Re: The Collatz discrete primes!

Source: http://sci.tech−archive.net/Archive/sci.math/2007−03/msg05977.html

- *From*: "Danny" <fasttrack2a@xxxxxxxxxxxxx>
- *Date*: 30 Mar 2007 07:22:52 −0700

On 24 Mar, 18:21, "mensana...@xxxxxxxxxxx" <mensana...@xxxxxxx> wrote:

> On Mar 24, 4:58?pm, "Danny" <fasttrac...@xxxxxxxxxxxxx> wrote:
>
> > > On 24 Mar, 10:57, "mensana...@xxxxxxxxxxx" <mensana...@xxxxxxx> wrote:
> > >
> > > > On Mar 23, 8:01 am, "Danny" <fasttrac...@xxxxxxxxxxxxx> wrote:
> > > >
> > > > > > > Just spotted this In OEIS −−− A127781 "The Hailstone pure numbers" So my special list ofprimescould be called the Hailstone pureprimes!
> > > > >
> > > > > That's Pure Hailstoneprimes−−−

A127928.

I missed that one, I guess I just reinvented
the wheel!

Great minds think alike, eh?

What interest me more about all the pure
hailstone
numbers is the difference pattern they leave.

At first I didn't realize you had gone back to _all_
pure numbers. Changing my program to show all numbers
(not justprimesor odds) I get

(0) 405 [0]
? ? ? ? ? ? ? ? (1) 406 [0]
? ? ? ? ? ? ? ? (2) 407 [0]
(0) 408 [0]
? ? ? ? ? ? ? ? (1) 409 [2]
? ? ? ? ? ? ? ? (2) 410 [0]
(0) 411 [0]
? ? ? ? ? ? ? ? (1) 412 [0]
? ? ? ? ? ? ? ? (2) 413 [0]
(0) 414 [0]
? ? ? ? ? ? ? ? (1) 415 [0]
? ? ? ? ? ? ? ? (2) 416 [0]
(0) 417 [0]
? ? ? ? ? ? ? ? (1) 418 [0]
? ? ? ? ? ? ? ? (2) 419 [2]
(0) 420 [0]
(1) 421 [2]
? ? ? ? ? ? ? ? (2) 422 [0]
(0) 423 [0]
? ? ? ? ? ? ? ? (1) 424 [0]
? ? ? ? ? ? ? ? (2) 425 [0]
(0) 426 [0]
? ? ? ? ? ? ? ? (1) 427 [0]
? ? ? ? ? ? ? ? (2) 428 [0]
(0) 429 [0]
? ? ? ? ? ? ? ? (1) 430 [0]

? ? ? ? ? ? ? ? (2) 431 [2]
(0) 432 [0]
? ? ? ? ? ? ? ? (1) 433 [2]
? ? ? ? ? ? ? ? (2) 434 [0]
(0) 435 [0]
? ? ? ? ? ? ? ? (1) 436 [0]
? ? ? ? ? ? ? ? (2) 437 [0]
(0) 438 [0]

where for (m) n [p]

?− m is modulo 3
?− n is the number
?− p is prime flag (0=composite,2−prime)

pure on the left, impure to the right.

And when I calculate differences, I get something like (not the same sequence)

? ? 1 2 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3 3 3
? ? 1 2 3 3 3 3 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3 3 3
? ? 1 2 3 3 3
? ? 1 2 3
? ? 1 2 3 3 3

? ? 1 2 3
? ? 1 2 3 3 3
? ? 1 2

So I think I'm finally on the same page.

> I belive we discussed this on an earlier post
> but delving into it more I discovered this −−
>
> After the initial start these are the only
> difference
> patterns in the hailstone pure numbers.
>
> 1,2,3
> 1,2,3,3,3
> 1,2,3,3,3,3,3

Which I concur on.

> There never is a sequential repeat of the first
> two patterns (1,2,3) and (1,2,3,3,3) but
> (1,2,3,3,3,3,3) at times will repeat once.
>
> These repeats occur between hailstone pure
> @
> 405 − 438
> 891 − 924
> 1863 − 1896
> 3159 − 3192
> 3321 − 3354
> 4779 − 4812
> 5265 − 5298
> 6237 − 6270
> 6705 − 6738
> −− etc.

> Most of the time the general pattern will be
> −−
> [123][12333][123][12333][123][1233333][12333][123]−−−
> and once in awhile the repeat of
> [1233333][1233333]
> but never [123][123] or [12333][12333].
> I wonder why that is?

