Symbols

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## Problem 21. [Amicable numbers](https://projecteuler.net/problem=21)

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| --- |
| Algorithm D |
| Input: integer n;  Output: sum {a | a < n, a divides n}  begin  s ← ⌋  ;  sum ← 0;  for a ← 2 to MN-1 do  if (a is unmarked) then  b ← D(a);  if (b != a and D(b) = a) then  add (a+b) to sum;  mark(a);  endif b  end if a  endfor  return sum;  endE21 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| position | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |
| num[i] | 0 | 0 | 8 | 8 | 2 | 6 | 3 |  |  | 10! = 3628800 |
| p = 11×num[i]+carry | 0 | 0 | 88 | 96 | 31 | 69 | 39 |  |  |  |
| new value of num[i] | **0** | **0** | **8** | **6** | **1** | **9** | **9** | **3** |  |  |
| carry | 0 | 0 | 8 | 9 | 3 | 6 | 3 |  |  |  |
| 11! = 10! × 11 = 39916800 | | | | | | | | | | |

|  |  |  |
| --- | --- | --- |
|  | PosToPer | PerToPos |
| Given | n, S, t | n, S, p |
| Find | p | t |
| ***Tab. 24.*** *Problems of permutations* | | |

C++ Program

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Problem 21. Amicable numbers

sum{(a+b) | a < b < 10000, d(a) = b, d(b) = a}

Answer = 31626

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#include <iostream>

#include <windows.h>

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| --- | --- |
| Step 1 | Scan from *n* backward to 1 to find the last index *i* such that *xi* < *xi*+1.  If i does not exist then p is the maximum permutation p = (n−1, n−2,…,1) and of couse p' does not exist: return false. |
| Step 2 | (There is an *i* such that *xi* < *xi*+1.)  Scan again from *n* backward to i to find the last index *j* such that *xi* < *xj*. |
| Step 3 | Swap *xi* and *xj* |
| Step 4 | Reverse suffix-segment *p*(*i*+1..*n*) |
| Step 5 | Return *p* as the next permutation. |