

Combinations with repetitions:

The number of ways to distribute objects of n different types over r different containers equals:

$$C(n + r - 1, r)$$

(assuming there are enough objects of each type)

Explanation: this equals the number of ways to place r crosses and $n - 1$ dividers in a row.

Examples:

The number of different ways to fill a box with r doughnuts, if the doughnut shop sells n different types of doughnuts.

The number of solutions to the equation

$$x_1 + x_2 + \dots + x_n = r,$$

where all variables x_i are non-negative integers.

The number of ways to choose three integers i, j, k , where $0 \leq i \leq j \leq k \leq 100$

The number of times the print statement is executed in the program:

```
for  $i := 1$  to 20 do  
  for  $j := i$  to 20 do  
    for  $k := j$  to 20 do  
      print ( $i * j + k$ )
```