Re: Relative Cardinality

Source: http://sci.tech−archive.net/Archive/sci.math/2005−07/msg01996.html

- *From*: "Proginoskes" <proginoskes@xxxxxxxxxxxxx>
- *Date*: 13 Jul 2005 15:53:59 −0700

mueckenh@xxxxxxxxxxxxxxxxx wrote:
> Proginoskes wrote:
> > mueckenh@xxxxxxxxxxxxxxxxx wrote:
> > > Proginoskes wrote:
> > >
> > > > Let me digress for a moment:
> > > >
> > > > Lemma. If we can't count up to N, then we can't count up to N−1.
> > > >
> > > > Proof: This statement is equivalent to: If we can count up to N−1, then
> > > > we can count up to N. This is trivially true.
> > >
> > > No. Use, as a simple model, three chips. How far can you count and
> > > store the result by means of these chips? 1 , 2, end. In order to store
> > > 3, you must forget 1 and 2. Now turn the whole universe into a big
> > > computer. The principle remains the same, the numbers get larger
> > > though.
> >
> > That's right, you're not allowing any numbers with more than 10^100
> > digits, because you can't write them down in the real world. How
> > pathetic; you haven't even scratched the surface in what numbers are
> > allowed outside this universe.
>
> I call 10^10^10^10^10 a number. In fact it is one of the smaller
> numbers.

You're trying to have your cake and eat it too, here. You want to say
that you can make arbitrarily large numbers, but you also want to say
that any number that requires more than 10^100 decimal digits isn't
really a number.

Let's define a WM−number to be one that can be expressed by writing
digits on each piece of matter in the universe, and that there are M
particles of matter in the universe. (We've been saying M is 10^100,
but its exact value isn't important.)

THEOREM. There are only a finite number of WM−numbers.

Proof: Order the pieces of matter as m_1, m_2, ..., m_M. Suppose that
the digit a_i appears on m_i, for all i between 1 and M.

This representation a_1 ... a_M corresponds to at most one WM−number.
(a_1 ... a_M might represent a nonsense string of digits which doesn't
actually "encode" a number.) Thus the number of WM−numbers is at most
the number of ways to choose a_1 a_2 ... a_M.

This number is 10^M, which means there are at most 10^M WM−numbers.
Since 10^M is finite (no matter what M is, as long as M is finite),
this directly implies there are a finite number of WM−numbers. QED.

> > (Comment added later: The hydrogen atom has an infinite (countable)
> > number of stable energy states. Any amount of energy can be created, as
> > long as it's "paid back" a short time later, so you can store one of a
> > countable number of natural numbers in one atom.)
>
> And how can we measure these states? How can we enumerate them? If we
> measure an amount of energy, how can we map it on the due number? Your
> proposal would require by far more matter to represent numbers than the
> simple spin computer.

It may need more technology, but once you've gotten past it, then you
can express ANY positive integer (not just WM−integers).

> > Every natural number is finite, since it only has a finite number of
> > digits. But there are an infinite _number_ of them.
>
> There are finite natural numbers which have more digits than any given
> number n, namely n+1, n+2, ... According to your definition of
> infinity, the digits of natural numbers form an infinite set.

I only brought up "a finite number of digits" to define what I mean by
a natural number. I don't want to include ...1111 as a natural number,
where the 1's go on forever. (This idea has surfaced in other threads
on sci.math.)

> Or do you mean the set of digits is infinite? Of course, if there are
> infinitely many numbers, then the set of digits is infinite.

I mean the set {n+1, n+2, ...} is infinite.

> Or easier: Use the unal system, where 7 is represented by IIIIIII.
> There are infinitely many natural numbers, but thee are only finitely
> many strokes?

To express ONE natural number, you're allowed a finite number of
strokes. However, that number of strokes can be a big number −− I'm not
stopping you from writing down 10^10^100 of them.

> > Actually, they don't by _your_ definition of a natural number (it has

> > to be less than 10^10^100). The definition of natural number allows
> > more digits than yours does.
>
> You did not understand my definition. Please refrain from discussing
> it. The numbers have no upper limit.

Okay, refresh my memory: what IS your definition of a WM−number?

> > I figured everyone would know there was a 8−) at the end of that
> > sentence.
>
> I don't understand what a 8−) should mean. However, I understand what
> Euclid meant and what he said.

8−) means a joke, something not to be taken seriously. It's called an
emoticon (or a smiley) and is a standard part of Usenet.

> > What do you mean by a "simple rule" ?
>
> A rule which does not consume much information or negentropy.

How much information is too much information?

