A simple algorithm to express any odd composite number that is a product of k-primes not necessarily distinct as a sum of exactly k unequal terms

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Abstract: If N is an odd composite number that can be written as a product of k-primes not necessarily distinct, then we have devised a simple algorithm that would allow us to express N as the sum of exactly k terms all distinct derived using its prime factors.

Results :

Let N be an odd composite number that is a product of exactly k-primes $p_1, p_2, p_3, \ldots\ldots\ldots, p_{k-2}, p_{k-1}, p_k$.

Therefore N= $p_1 p_2 p_3 \ldots\ldots\ldots p_k$

Consider a circle.

If in **step1,** we cut we cut it at p_1 positions it would result in p_1 arcs.

(Note that we have used a total of p_1 cuts to the circle until now to yield p_1 arcs)

If in **step 2,** we cut within each arc from step 1 at p_2-1 positions, then we would end up with p_1p_2 arcs and in this step alone we have used $p_1(p_2-1)$ cuts.

(Note that we have used a total of $p_1 + p_1(p_2-1)$ cuts to the circle from the beginning to yield p_1p_2 arcs at end of step 2)

If in **step 3,** we cut within each of the arcs at end of step2 at p_3-1 positions, then we would end up with $p_1p_2p_3$ arcs and in this step alone we have used $p_1p_2(p_3-1)$ cuts.

(Note that we have used a total of $p_1 + p_1(p_2-1) + p_1p_2(p_3-1)$ cuts to the circle from the beginning to yield $p_1p_2p_3$ arcs at end of step 3)

Using the same strategy at the end of k-steps we would end up with N arcs which is $p_1p_2p_3\ldots\ldots\ldots p_k$ and we have used $p_1p_2p_3\ldots\ldots\ldots(p_k-1)$ cuts in the k^{th} step.

(Note that we have used a total of
$p_1 + p_1(p_2-1) + p_1p_2(p_3-1) + \ldots\ldots. + p_1p_2p_3\ldots\ldots\ldots(p_k-1)$ cuts to the circle from the beginning to yield N= $p_1p_2p_3\ldots\ldots\ldots p_k$ arcs at end of k^{th} step)

Conclusions:

If N= $p_1p_2p_3\ldots\ldots\ldots p_k$ where $p_1, p_2, p_3, \ldots\ldots\ldots, p_{k-2}, p_{k-1}, p_k$ are k-primes not necessarily distinct then we can express N as the sum of k distinct terms as follows

$$N = p_1 + p_1(p_2-1) + p_1p_2(p_3-1) + \ldots + p_1p_2p_3\ldots(p_{k-2}-1) + p_1p_2p_3\ldots\ldots(p_{k-1}-1) + p_1p_2p_3\ldots(p_k-1)$$

Since we are dealing with an odd composite number N, none of the k prime factors of N is equal to the even prime 2 and therefore all the k-terms in the sum partition derived using the above algorithm are unequal.