Lesson Eleven
Math 6080 (for the Masters Teaching Program), Summer 2020

The Sieve of Eratosthenes. We start with a list of the integers from 0 to 999. (You can prompt the user to make this any list from 0 to \( n \).)

\[
\text{Sieve} = [] \\
\text{for } i \text{ in range}(1000): \\
\quad \text{Sieve} = \text{Sieve} + [i]
\]

Our goal is to put zeroes in this list wherever there is a non-prime.

\[
\text{Sieve}[1] = 0
\]

The first non-zero element we find is 2, which we use to turn all multiples of 2 (other than 2 itself) into zeroes. The next non-zero element after that is 3, which we use to turn all multiples of 3 (other than 3 itself) into zeroes. The next non-zero element after that is 5, etc.

\[
d = 2 \\
\text{while } d**2 < n: \\
\quad \text{if } d == 0: \text{ continue } \\
\quad \text{else: } \\
\quad \quad i = 2 \\
\quad \quad \text{while } d*i < n: \\
\quad \quad \quad \text{Sieve}[d*i] = 0 \\
\quad \quad \quad i = i + 1 \\
\quad d = d + 1 \\
\text{print(Sieve)}
\]

Try it out!

Exercise. Convert this, by use of the .pop command, into a list of the primes less than 1000 (removing all the zeroes). This is, I claim, a very efficient way to conjure up lists of primes. We will use the Sieve with the zeroes intact in our first extended project in Lesson Twelve.