Subject: complex math error?
Posted by heard on Wed, 17 May 1995 07:00:00 GMT
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Hi,

I think we've found an erratic math error in IDL V3.6 (running on a PPC and an SGI results were similar). Here it is:

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print, exp( complex(0,1)*sqrt(2.)*10. )^sqrt(2.)
```

Execute the above line a time or two and you'll get the wrong answer, then try almost any simple math operation on a complex number. i.e.,

```
print, complex(0,1)^2
```

Chances are you'll get a wrong answer again. Try the last operation again and you might then get the correct answer. It's an erratic sort of bug and seems to have a lot to do with complex numbers and sqrt functions. But it is unpredictable. The only way we have been able to induce it so far is to raise a complex exponential to a power involving a sqrt. I guess you should be wary of any complex math in IDL until RSI has had a look at it. Also, the bug may not exist in V4. I think that WAVE may not allow these kinds of operations on complex values, so in a way that will protect you from this bug (I might be wrong about this since I don't have a current WAVE version to try it on).

Garry J. Heard heard@edrd.dnd.ca
Esquimalt Defence Research Detachment
Victoria, B.C., Canada
604/363-2905

Any opinions expressed are my own and not necessarily those of my employer.

Subject: Re: complex math error?
Posted by heard on Fri, 19 May 1995 07:00:00 GMT
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In Article <3pgkmo$b3s@post.gsfc.nasa.gov>, thompson@orpheus.nascom.nasa.gov (William Thompson) wrote:
> heard@drep.dnd.ca (Garry J. Heard) writes:
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>> an SGI results were similar). Here it is:
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>> bug may not exist in V4. I think that WAVE may not allow these kinds of
>> operations on complex values, so in a way that will protect you from this
>> bug (I might be wrong about this since I don't have a current WAVE version
>> to try it on).
>
> I can't make it fail running IDL 3.6.1c under OSF/1 v2.0 on an AXP 3000/600
> workstation. I always get the result
>
>   IDL> print, exp(complex(0,1)*sqrt(2.)*10.)^sqrt(2.)
>   (-1.28269e-10, 1.66070e-10)
>
> no matter how many times I try it. (I assume that's the correct value.) Also,
> I always get
>
>   IDL> print, complex(0,1)^2
>   (-1.00000,   0.00000)
>
> Bill Thompson

Hi Bill,

  Sorry. That answer is wrong. exp[i z] will always have a magnitude of 1.
This turns out to be an impossible problem anyway since there are several
roots to the solution, but each of them must have a unit modulus. It's odd
that you always get the other problem to work properly after getting the
previous one wrong, but I did say that it was unpredictable. I've done it
quite a few times and never gotten exactly the same results.

  In any case, I must tell you that RSI responded very quickly to my e-mail
to their support department. They were aware of the bug and have fixed it
in V4.0 that is now being shipped.

Also, I had some friends try it on PV-WAVE and they can't do it at all. WAVE only appears to have marginal complex number support. WAVE users should try squaring a complex number, I think they will get an illegal operation error.

Garry J. Heard EDRD
heard@edrd.dnd.ca
604/363-2905

Subject: Re: complex math error?
Posted by thompson on Fri, 19 May 1995 07:00:00 GMT
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llobet@elpp1.epfl.ch (Xavier Llobet i Sales EPFL-CRPP 1015 Lausanne CH) writes:

> In article <3pgkmo$b3s@post.gsfc.nasa.gov>, thompson@orpheus.nascom.nasa.gov
> (William Thompson) writes:

> [...]
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> =
> =no matter how many times I try it. (I assume that's the correct value.)

> Nope. Just try

> IDL> print, exp(complex(0,1)*sqrt(2.)*10.)^sqrt(2.D0)
> (-0.611276, 0.791417)

> This gives the right value.

> -xavier

Hmmm, when I tried this with IDL 3.6.1c I get

IDL> print, exp(complex(0,1)*sqrt(2.)*10.)^sqrt(2.D0)
(-0.0477381, -0.00519184)

Which is significantly different from either of the above. However, when I tried this in a beta test version of IDL 4, I get

```
 IDL> print, exp( complex(0,1)*sqrt(2.)*10. )^sqrt(2.D0)
 (     -0.61127603,      0.79141748)
 IDL> print, exp( complex(0,1)*sqrt(2.)*10. )^sqrt(2.)
 (    -0.611276,     0.791418)
```

This seems to suggest that there is a bug in IDL v3.6 which is corrected in the upcoming IDL v4. (Versions of IDL previous to 3.6 wouldn't have allowed the above expression.)

Bill Thompson

Subject: Re: complex math error?
Posted by asb on Tue, 23 May 1995 07:00:00 GMT
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In article <heard.1151115158F@131.136.96.1> heard@drep.dnd.ca (Garry J. Heard) writes:

> Newsgroups: comp.lang.idl-pvwave
> Path: nih-csl!darwin.sura.net!mojo.eng.umd.edu!bloom-beacon.mit.ed
> u!panix!news.mathworks.com!news.kei.com!ub!netfs.dnd.ca!drep .dnd.ca!131!heard
> From: heard@drep.dnd.ca (Garry J. Heard)
> Sender: nobody@drep.dnd.ca
> Organization: Esquimalt Defence Research Detachment
> Date: Wed, 17 May 1995 16:18:38 GMT
> X-Newsreader: VersaTerm Link v1.1.3
> Lines: 33
>
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> and you might then get the correct answer. It's an erratic sort of bug and
> seems to have a lot to do with complex numbers and sqrt functions. But it
> is unpredictable. The only way we have been able to induce it so far is to

raise a complex exponential to a power involving a sqrt.

The error appears to occur only when complex numbers and real numbers
are used with certain functions. The command

print, exp(complex(0,1)*sqrt(2.)*10.)^complex(sqrt(2.),0)

gives the correct result.
