

## Binomial coefficients

P93625\_en

Concurso On-line 3 (OIE08) (2008)

The binomial coefficient or choose function  $\binom{n}{k}$  is the number of ways to choose  $k$  objects from  $n$  objects. Its formula is well known:

$$\binom{n}{k} = \frac{n!}{k!(n-k)!} \quad ,$$

where  $n! = n \cdot (n - 1) \cdots 2 \cdot 1$ . This formula is not very useful from a computational point of view, because we have to deal with huge numbers (the factorial numbers) to obtain much smaller results. For instance,

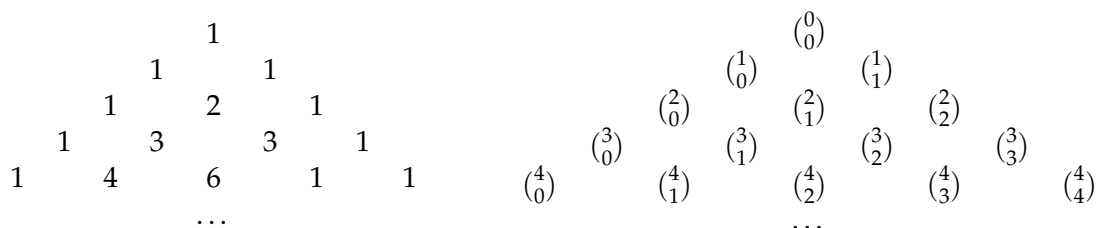
$$\binom{20}{10} = \frac{20!}{10!10!} = \frac{2432902008176640000}{1316819440000} = 184756 \text{ .}$$

Despite the fact that the final number has only 6 digits, we need to compute  $20!$ , which has 19 digits. This can be a problem because the type `int` of 32 bits cannot store numbers with more than 10 digits.

However, this is not the only way to compute  $\binom{n}{k}$ . For instance, binomial coefficients satisfy the following property:

$$\binom{n}{k} = \begin{cases} 1 & \text{if } k = 0 \text{ or } k = n \\ \binom{n-1}{k-1} + \binom{n-1}{k} & \text{if } 0 < k < n \end{cases}$$

This recursive formula allow us to compute binomial coefficients with no multiplications nor divisions, by using a procedure known nowadays as “Pascal’s triangle” or “Tartaglia’s triangle”, although it has historical references more than 1000 years old:



To compute more binomial coefficients, you only have to fill more rows of the triangle. Use this idea to compute the value of several binomial coefficients.

## Input

Input consists of several cases, each with two natural numbers  $n$  and  $k$ , where  $0 \leq n \leq 30$  and  $0 \leq k \leq n$ .

## Output

For each case, print  $\binom{n}{k}$ .

### Sample input 1

```
0 0
1 0
1 1
2 0
2 1
2 2
```

### Sample input 2

```
20 10
30 15
30 10
30 20
30 0
30 30
```

### Problem information

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### Sample output 1

```
1
1
1
1
2
1
```

### Sample output 2

```
184756
155117520
30045015
30045015
1
1
```