifying or describing the sampling model.

4: Comparison of Histogram and Model – A complete comparison will discuss shapes, centers, and spreads, will have comparative graphs or invoke the 68-95-99.7 Rule, and will note that more runs should produce an observed distribution in closer agreement with the theoretical model
- **E** – Comparison has all 5 listed properties
- **P** – Comparison has 3 or 4 of the listed properties
- **I** – comparison has fewer than 3 of the properties

	Components
Think	Demonstrates clear understanding of sampling distributions and models.
Show	**Simulations and Histograms**: ○ completes 20 trials for each ○ constructs well-labeled graphs ○ uses the same scale for comparison **Model:** ○ checks conditions ○ has correct parameters
Tell	**Compares histograms:** ○ shapes (roughly symmetric?) ○ centers (both near 50%?) ○ spreads (less variability for 100?) **Compares histogram to model:** ○ sketches curve on comparable scale or uses the 68-95-99.7 Rule ○ compares shape, center, and spread ○ suggests that more trials should produce a better fit

<u>Scoring</u>

- E's count 1 point, P's are ½
- AP Score = sum of 4 components; rounding based on understanding of differences between models and distributions (including proper use of vocabulary and notation)
- Grade A = 4, B = 3, etc. +/- based on rounding (Ex: 3.5 rounded to 3 is B+)

*To use the table for a simulation, I would recommend using RandInt(0, 1) with the 1 representing heads. To fill L1 with these random digits, at the top of L1, put RandInt(0, 1, n) – *n is the number of trials*. It will then fill *n* number of cells in the table with those random digits. Since 1 represents heads, a simple sum of L1 will tell you how many heads out of *n* you generated.