

# Power Calculus

Starting with  $x$  and repeatedly multiplying by  $x$ , we can compute  $x^{31}$  with thirty multiplications:

$$x^2 = x * x, \quad x^3 = x^2 * x, \quad x^4 = x^3 * x, \quad \dots \quad x^{31} = x^{30} * x.$$

The operation of squaring can appreciably shorten the sequence of multiplications. The following is a way to compute  $x^{31}$  with eight multiplications:

$$x^2 = x * x, \quad x^3 = x^2 * x, \quad x^6 = x^3 * x^3, \quad x^7 = x^6 * x, \quad x^{14} = x^7 * x^7, \\ x^{15} = x^{14} * x, \quad x^{30} = x^{15} * x^{15}, \quad x^{31} = x^{30} * x.$$

This is not the shortest sequence of multiplications to compute  $x^{31}$ . There are many ways with only seven multiplications. The following is one of them:

$$x^2 = x * x, \quad x^4 = x^2 * x^2, \quad x^8 = x^4 * x^4, \quad x^{10} = x^8 * x^2, \\ x^{20} = x^{10} * x^{10}, \quad x^{30} = x^{20} * x^{10}, \quad x^{31} = x^{30} * x.$$

There however is no way to compute  $x^{31}$  with fewer multiplications. Thus this is one of the most efficient ways to compute  $x^{31}$  only by multiplications.

If division is also available, we can find a shorter sequence of operations. It is possible to compute  $x^{31}$  with six operations (five multiplications and one division):

$$x^2 = x * x, \quad x^4 = x^2 * x^2, \quad x^8 = x^4 * x^4, \quad x^{16} = x^8 * x^8, \quad x^{32} = x^{16} * x^{16}, \quad x^{31} = x^{32} \div x.$$

This is one of the most efficient ways to compute  $x^{31}$  if a division is as fast as a multiplication.

Your mission is to write a program to find the least number of operations to compute  $x^n$  by multiplication and division starting with  $x$  for the given positive integer  $n$ . Products and quotients appearing in the sequence of operations should be  $x$  to a positive integer's power. In other words,  $x^{-3}$ , for example, should never appear.

## Input

The input is a sequence of one or more lines each containing a single integer  $n$ .  $n$  is positive and less than or equal to 1000. The end of the input is indicated by a zero.

## Output

Your program should print the least total number of multiplications and divisions required to compute  $x^n$  starting with  $x$  for the integer  $n$ . The numbers should be written each in a separate line without any superfluous characters such as leading or trailing spaces.

## Example

Input:

1

31  
70  
91  
473  
512  
811  
953  
0

**Output:**

0  
6  
8  
9  
11  
9  
13  
12