> > > > If that's what you've really meant, then you should have said so,
> > > > instead of wondering about whether numbers of the form 111...111 give
> > > > you infinitely many primes, since you won't be able to write them down
> > > > anyway.
> > >
> > > Not write them down, but I would know each digit of that number.
> >
> > You need to record the number of digits in the number 111...111,
> > though, because 11 and 111 differ only in the number of digits. That
> > means you can't deal with numbers with that "simple rule" which are
> > larger than 10^10^10^100.
>
> If I know that all their digits are 1, then this is sufficient.

No, you need to know how many there are. Otherwise there's no
distinction between 11 and 111. They are both geneated by the rule:
"All the digits are 1." If you want to differentiate these two numbers,
you need more information.

BTW, if you use the rule "All the digits are 1", this needs to be kept
in your head, which is made up of matter, which means it's part of the
digits written on the particles.

> > But this means that, if you came upon the number N (> 1) written among
> > all the particles in the universe, how do you decide whether it's meant
> > to be N or 111...111 (with N digits)?
>
> That must be fixed by definition like every numeral system.

There is no definition: You show up "at work", and all those 1's are on all particles of matter. What number do they represent?

> > This means that your system of recording numbers on particles is not
> > "well−defined", because you can get more than one number out of a
> > single representation.
>
> 111 can be interpreted as 3 or as onehundred and eleven. It must be
> definied what is meant.

How do you make the definition? Or can 111 mean 3 today and 111 tomorrow? Where's the information which tells you which is to be used? (Note that it must be written down in the universe somewhere, even if it's in your head.)

In other words, suppose I offer you a large monetary reward if you can tell me what 111111111 means, based on your definition. You have one guess; what do you say?

> > > Therefore, for any other number I could find out which of them is
> > > larger. This is the criterion of existence for a "measure of
> > > largeness", i.e., a number.
> >
> > > > Mathematics was designed to work outside of the physical universe.
> > >
> > > Nothing does work outside of the physical universe.
> >
> > How can you be sure of this? All the physics that has been developed
> > has been for use in this universe, based on observations and trying to
> > come up with a system that fits those observations.
> >
> > There's no problem with my statement, because I included the phrase
> > "was designed to."
>
> It was not designed to work outside. Geometry was designed to measure
> land, arithmetics was designed to count cattle. Nothing could be
> designed to work outside, because there is no outside.

You've shown a part of mathematics "must work inside of the universe", but there are other parts which _don't_ have to be a part of the universe. What is the phyisical−world interpretation of (first order) logic, for instance?

(Geometry can't measure land, by the way, since it assumes that rectangles, triangles, etc., are perfect, which is not the case of objects in the physical world, which consist of a finite number of particles.)

> > > Those numbers do certainly exist.
> >

> > So you've stated that there are numbers that exist that you can't write
> > down.
>
> Numbers are conceivable, that could be raised into existence but which
> do not yet exist. Others, although called numbers by present
> mathematics, cannot exist and, therefore, are erroneously called
> numbers.

What exactly is the mechanism that keeps sqrt(2) from existing? Because you can't have an object with length sqrt(2)? In that case, 1 doesn't either, because there is always error in any measure.

So maybe you should define "numbers" to be intervals, where the intervals give upper and lower bounds. I.e., we don't talk about 1 being a number, but we do talk about [0.9,1.1] being a number, since you _can_ create something whose length is between 0.9 and 1.1 units long.

(What about Planck length, though?)

> > But this has been your point throughout the discussion. So you've
> > contradicted yourself here.
>
> Where?

Maybe there isn't a contradiction, but I thought there was one due to you using the word "numbers" to mean more than one thing. (This also happened when you used the word "cardinality" in your original post instead of using another term.) Terminology which already exists should refer to the standard definition.

> > > But how would you satisfy the
> > > set−theoretic requirement that each element must be distinguished by at
> > > least one property from its companions? With less than 10^100 particles
> > > in the whole universe?
> >
> > I don't need to follow the second requirement with "my" mathematics,
> > which is the point of the whole thread. _You_ need to tell me this,
> > because you've insisted on it.
>
> Set theory, i.e., your mathemaics, requires that the elements of a set
> must be distinguished. Only now where you recognize that this task is
> impossible for infinite sets, you react defiant.

So you're saying that the numbers 1, 2, 3, etc., off to infinity _aren't_ all distinct? Which two are the same?

When real numbers were defined (based on sequences of rational numbers), great care was taken to show when two of these resulting real numbers are the same and when they are different. Of course you may not know this, having not seen it ...

Or maybe you are saying that two different _representations_ of an
object could be the same, but I might count them as being different?
This won't happen: The set
{1/2, 2/4} only has one element in it, accoring to standard set theory;
there is no debate here.

> But this recognition will spead out nevertheless.

Time will tell if this statement will stand the test of time.

−−− Christopher Heckman

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