

Re: FLTMA: A little group theory

Source: <http://sci.tech-archive.net/Archive/sci.math/2006-10/msg06822.html>

- *From:* "The Dougster" <DGoncz@xxxxxxx>
 - *Date:* 25 Oct 2006 03:44:42 -0700
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Chip Eastham wrote:

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<http://www.mathpages.com/home/kmath264.htm>

I think I see this more clearly today. If some power of $w \equiv -1 \pmod{z}$ then, knowing $w^0 = 1$, we have $\{ 1, -1 \} \leq \langle w \rangle$ and so $|-1|$ divides $|\langle w \rangle|$, where \leq means "is a subgroup of".

I think it would be interesting to make a targeted search for solutions with $n = 3$, the smallest possible prime, or even better, to develop a proof that no such solutions exist.

Using what we have already shown, we need coprime x, y, z such that:

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$(z/y) \bmod x$ has order 3
 $(z/x) \bmod y$ has order 3
 $(x/y) \bmod z$ has order 6 & $(x/y)^3 \equiv -1 \pmod z$

where $0 < x < y < z < x+y$ and xyz even.

Thus $\phi(x)$ and $\phi(y)$ must be divisible by 3, and $\phi(z)$ must be divisible by 6. Thus $z = 7, 9, 13, 14, 19, 18,$ etc. are candidates.

OK. I have done that in Mathcad, which doesn't share nicely in Usenet, and am working in VB4 now, so I can do something up which can be shared.

Is that xyz even or $x+y+z$ even?

With x,y,z pairwise coprime, the notion that exactly one of x,y,z is even is expressed equally well by xyz even or $x+y+z$ even, but I meant the former.

I wonder if I have access to a language in which operators can be overloaded to make the source code look more like abstract algebra and less like binary arithmetic. Hmm.

I like Prolog because one freely defines the relations/predicates that make up the language (and they are readily "overloaded" for different datatype, albeit at the expense of weak/runtime typing). However you may want to look at some "functional" languages like Haskell or ML. Lisp and descendants like Scheme are more "function" friendly, but I don't know how important infix notation is for you.

Can anyone in sci.math suggest an appropriate limit for such a search? Would 32-bit integers do all right? I think that's 16-bits of value before the table $a*b$ in $\mathbb{Z}/n\mathbb{Z}^*$ begins to overflow. There may be other limits. Shall we say, to $z < 65535$?

Yes, I think this would be plenty interesting, to run z out to 16 bit unsigned limits, implemented in 32-bits for taking powers, etc.

I wonder if Prolog or any language allows syntax like the following for programmers like me with some cognitive deficits to deal with:

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* A function definition *

```
The Function phi of integer x returns integer y such that
y = 0
for z = 1 to z-1
if y mod x > 0 then y = y + 1
next z
return y
```

Just wondering how flexible syntax can be. In discourse I hate pronouns. I abhor them. In programming I love them. In discourse, they are omnipresent. In programming, absent. How about that.

Anyway, like this, from FLTMA Explorer 3, *untested*?

-----VB 4.0 Source-----

```
Private Sub Exp_3_Click()
For z = 5 To 65536
For y = 4 To z
For x = 3 To y
f _
gcd(x, y) = 1 And _
gcd(y, z) = 1 And _
gcd(x, z) = 1 And _
(x Mod 2) + (y Mod 2) + (z Mod 2) = 2 And _
(x < y) And (y < z) And (z < (x + y)) And _
(phi(x) * phi(y) * phi(z) ) mod 3 = 0 Then

Find (0)

If _
(zxyz + zyxz) > 1 And _
zxyz = 3 And _
xyzx = 3 And _
ozxy = 3 And _
ozyx = 3 Then
Text1.Text = Text1.Text & 3 & z & y & x & vbCrLf
End If

Next x
Next y
Next z

End Sub
```

-----End VB 4.0

Source-----

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