Hw5 Report (b07801004 陳佳雯)

Environment:

Visual studio code; Windows 10

Langage:

C++11

Execute:

1. Make sure the test data exist.
2. Execute cpp file “hw5.cpp”
3. Output will be on the screen, such as “Case 1: 5”

Discription:

Definition of the border:
Let say the F(n)’s border means the connection point between F(n-1) and F(n-2).
Ex: F(2) = 10, F(3) = 101, F(4) = 10101, according to F(4), if we have a query 010, then it is on the border.

n	$F(n)$
0	0
1	1
2	10
3	101
4	10110
5	10110101
6	1011010110110
7	10110101101101011010110101
8	1011010110110101101011011010110110
9	10110101101101011010110110101101101011010110110101101011010110101

The Fibonacci words have 3 types of case as follow:
Case1: if the given query first occurred in F(n), it will also occur on the border of F(n + 1)
Take n = 96, query = 10110101101101 as an example.
The query first occurs in F(7), and it also occurs on the border of F(8).

Case2: if the given query first occurred in F(n), it will also occur on the border of F(n + 2), but not on the border of F(n+1).
Take n = 6, query = 01 as an example.
The query first occurs in F(3), and it also occurs on the border of F(5).

Case3: The given query first occurred in F(n), but it never occur on the border in

F(n+1) and F(n+2).
Take n = 6, query = 10 as an example.
The query first occurs in F(2), and it doesn't show on the border afterward.

We denote firstOccur as the first occurrence of the query at F(x), $x \leq n$.

Then, we can compute the number of occurrences now!
From observation, we find that the Fibonacci words obey the following rules:
Case1: F (n – firstOccur +1) + F (n – firstOccur +1 - 2) + F (n – firstOccur +1 – 2*2)……
Case2: F (n – firstOccur +1) + F (n – firstOccur +1 - 1) + F (n – firstOccur +1 – 1*2)……
Case3: F (n – firstOccur +1)

* F(n) represents the Fibonacci numbers.

However, if the query is unreasonable, such as "00", "111", "01010"…, we can detect and exclude them from the beginning.