**Extra Problems**

1. While numbers do not feel emotion, people do respond emotionally when numbers behave consistently in surprising and amusing ways. Happy Numbers can be reduced to 1 with a simple formula.

To determine if a number is happy, or not, follow these simple rules with any number:

* If the number is a single digit, square it.
* If the result or the original number has multiple digits, take each digit by itself and square the digit and add the squares of the digits.
* Repeat until you get to the number 1 or you find the results are repeating.

Happy numbers, and other numeric patterns, can be identified programmatically with code. The first step to creating pseudo code to evaluate happy numbers is to remind yourself how to determine if a number is happy or not. You take any number, break the number into single digits, then square each digit and add up the sum of all you multiplications. You repeat this process until either you get the number 1 (the number you started with is happy) or your results match a pattern that indicates an unhappy number (the sequence of results starts repeating).

Your task is to write a program that will find all of the happy numbers from 1 to 1000. I recommend writing a function isHappy that is passed an integer and returns True if the integer is happy and False if the number is sad.

1. In number theory, a perfect number is a positive integer that is equal to the sum of its positive divisors, excluding the number itself. For instance, 6 has divisors 1, 2 and 3 (excluding itself), and 1 + 2 + 3 = 6, so 6 is a perfect number. Write a program that will report all of the perfect numbers less than or equal to 10000. Do you see any pattern in the perfect numbers?

Answer:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What are the perfect numbers <= 10000?

Answer:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. In mathematics, a **Mersenne prime** is a prime number that is one less than a power of two. That is, it is a prime number of the form *Mn* = 2*n* − 1 for some integer *n*. They are named after Marin Mersenne, a French Minim friar, who studied them in the early 17th century. Specifically, A Mersenne prime is a Mersenne number, i.e., a number of the form

|  |
| --- |
| M_n=2^n-1, |

that is prime. In order for M_n to be prime, n must itself be prime. It should be noted that there are only 51 known Mersenne primes. The last 17 were found by GIMPS (Great Internet Mersenne Primes Search) using distributed computing techniques. The 8th one was found by Leonard Euler in 1772. The 51st one was found in 2018 with a value of 282589933 – 1 (24862048 digits).

Write a program that will report the first 8 Mersenne primes