Subject: Re: Numbers from nowhere?
Posted by Sven Utcke on Thu, 21 Feb 2008 13:06:48 GMT
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David Fanning <news@dfanning.com> writes:

> elwood writes:
>
>> But my question is more pointed: if you assign x=3.3 and you know
>> apriori that the floating point data type will not have enough bits
>> to store this number precisely, why does "print" show this number
>> as 3.3?
>
> I presume it is because whatever number *is* stored, when rounded to
> the 7-8 significant figures a float can accurately represent, comes
> out to 3.300000.

What number _is_ stored, actually? Assuming we are talking ieee, we have one bit for the sign, 8 for the exponent, and 23 for the mantissa. So what is 3.3?

3 = 11 = 1.1 * 2^1
0.3 = 0.0100110011001100110011001100110011001100...
which we see from

0.3*2 = _0_.6
0.6*2 = _1_.2
0.2*2 = _0_.4
0.4*2 = _0_.8
0.8*2 = _1_.6
0.6*2 = ...

so we get, combined,

3.3 = 1.10100110011001100110011 * 2^1

or

S | Exp + 127 | Mantissa without leading 1
0 | 1000000 | 1010011 00110011 00110011

which, if we recombine it, turns out to be 3.299999952316284179687 5

We can actually see this in IDL too:

IDL> print, byte(3.3,0,4)
51 51 83 64
Which, if we rewrite it appropriately, turns out to be:

01000000 01010011 00110011 00110011

which, recombined differently, is the above number :-)

Sven
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