Re: problem of arithmetic modulo

Source: http://sci.tech−archive.net/Archive/sci.math/2008−01/msg03545.html

- *From*: Gerry Myerson <gerry@xxxxxxxxxxxxxxxxxxxxxxxxxx>
- *Date*: Tue, 22 Jan 2008 22:53:57 GMT

In article
<Pine.LNX.4.63.0801221602130.7864@xxxxxxxxxxxxxxxxxxxxxxxxxxxx>,
Helmut Richter <hhr−m@xxxxxx> wrote:

> On Tue, 22 Jan 2008, Cat wrote:
>
>> Date: Tue, 22 Jan 2008 15:49:40 +0100
>> From: Cat <Ct@xxxxxxxxx>
>> Newsgroups: sci.math
>> Subject: Re: problem of arithmetic modulo
>>
>> Rainer Rosenthal <r.rosenthal@xxxxxx> a écrit dans le message :
>> 5vmbh9F1mnj3lU1@xxxxxxxxxxxxxxxxxxxxxx
>>
>>> Bill wrote:
>>>
>>>> but this is not the case with modulo 7.
>>>> 10^0=1[7], 10^1=3 [7], 10^2=2[7], 10^3=6,
>>>> 10^4=4, 10^5=5, 10^6=1 and so
>>
>> on
>>
>>>> [modulo 7]
>>>
>>> Please write some more terms of the "and so on". Won't be
>>> that random as
>>> you seem to expect. Draw your conclusions.
>>>
>>> Regards,
>>> Rainer
>>
>> I know it's not random.
>> But how do you compute c modulo 7 with c =sum(a_i)

> > where a_i are the digits of the numbre 3^1000?
> > It does'nt seem as straightforward as with c modulo 3.
> > I even wonder if it's possible to solve the problem.
>
> The unfair solution is to compute 3^1000 which is
> 132207081948080663689045525975214436596542203275214816766492036822682859734670
> 04
> 899540778313850608061963909777696872582355950954582100618911865342725257953674
> 02
> 762022519832080387801477422896484127439040011758861804112894781562309443806156
> 61
> 730540866744905061781254803444055470543970388958174653682549161362208302685637
> 78
> 582290228416398307887896918556404084898937609373242171846359938695516765018940
> 58
> 810906042608967143886410281435038564874716583201061436613217310276890285522000
> 1,
>
> then add up its digits, giving c=2142, then computing the desired values:
>
> c = 0 (mod 2)
> c = 0 (mod 3)
> c = 0 (mod 7)
> c = 0 (mod 17)
>
> Conjecture: c = 0 (mod p) for all prime p.

I trust the conjecture is a joke.

I would suggest the OP calculate the sum mod 7 of the decimal digits
of 1, 3, 9, 27, 81, 243, ..., and see whether there is a pattern and
report back to us. I'm guessing there won't be much of a pattern.

3^n has roughly (log−base−10−of−3) n digits. The average digit
is 4−and−a−half, it's plausible that holds for the digits in 3^n,
in which case the sum of the digits in 3^n should be about
(4.5) (log_10 3) n. But it must be a multiple of 9, so I'd bet on
the multiple of 9 closest to (4.5) (log_10 3) n. As n increases,
every so often that will go up by 9, so the residue mod 7 will go up
by 2, or down by 5. But it won't be so regular.

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Gerry Myerson (gerry@xxxxxxxxxxxxxxx) (i −> u for email)
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