1. Log in to your Sage/Cocalc account.
   
   (a) Start the Chrome browser.
   (b) Go to http://cocalc.com and sign in.
   (c) You should see an existing Project for our class. Click on that.
   (d) Click “New”, call it c25, then click “Sage Worksheet”.

Problems

2. Let \( p_1, p_2, \ldots, p_k \) be a list of any \( k \) primes. The product \( p \) of these primes plus one is

\[
p = p_1 \cdot p_2 \cdot \ldots \cdot p_k + 1
\]

\( p \) is either a prime (different from each of these \( k \) primes) or it has a prime factor also different from each of these. (This implies there are infinitely many primes). Write a program to find the smallest prime number \( q \) no more than \( p \) and different from each of \( p_1, p_2, \ldots, p_k \).

3. The Fibonacci sequence \( F_n \) is defined as follows \( F_0 = 0, F_1 = 1 \) and \( F_n = F_{n-1} + F_{n-2} \) for \( n > 1 \).

Here is an iterative function \( \text{fibonacci2}\(n\) \) that computes the \( n^{th} \) Fibonacci number.

```python
def fibonacci2(n):
    F=[0,1]
    for i in [2..n]:
        F.append(F[i-1]+F[i-2])
    return F[n]
```

What is the first term in the Fibonacci sequence to contain 1000 digits?
4. Find the sum of the even Fibonacci numbers less than four million.

5. By listing the first six prime numbers: 2, 3, 5, 7, 11, and 13, we can see that the 6th prime is 13. What is the 10,001st prime number?

6. \( n! \) means \( n \times (n-1) \times \ldots \times 3 \times 2 \times 1 \). For example, \( 10! = 10 \times 9 \times \ldots \times 3 \times 2 \times 1 = 3628800 \), and the sum of the digits in the number 10! is \( 3 + 6 + 2 + 8 + 8 + 0 + 0 = 27 \). Find the sum of the digits in the number 100!