*Break into POGIL teams of 4 and assign each team member one of the following roles.*

|  |  |  |
| --- | --- | --- |
| **Student Name** | **Role** | **Responsibility** |
| Zachary Lineman | Facilitator | Records the team’s data -- i.e., the number of flips and the heads for each run of the app. Tallies the results and calculates the percentage of heads and tales. |
| Grayson Kurth | Spokesperson | Reports the team’s results. |
| Cole Swierczek | Quality Control | Validates the Facilitator’s data -- Are the results of each run recorded correctly? Are the tallies and calculations correct? |
| JP Duffy | Process Analyst | Keeps track of the team’s progress and assess its performance. |

Experimental Procedure

Our hypothesis for this experiment: App Inventor’s PRNG provides a good model of randomness.

Perform the following steps:

1.) Repeatedly run the app on each device and record the number of heads and tails received in each trial. Do at least 20 runs (**trials**) among the team. The maximum number of "flips" per trial is 100. Your team should have at least 2000 "flips"

|  |  |  |
| --- | --- | --- |
| **Run #** | **Heads** | **Tails** |
| 1 | 43 | 57 |
| 2 | 54 | 46 |
| 3 | 48 | 52 |
| 4 | 46 | 54 |
| 5 | 56 | 44 |
| 6 | 45 | 55 |
| 7 | 53 | 47 |
| 8 | 49 | 51 |
| 9 | 46 | 54 |
| 10 | 52 | 48 |
| 11 | 43 | 57 |
| 12 | 45 | 55 |
| 13 | 39 | 61 |
| 14 | 47 | 53 |
| 15 | 51 | 49 |
| 16 | 49 | 51 |
| 17 | 56 | 44 |
| 18 | 51 | 49 |
| 19 | 59 | 41 |
| 20 | 47 | 53 |
| **Totals** | **979** | **1021** |

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2.) Tally your results and calculate the percentage of heads for each trial. In addition, calculate the cumulative number and percentage of heads after each trial. For example, after the 5th trial of 100 flips, your table will show the number and percentage of heads for 500 flips.

|  |  |  |
| --- | --- | --- |
| Trail Number | Individual Percentage | Cumulative Percentage |
| 1 | 43% | 43% |
| 2 | 54% | 48% |
| 3 | 48% | 48% |
| 4 | 46% | 48.3% |
| 5 | 56 % | 49.4% |
| 6 | 45% | 48.66% |
| 7 | 53% | 49.3% |
| 8 | 49% | 49.25% |
| 9 | 46% | 48.8% |
| 10 | 52% | 49.2% |
| 11 | 43 % | 48.63% |
| 12 | 45% | 48.3% |
| 13 | 39% | 47.6% |
| 14 | 47% | 47.57% |
| 15 | 51% | 47.8% |
| 16 | 49% | 47.87% |
| 17 | 56% | 48.35% |
| 18 | 51% | 48.5% |
| 19 | 59% | 49.05% |
| 20 | 47% | 48.95% |

3.) (**Portfolio**) Record your team’s results for each trial in a neatly organized table. That is, if you did 20 trials of 100 coin flips each, your table should have 20 rows of results, with the percentage for each trial along with the cumulative numbers. Here's an example:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Trial** | **Flips** | **Heads** | **% Heads** | **Total Flips** | **Total Heads** | **Total % Heads** |
| 1 | 100 | 45 | 45.0 | 100 | 45 | 45% |
| 2 | 100 | 51 | 51.0 | 200 | 93 | 46.5% |

Template table available online. Linked in Lesson 4.6.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Trial | Flips | Heads | % Heads | Total Flips | Total Heads | Total % Heads |
| 1 | 100 | 43 | 43% | 100 | 43 |  |
| 2 | 100 | 54 | 54% | 200 | 97 |  |
| 3 | 100 | 48 | 48% | 300 | 145 |  |
| 4 | 100 | 46 | 46% | 400 | 191 |  |
| 5 | 100 | 56 | 56 % | 500 | 247 |  |
| 6 | 100 | 45 | 45% | 600 | 292 |  |
| 7 | 100 | 53 | 53% | 700 | 345 |  |
| 8 | 100 | 49 | 49% | 800 | 394 |  |
| 9 | 100 | 46 | 46% | 900 | 440 |  |
| 10 | 100 | 52 | 52% | 1000 | 492 |  |
| 11 | 100 | 43 | 43 % | 1100 | 535 |  |
| 12 | 100 | 45 | 45% | 1200 | 580 |  |
| 13 | 100 | 39 | 39% | 1300 | 619 |  |
| 14 | 100 | 47 | 47% | 1400 | 666 |  |
| 15 | 100 | 51 | 51% | 1500 | 717 |  |
| 16 | 100 | 49 | 49% | 1600 | 766 |  |
| 17 | 100 | 56 | 56% | 1700 | 822 |  |
| 18 | 100 | 51 | 51% | 1800 | 873 |  |
| 19 | 100 | 59 | 59% | 1900 | 932 |  |
| 20 | 100 | 47 | 47% | 2000 | 979 |  |

4.) (**Portfolio**) According to your results, does App Inventor's PRNG provide a good model of randomness?

Yes, it does because the answer is pretty close. If other data shows that it is farther apart, it is possible that it is not a good random number generator. But, with our data, it is not perfect but is very good.

5.) (**Portfolio**) A friend claims that flipping a coin 100 times and finding that it comes up heads only 45% of the time shows that the coin is biased. How should you reply?

It does not show that the coin is biased. As it is random, it can randomly give answers that lean toward one side. As the number of flips gets larger, you become more likely to have results closer to normal.