

# Quiz Section for Program Design (I)

## Exercise #7

The well-known **Fibonacci** sequence is obtained by starting with 0 and 1 and then adding the two last numbers to get the next one. For example, the third number in the sequence is 1 ( $1=1+0$ ), the fourth is 2 ( $2=1+1$ ), the fifth is 3 ( $3=2+1$ ), and so on.

<i>i</i>	0	1	2	3	4	5	6	7	8	9
<i>Fib(i)</i>	0	1	1	2	3	5	8	13	21	34

**Figure1**-The numbers in the **Fibonacci** sequence

The well-known **Tribonacci** sequence is similar to the Fibonacci sequence but is defined by adding the last three numbers to obtain the next one. It starts with 0, 1, and 1 as the first three terms. For example, the fourth number in the sequence is 2 ( $2 = 1 + 1 + 0$ ), the fifth is 4 ( $4 = 2 + 1 + 1$ ), and the sixth is 7 ( $7 = 4 + 2 + 1$ ), and so on.

<i>i</i>	0	1	2	3	4	5	6	7	8	9
<i>Tri(i)</i>	0	1	1	2	4	7	13	24	44	81

**Figure2**-The numbers in the **Tribonacci** sequence

The **Fibonacci** sequence appears widely in nature and has deep significance. Interestingly, every positive integer can be uniquely represented as a sum of non-consecutive Fibonacci numbers. For instance, 13 can be represented by {13} or {5, 8}, while 17 can be {1, 3, 13}. Using this rule, any number can be expressed in binary form, with "1" for included Fibonacci numbers and "0" for others. For example,  $17 = 1 + 3 + 13$ , written as 100101, which we call the "Fibonacci base," noted as  $17 = 100101$  (fib).

17 =	1	0	0	1	0	1
13+3+1 =	13	8	5	3	2	1

A similar concept applies to the **Tribonacci** sequence. The Tribonacci sequence starts with three initial numbers, and each subsequent number is the sum of the previous three. Just as with the Fibonacci base, a positive integer can have a unique representation as the sum of non-consecutive Tribonacci numbers. For example, 17 can be represented as  $13 + 4$ , written as 10100 (Tri).

17 =	1	0	1	0	0
13+4=	13	7	4	2	1

- **Input Format**

A single integer  $n$  represents the number in decimal base that you want to convert to Fibonacci and Tribonacci bases.

- **Output Format**

- Print the result of the input number, with the format FIB\_BASE (fib) and TRI\_BASE (tri).
- DEC\_BASE is the original number in decimal base, and FIB\_BASE is its representation in Fibonacci base.
- DEC\_BASE is the original number in decimal base, and TRI\_BASE is its representation in Tribonacci base.

- **Technical Specifications**

$$1 \leq n < 10^8$$

The table below shows the example input and output.

Input	Output
<u>6</u>	1001 (fib) 110 (tri)
<u>17</u>	100101 (fib) 10100 (tri)
<u>526</u>	1010000001000 (fib) 10000011010 (tri)
<u>1230</u>	100100000010010 (fib) 101000100101 (tri)