

## Re: Factorization of $n!$ as power of primes

---

*Source:* <http://sci.tech-archive.net/Archive/sci.math/2006-02/msg03013.html>

---

- *From:* "Tim Peters" <[tim.one@xxxxxxxxxxx](mailto:tim.one@xxxxxxxxxxx)>
  - *Date:* Fri, 17 Feb 2006 13:12:42 -0500
- 

[Arturo Magidin]

...  
I misread the original and cancelled my posting.

I thought the original poster wanted to obtain BOTH the list of primes and their exponents. Of course, it is easy, given a prime  $p$  and a positive integer  $n$ , to find the exponent of  $p$  in the factorization of  $n!$ . But there is no easy way to find all the primes that occur in the factorization of  $n!$  given only  $n$ ; at least, no known way.

The set of primes dividing  $n!$  is the set of primes  $\leq n$ , and you surely don't mean to say there's no known way to find the latter. Perhaps "easy" is an informal notion of efficiency here? For example, the sieve of Eratosthenes is "easy" by most measures, but does take time mildly super-linear in  $n$  (and fancier sieve methods exist that are mildly sub-linear in  $n$ ; since there are about  $n/\log(n)$  primes  $\leq n$ ,  $O(n/\log n)$  is a lower bound).

Otherwise, figuring out if  $n$  is a prime would be easy, not to mention factoring: just factor  $n!$  and factor  $(n-1)!$  to find a factorization for  $n$ .

Sounds more efficient than "surrogate factoring" anyway ;-)