Problem 20. n! means $n \times (n-1) \times ... \times 3 \times 2 \times 1$.
For example $10! = 10 \times 9 \times ... \times 3 \times 2 \times 1 = 3628800$,
and the sum of all digits of 10! is $3 + 6 + 2 + 8 + 8 + 0 + 0 = 27$.
Find the sum of digits in the number 100!

Knowledge required How to multiply two numbers using elementary school method

Solution Outline This problem can be solved in programming languages that support Big-Int library like Java, Python etc. The brute-force solution that I wrote works under 1sec. But let us understand how Big-Int multiplication might be implemented underneath. The basic strategy is to have a dynamically growing list which has only 1 at the start, now when we want to multiply it with a number we will follow the elementary school multiplication as we multiply from 1 to n the list will grow and finally we just sum the elements in the list.

```python
factNum = [1]

def multiply(x):
    # multiplies the number represented
    # as a list with x using the elementary
    # school multiplication method
    carry = 0
    for i in range(len(factNum)):
        current = carry + factNum[i] * x
        factNum[i] = current % 10
        carry = current // 10

    # if carry is left append it
    while carry:
        factNum.append(carry % 10)
        carry //= 10

N = 10000
for i in range(1, N):
    multiply(i)

digSum = sum(el for el in factNum)
print(digSum)
```