

Probability and Primes

Assignment Rubric

Part I

Answer the following using experimental and actual probabilities. Show your code and explain your conclusions in a few sentences.

When randomly selecting a number between 0 and 100, what is the probability of choosing a prime number?

```
Count [PrimeQ [Range [100]], True]
25
```

There are 25 prime numbers between 0 and 100. Therefore, the ACTUAL probability of selecting a prime number is

```
N [25 / 101]
0.247525
```

Note: PrimeQ will evaluate all elements of the list. Some students may use Map.

Below is one example of an experiment for this question. Most students will likely have this in several steps with names for lists, etc.

```
N [Count [PrimeQ [RandomChoice [Range [100], 200]], True] / 200]
0.295
```

Part II

Organize your code into a short program that will let you run several calculations with one evaluation. Then repeat Part I to find the probability of choosing a prime between (a) 0 and 500 and (b) 0 and 1000.

Note for this part many students separated the code for the actual and experimental probabilities.

One example:

```
trials = 1000;
N [Count [PrimeQ [RandomChoice [Range [100], trials]], True] / trials]
0.257
```

Actual probabilities for 500 and 1000:

```
number = 500;  
N[Count[PrimeQ[Range[number]], True] / (number + 1)]  
0.189621  
  
number = 1000;  
N[Count[PrimeQ[Range[number]], True] / (number + 1)]  
0.167832
```

Grading

Part I

5 pts for actual probability (code + results + written statement)

5 pts for experimental probability (code + results + written statement)

Part II

5 pts for putting code together in a program

5 pts for experimental and actual probabilities for 500.

5 pts for experimental and actual probabilities for 1000.

Total: 25 pts.