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 c40, then click “Sage Worksheet”.

Here are the Final-type questions, together with a selection of problems. Go over your classroom worksheets as needed. You will be allowed to refer to your classroom worksheets on the Final.

2. Define a function attitude() which randomly prints “Don’t look at me.” or “Are you looking at me!?!?”.

3. Let \( L \) be a list with 300 (random) entries. What would you write to get the slice of \( L \) consisting of the first ten elements of \( L \)?

4. Define a function apples(a,b) that takes positive integers \( a \) and \( b \) and prints “I picked \( a \) apples and \( b \) oranges.”

5. Define a function prime_sum(n) which takes an integer \( n \) as input and returns the sum of the prime numbers up to \( n \).

6. Define a function constant_matrix(n,m,c) which takes positive integers \( n \), \( m \) and \( c \) as input and returns a \( n \) by \( m \) matrix whose entries are all \( c \).

7. Let \( M \) be the \( 3 \times 3 \) identity matrix. Change the upper right corner entry to be 5.

8. Define a function sum_digits(n) that takes an integer \( n \) and returns the sum of its digits.

9. Write a program to find all triples \((a,b,c)\) with positive integers \( a,b,c \leq 10 \) where \( a^2 + b^2 = c^2 \).

10. Define a function a_count(s) that takes a string \( s \) and counts the number of occurrences of the letter \( a \) in the string.

11. Write a program that produces 100 random numbers from the interval \([0, 100]\) and stores them in separate lines of a file called rand_store.txt.

12. Define a function read_data(filename) that opens a file called filename consisting of integers on separate lines, pulls out those numbers, puts them in a list, and returns that list of numbers. The function should not alter the contents of filename.

13. Use map and an anonymous function to produce the cubes of the numbers in the list \( L = [3, 7, 2, 5] \).
14. Consider the following sequence defined by a function on the positive integers. \( T(1) = 3, T(2) = 4, T(3) = 5, T(n) = T(n - 1) + T(n - 2) + T(n - 3) \). Define a recursive function \texttt{recursT(n)} that takes a positive integer \( n \) as input and outputs \( T(n) \). Find \( T(10) \).

15. Write a program to find the set of positive integers less than 100 that are multiples of 3 or 5.

16. Define a function \texttt{random_average(n)} to choose \( n \) random integers between 1 and 100 and find the average of these \( n \) numbers.

17. Find \texttt{random_average(n)} for \( n = 10 \) to \( n = 1000 \). Use \texttt{scatter_plot} to display the results.

18. Define a function \texttt{order_size(g)} which takes a graph \( g \) as input and returns the product of the number of vertices of the graph and the number of edges of the graph.

19. If we list all the natural numbers below 10 that are multiples of 3 or 5, we get 3, 5, 6 and 9. The sum of these multiples is 23. Write a program to find the sum of all the multiples of 3 or 5 below 1000.

20. 3, 5 and 7, 11, 13, etc are called twin primes. Find all of the twin primes less than 1000.

21. 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 \( n > 1 \). What is the first term in the Fibonacci sequence to contain 1000 digits?

22. 12 has 6 factors: 1, 2, 3, 4, 6, 12. Find the positive integer no more than 100 with the most factors.

23. (Ramanujan revisited) We found that 1729 is the smallest number which is the sum of 2 cubes in 2 different ways (1729 = \( 1^3 + 12^3 = 9^3 + 10^3 \)). Find the smallest integer which can be written as the sum of 2 squares in 2 different ways.

24. (New) Find the sum of the digits in the number 100!

25. (New) Write a program \texttt{digit_of_e(n)} that outputs the \( n^{th} \) decimal digit of \( e \).