1. Integer to Roman (Leetcode-12)

Problem Statement:
Roman numerals are represented by seven different symbols: **I, V, X, L, C, D** and **M**.

Symbol	Value
I	1 → smallest
V	5
X	10
L	50
C	100
D	500
M	1000 → largest

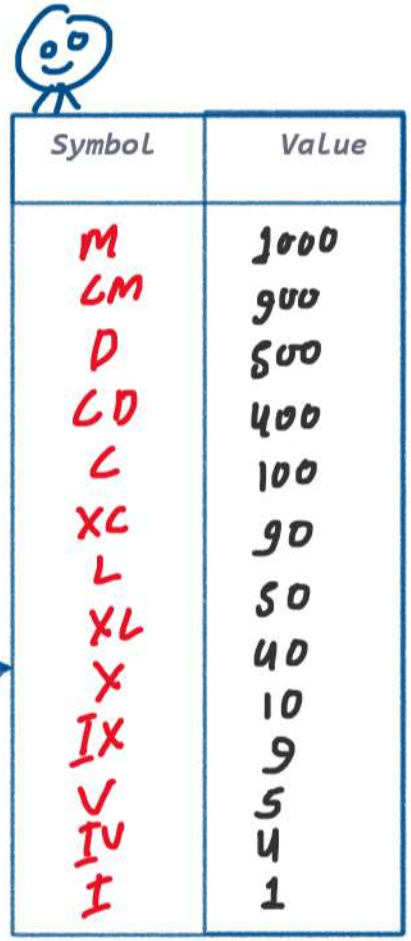
For example,
2 is written as II in Roman numeral, just two one's added together.
12 is written as XII, which is simply X + II.
27 is written as XXVII, which is XX + V + II.

Roman numerals are usually written largest to smallest from left to right.
However, the numeral for **4** is not **IIII**. Instead, the number **4** is written as **IV**.
Because the one is before the five we subtract it making four.
The same principle applies to the number **9**, which is written as **IX**.

There are six instances where subtraction is used:
I can be placed before **V** (5) and **X** (10) to make **4** and **9**.
X can be placed before **L** (50) and **C** (100) to make **40** and **90**.
C can be placed before **D** (500) and **M** (1000) to make **400** and **900**.
Given an integer, convert it to a roman numeral.

CONVERSION RULE

Constraints
$1 \le NUM \le 3999$



Symbol	Value
M	1000
CM	900
D	500
CD	400
C	100
XC	90
L	50
XL	40
X	10
IX	9
V	5
IV	4
I	1

Symbol	Value
M	1000
CM	900
D	500
CD	400
C	100
XC	90
L	50
XL	40
X	10
IX	9
V	5
IV	4
I	1

Ex 1 NUM = 58

⇒ 50 + 8

⇒ 50 + 5 + 3

⇒ LVIII

ROMAN

DRY RUN

⇒ NUM = 58

- 50 + 8 = L 58 ≥ 50

NUM = 58 − 50 = 8

ANS = L

⇒ NUM = 8

- 5 + 3 = V 8 ≥ 5

NUM = 8 − 5 = 3

ANS = LV

⇒ NUM = 3

- 2 + 1 = I 3 ≥ 1

NUM = 3 − 1 = 2

ANS = LVI

⇒ NUM = 2

- 1 + 1 = I 2 ≥ 1

NUM = 2 − 1 = 1

ANS = LVII

⇒ NUM = 1

- 1 = I 1 ≥ 1

NUM = 1 − 1 = 0

ANS = LVIII

⇒ NUM = 0

X N ≥ 1

STOP

Condition (NUM ≥ value)

↳ Largest → Smallest

Symbol	Value
M	1000
CM	900
D	500
CD	400
C	100
XC	90
L	50
XL	40
X	10
IX	9
V	5
IV	4
I	1

Ex 2 NUM = 1994

⇒ 1000 + 900 + 90 + 4

⇒ M CM XC IV

ROMAN ANS

⇒ NUM = 1994

- 1000 + 994 = M — 1994 ≥ 1000

NUM = 1994 − 1000 = 994

ANS = M

⇒ NUM = 994

- 900 + 94 = CM — 994 ≥ 900

NUM = 994 − 900 = 94

ANS = MCM

⇒ NUM = 94

- 90 + 4 = XC — 94 ≥ 90

NUM = 94 − 90 = 4

ANS = MCMXC

⇒ NUM = 4

- 4 = IV — 4 ≥ 4

NUM = 4 − 4 = 0

ANS = MCMXCIV

⇒ NUM = 0 ↳ STOP

✗ NUM ≥ 1

```cpp
// 1. Integer to Roman (Leetcode-12)

class Solution {
public:
    string intToRoman(int num) {
       string romanSymbols[] = {"M","CM","D","CD","C","XC","L","XL","X","IX","V","IV","I"};
       int romanValues[] = {1000, 900, 500, 400, 100, 90, 50, 40, 10, 9, 5, 4, 1};

       string romanAns = "";

       for(int i = 0; i < 13; i++){
            // Rule to making roman value from integer is:
            // Traversal from Largest ----> Smallest
            while(num >= romanValues[i]){
                romanAns += romanSymbols[i];
                // Udate the num
                num = num - romanValues[i];
            }
       }
       return romanAns;
    }
};
```

Time complexity: *O(1)*
Space complexity: *O(1)*

The reason *for this is that the for loop has a fixed number of iterations.*