

**Author(s) :** K.S. Kölbig

**Submitter :**

**Language :** Fortran

**Library:** MATHLIB

**Submitted:** 15.11.1995

**Revised:**

## Prime Numbers and Prime Factor Decomposition

Subroutine subprogram PRMFCT

- sets the first  $n \leq 1229$  prime numbers  $p_1 = 2, p_2 = 3, p_3 = 5, \dots, p_{1229} = 9973$  into an array;
- performs the decomposition of a positive number  $N < 10007$  into its prime factors:

$$N = 2^{\alpha_1} \cdot 3^{\alpha_2} \cdot 5^{\alpha_3} \dots 9973^{\alpha_{1229}};$$

- performs the decomposition of the factorial  $N!$  of a positive number  $N < 10007$  into its prime factors:

$$N! = 2^{\alpha_1} \cdot 3^{\alpha_2} \cdot 5^{\alpha_3} \dots 9973^{\alpha_{1229}}.$$

Note that this allows in particular to handle quotients of factorials of rather large numbers in an exact way.

### Structure:

SUBROUTINE subprogram

User Entry Names: PRMFCT

Files Referenced: Unit 6

### Usage:

```
CALL PRMFCT(MODE,N,NPRIME,NPOWER,M)
```

MODE = 0 : Sets the first  $n$  prime numbers into an array.

N (INTEGER) The number  $n$  of prime numbers requested.

NPRIME (INTEGER) One-dimensional array of length  $\geq N$ . On exit, NPRIME( $j$ ), ( $j = 1, 2, \dots, N$ ) contains the  $j$ -th prime numbers  $p_j$ , where  $p_1 = 2, p_2 = 3, p_3 = 5, \dots$

NPOWER (INTEGER) One-dimensional array of length  $\geq N$ . On exit, NPOWER( $j$ ), ( $j = 1, 2, \dots, N$ ) contains the value 1.

M (INTEGER) Contains, on exit, the number  $n$ .

MODE = 1, 2 : Performs the decomposition of  $N$  (MODE = 1) or  $N!$  (MODE = 2) into its prime factors.

N (INTEGER) The number  $N$  itself (MODE = 1) or its factorial (MODE = 2) to be decomposed into prime factors.

NPRIME (INTEGER) One-dimensional array of length  $\geq N$ . On exit, NPRIME( $j$ ), ( $j = 1, 2, \dots, M$ ) contains the  $j$ -th prime numbers  $p_j$ , where  $p_1 = 2, p_2 = 3, p_3 = 5, \dots$

NPOWER (INTEGER) One-dimensional array of length  $\geq N$ . On exit, NPOWER( $j$ ), ( $j = 1, 2, \dots, M$ ) contains the power  $\alpha_j$  corresponding to the prime number  $p_j$ .

M (INTEGER) Contains, on exit, the index  $M \leq N$  defined by  $\alpha_M > 0$  and  $\alpha_j = 0$  for  $j > M$ .

**Restrictions:**

MODE = 0 :  $1 \leq N \leq 1229$ .

MODE = 1 or MODE = 2 :  $2 \leq N \leq 10007$ .

**Error handling:**

Error B002.1: MODE  $\neq$  0 and MODE  $\neq$  1 and MODE  $\neq$  2.

Error B002.2: N out of range.

In both cases, NPRIME(j) and NPOWER(j), ( $j = 1, 2, \dots, N$ ) are set to zero and a message is written on Unit 6, unless subroutine MTLSET (N002) has been called.

●