

M82589933

In this lab, you will analyze the **almost 25 million digits** of the largest prime number ever found. This prime happens to be a special prime known as a Mersenne prime. A Mersenne prime is a prime number that is one less than a power of two (e.g. 31 is a Mersenne prime since $31 = 2^5 - 1$). Only 51 Mersenne prime numbers have ever been found. The **51st Mersenne prime**, $2^{82589933} - 1$ was discovered on **December 7, 2018** (they actually found 2 in 2018) by Patrick Laroche, a 35-year-old from Ocala, Florida by running the free [Great Internet Mersenne Prime Search \(GIMPS\)](#) software on a four-core Intel Core i5-4590T processor for over 12 days.



1. Materials

- A. [M82589933.txt](#) contains ALL the digits of the 51st Mersenne prime. The numbers are on multiple lines, so you will want to remove all newline characters after you read the file to get the number in a single string.
- B. [python_strings.htm](#) [python_lists.htm](#) [python_dictionary.htm](#) [python_tuples.htm](#)

2. Tasks

- A. print the length (i.e. # of digits) of the M82589933 prime number
24###048
- B. If you find the number **3** followed by the first **6** decimal places of π (i.e. you find the consecutive digits **3141592**), print out the 3 and the **10** digits after the 3.
31415924593
#####45
:
#####62

In Carl Sagan's novel **Contact**, scientists detect a signal containing a series of prime numbers coming from the Vega system, 26 light years away. This leads to the discovery of a further message describing plans for an advanced machine. [link](#) "One interesting feature in Sagan's novel is that he lets the alien race disclose in passing that a master race may have left a message hidden deep inside the transcendental numbers (like π)."

See if your birthday or name is in π <https://www.angio.net/pi/>

- C. If **You must** use a dictionary to store the individual digit counts.
The number 9 occurs 2488615 times
The number 6 occurs 2487595 times
: **:** **:**

The run time of various solutions can differ greatly. It **must** be done in **less than 60 seconds**.

If you want, have Python measure your program's run time by putting the following lines at the very top of your program

```
import time
```

```
startTime = time.time()
```

and then putting this line at the very end of your program.

```
print("Run time =",time.time() - startTime)
```