Topics in Applied Mathematics Exercise

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1. Write a program using a for loop to calculate the sum of all even numbers, perfect squares, and powers of 2 that are greater than or equal to 0 and less than 10,000.

2. Repeat problem #1 using a while loop.

3. Write a program that takes an integer n as an input and prints the n^{th} Fibonacci number.

4. Write a program that takes an integer n as an input and prints all prime numbers less than or equal to n.

5. Define

$$\xi = \text{ minimum number of n such that } \sum_{i=1}^{n} r_i > 1$$

where r_i is a uniform random number in $[0, 1]$. Compute the average value of ξ from 10,000 samples of ξ. Compute the error of the average value to the Euler constant e. (Hint: use *random* library to sample r_i and *math* library to compute the error)

6. Write a program that takes a positive integer n (if a positive integer is given, print an error message and prompt to take another input) as an input and determines whether n is a prime number.