Re: The Collatz discrete primes!

Source: http://sci.tech−archive.net/Archive/sci.math/2007−03/msg04838.html

- *From*: "Danny" <fasttrack2a@xxxxxxxxxxxxx>
- *Date*: 22 Mar 2007 21:20:33 −0700

On 22 Mar, 14:14, "mensana...@xxxxxxxxxxx" <mensana...@xxxxxxx> wrote:

> On Mar 22, 12:39 pm, "mensana...@xxxxxxxxxxx" <mensana...@xxxxxxx>
> wrote:
>
>> On Mar 22, 1:36 am, "mensana...@xxxxxxxxxxx" <mensana...@xxxxxxx>
>> wrote:
>>
>>> On Mar 20, 12:23?am, "Danny"
>>> <fasttrac...@xxxxxxxxxxxxx> wrote:
>>>
>>>> 3x+1 revisited.
>>>>
>>>> 2,3,7,19,37,43,73,79,97,109,127,151,163,181,199,223,241,271
>>>> ,277,307,313,331,349,367,379,397,421,439...
>>>>
>>>> The above prime list are primes (p) that are
>>>> not in any seed (n)
>>>> path where any given seed (n) is < (p).
>>>>
>>>> e.g.
>>>> For prime 73 to make this list then −−−

All seeds (n) where n= (1,2,3,4,.72) 73 does
not
appear in any of these seed paths of (n) in
the Collatz tree.

Also after the second term in the list they all
are...
(p−1)==0(mod 3).

Will there ever be a prime in this list where
(p−1) is
not a ?0(mod 3)?

There are many primes (not) in this list
where (p−1) is
not a 0(mod 3) and some that are a 0(mod 3)
that are
not on this list.

Also, does this list −−−−>oo?

Dan

This seems to be true of odd numbers in general,
not just primes. Numbers that are not included
in the union of all pathways less than themselves,
include the composites:

25, 55, 115, 133, 145, 169, 187, 217, 235, 259, 289,
295, 343, 361, 385, 403, 451, 469, 475, etc.

all of which are 1(mod3).

I pondered this some more. First, we need some rules on how branches and sub−branches are organized (I'm going to use r0, r1, and r2 to represent 0(mod3), 1(mod3) and 2(mod3) as it's easier to type).

− all r0 branches have only r0 nodes to infinity and no sub−branches

− all r1 & r2 branches alternate r1 & r2 nodes to infinity and have sub−branches only at r1 nodes (if and only if r1 is even)

− sub−branches always appear in modulo 3 order

There are thus, only 7 types of branches:

r0
r0
r0
r0
r0
r0
r0
__r0

r2 r2 r2
r1__r2 r1__r0 r1__r1
r2 r2 r2
r1__r1 r1__r2 r1__r0
r2 r2 r2
r1__r0 r1__r1 r1__r2
r2 r2 r2
__r1 __r1 __r1

r2 r2 r2
r1__r2 r1__r0 r1__r1
r2 r2 r2

r1__r1 r1__r2 r1__r0
r2 r2 r2
r1__r0 r1__r1 r1__r2
__r2 __r2 __r2

Since an r0 branch can't have any sub−branches, _all_ ancestors of p must be > p.

For branches where p = r2, we have

a__b
__p

and doing the algebra, we get b = (2p−1)/3. The −1 isn't so important. Generally, because of the fraction 2/3, b < p, so _every_ p = r2 has an ancestor that's smaller than p.

For r1 branches,

b__c
a
__p

the fraction involved is 4/3, so c > P.

BUT...

What if c is itself an r2?

d__e
b__c

a
__p

Then the fraction becomes (4/3)*(2/3) which is 8/9 and thus, e < p. So an r1 branch _could_ have an ancestor smaller than p. We see this in the case of 27 to 31:

82__27
124__41
62
__31

Here, 41 > 31 yet 27 < 31.

And it need not be the first subranch. Take for example

e__f
d
b__c
a
_p

Here f is 16/3 p. But if we string together a big enough r2 chain, we can overcome the 16/3 and eventually reach a fraction with a smaller ancestor:

(16/3)*(2/3) = 32/9
(32/9)*(2/3) = 64/27
(64/27)*(2/3) = 128/81
(128/81)*(2/3) = 256/243
(256/243)*(2/3) = 512/729 <−− fraction is now less than 1

So, in the case of

m__n
k__l
i__j
g__h
e__f
d
b__c
a
_p

Oops, made a mistake there, should be

o__q
m__n
k__l
i__j
g__h
e__f
d
b__c
a
_p

so it's q < p.

n < p. A p = r1 joins the r2's as having an ancestor smaller than p _if_ a long enough chain of r2's can form. And obviously, the higher up the branch you go, the longer the r2 chain has to be (of course, they don't have to be consecutive, just that the r2's eventually overtake the net effect of the r1's).

In the case of consecutive r2 chains, it should be noted that r2 chains occur in 3−adic sequence on any given branch. The 3−adic sequence is

1,1,2,1,1,3,1,1,2,1,1,4,1,1,2,1,1,3,1,1,2,1,1,5,
1,1,2,1,1,3,1,1,2,1,1,4,1,1,2,1,1,3,1,1,2,1,1,6,
1,1,2,1,1,3,1,1,2,1,1,4,1,1,2,1,1,3,1,1,2,1,1,5,
1,1,2,1,1,3,1,1,2,1,1,4,1,1,2,1,1,3,1,1,2,1,1,7...

thus our r2 sub−branch chains could look like

r2
r1__r2 <−− chain is length 3
r2
r1__r1
r2
r1__r0
r2
r1__r2 <−− chain is length 1
r2
r1__r1
r2
r1__r0
r2
r1__r2 <−− chain is length 1
r2
r1__r1
r2
r1__r0
r2
r1__r2 <−− chain is length 2
r2
r1__r1
r2
r1__r0
r2
r1__r2 <−− chain is length 1
r2
r1__r1
r2
r1__r0
r2
r1__r2 <−− chain is length 1
r2
__r1

But also note that we could enter the 3−adic sequence at a random point, so the first non−1 number could be anything. I exploit this in my tree−crawler algorithm. I do a 3−level look−ahead (out of every 3 chains, at least one has a length>1) to see if I found a chain that is long enough to compensate for the extra cost of reaching it. Doesn't happen very often, but it _does_ happen.

In conclusion, I'll state, the numbers on your list

− have nothing to do with primes

− always on r0 branches, never on r2 branches, and possibly on r1 branches

− if the r1 branch can'r find a long enough r2 chain (consecutive or aggregate)

− the list goes to infinity− Hide quoted text −

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Just spotted this In OEIS −−− A127781
"The Hailstone pure numbers"
So my special list of primes could be called
the Hailstone pure primes!

Thanks for your input.

Dan

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