Ah, the $64 question: why?

There are always rules. Rules have implications. Sometimes the interaction of these implications is hard to see when they are all run together. I may not have crossed every i and dotted every t, but I think it works something like this:

First, every 0(mod3) number is pure and since natural numbers
are always in modulo 3 sequence, we start out with

0(mod3) pure
1(mod3) ?
2(mod3) ?
0(mod3) pure

That means no difference can be greater than 3. If that were the end of the story we would have only [3333333...] as a sequence of differences. There is, of course, more to it than that.

We also know that every 2(mod3) is impure (because its sub−branch is only one step above). This applies to both even and odd 2(mod3) numbers. So far, we've got

0(mod3) pure
1(mod3) ?
2(mod3) impure
0(mod3) pure

Which doesn't change our differences. What does change them
is whether or not the 1(mod3) is pure or impure (and it can be either). That gives us two possibilities

0(mod3) pure
1(mod3) impure
2(mod3) impure
0(mod3) pure

or

0(mod3) pure
1(mod3) pure
2(mod3) impure
0(mod3) pure

For the first case, we still get a 3, but for the second,
we get a 12 instead of a 3 for differences (essentially, a
3 can be replaced by a 12).

So everywhere we see a 12 in the sequence, a 1(mod3) is pure.
Wherever you see a 3, the 1(mod3) inside that block is impure.

Next, every _even_ 1(mod3) is impure. Any 1(mod3) is evenly
divisible by 3 when you subtract 1, but, by the implication
that 3n+1 always results in an even number, you cannot reverse
that operation when the 1(mod3) is odd. You can always reverse
it when 1(mod3) is even, thus, every even 1(mod3) has a smaller
ancestor and thus, every even 1(mod3) is impure.

What does that imply to our sequence? That you cannot have 2
pure 1(mod3) numbers in a row (because at least one will be even).
So a pure 1(mod3) implies

0(mod3) pure
1(mod3) pure
2(mod3) impure
0(mod3) pure
1(mod3) impure
2(mod3) impure
0(mod3) pure

and that means every 12 is followed by a 3, so [123] is the smallest possible unit and the sum of a unit must be a multiple of 6

? ? [123] = 6
? [12333] = 12
[1233333] = 18

But wait...there's more.

To have two [123] blocks in a row implies that the next numbers are 12..., in other words

[123][123][12...]

which means we have 3 odd 1(mod3) pure numbers in a row but that won't happen since to be pure, the first sub−branch can't be a 2(mod3) and out of three consecutive odd 1(mod3) numbers,

at least
one will have a 2(mod3) sub−branch. That gives us the major implication

?− there cannot be 3 consecutive odd 1(mod3) pure numbers

Of course, you can skip one, but if you do, you get two 3's, the one you skipped and the next one because the 1(mod3) number
would be even. So if you don't get [123], you must get at least
[12333].

Likewise, the other major implication is that out of 3 odd 1(mod3) numbers, at least one is pure, so we have

?− there cannot be 3 consecutive odd 1(mod3) impure numbers

which means we can't have a unit larger than [1233333].

Let's see, I haven't covered why you don't see [12333][12333],
but my brain is kinda fried right now, I'm sure there's a similar reason.

The answers are always there if you dig deep enough.

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Interesting deduction!
Thanks.

So if there was a counter example to the Collatzconjecture it would have to start with an odd pure?

That's an interesting thought. If you're counting upwards from 1, you would never see a pure until you got to it, so if the counter example was impure, you would see one of its ancestors first and that would lead you right into the counter example.

Unless you're not counting upwards from 1. If you had some magic formula that could take you directly to the counter example, I suppose you could find out that counter example is impure but its ancestors, although smaller, are in fact so large they haven't ever been seen either.

That might be worth looking at in other systems like 3n+5. Although pure might have a slightly diffent meaning when there are multiple trees involved.

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Pondering a counter example in Collatz 3x+1 is all hypothetical of course an the implications if there is one is
interesting but hard to comprehend because it not only involves the integers in the loop but larger integers in a reverse path doubling outside the loop.

I have been pondering your explanation about the counter

example being pure or impure but my thought is that the smallest odd integer in the counter example path would have to be pure.
This brings up another question, is this true,
where the smallest (pure) odd integer does not necessarily have to be included in the counter example loop but just a lead in to this counter example loop?
In other words a (pure) odd integer starting a side path leading into the counter example loop but not in the actual repeating loop and also maintaining its smallest value against each of the values in the entire counter example!

Dan

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