

Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorian

Source: <http://sci.tech-archive.net/Archive/sci.logic/2005-05/msg00304.html>

- *From:* The Ghost In The Machine <ewill@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>
 - *Date:* Tue, 24 May 2005 05:00:04 GMT
-

In sci.logic, ken quirici
<kquirici@xxxxxxxx>
wrote
on 23 May 2005 07:28:10 -0700
<1116858490.058108.124030@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>:
>
> The Ghost In The Machine wrote:
>>
>> [2] All algorithms must terminate.
>>
>
> Unless of course you code an infinite loop :-)
>
> Ken
>

Heat death of the Universe. Next question? :-)

Of course you do have a point; there are algorithms:

```
j=0; for(int i = 0; i < n; i++) { j += i*i; } return j;
```

provably infinite loops:

```
while(1) printf("Yes, this is brain-dead\n");
```

and those that might give us pause:

```
k=0; while(n != 1) { if (n % 2==0) n/=2; else n=3*n+1; k++; } return k;
```

One of the more interesting issues is ordering a list of semicomputable numbers. (I call a number "semicomputable" if it can be approximated to any given degree of precision -- or any number of digits -- with a Turing machine using a sufficiently large amount of tape space. A fully computable number in this context would have a finite number of digits. There are admittedly a number of quibbles here; 1/3's decimal expansion is infinite but its duodecimal expansion is not; 1/3 is a finite representation for a certain number in Q with an

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infinite decimal expansion.)

Now postulate a UTM and an encoding scheme, and list the semicomputable numbers in order:

UTM(1) = ...

UTM(2) = ...

UTM(3) = ...

(We ignore issues such as whether a TM requires a prepopulated tape, and whether UTM(n) properly generates a number, freezes up, or jiggles.)

Now construct an antidiagonal. Is the antidiagonal associated with a UTM? Probably not, but I'm not sure there's an elegant way to prove it; the best I can do is show it's not on this list.

If one restricts the range of a "real" function to that of the semicomputables, I for one cannot be certain as to precisely how many numbers there are (there are only a denumerably infinite number of machines, though if one includes input tapes one might get an uncountable number of run-sets --- but that's cheating in a way since the input tapes would probably comprise all real numbers in that case).

Fortunately, mathematicians are under no such restrictions. If one has a list $f : \mathbb{N} \rightarrow \mathbb{R}$, then one can prove the existence of (and approximate to any desired precision) an antidiagonal number which is not on that list, or in the set representing the actual range (as opposed to the specified range --- the reals) of that list. Cantor found two methods, in fact, only one of which depends on an antidiagonal (the other depends on various properties of sequences and the "continuumness" or contiguity of the reals).

#191, ewill3@xxxxxxxxxxxxxx
It's still legal to go .sigless.
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• *Follow-Ups:*

◆ *Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorians*

◇ *From: ken quirici*

• *References:*

◆ *Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorians*

◇ *From: george*

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◇ From: HERC777
- ◆ **Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorians**
◇ From: george
- ◆ **Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorians**
◇ From: HERC777
- ◆ **Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorians**
◇ From: george
- ◆ **Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorians**
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- ◆ **Re: when laypersons look smarter than math professors Re: a question for the anti-Cantorians**
◇ From: ken quirici

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