Subject: Problems with JULDAY and CALDAT
Posted by John J. Boia on Wed, 07 Apr 1999 07:00:00 GMT
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I've been developing a set of time conversion functions
(primarily using Modified Julian Date) and I have discovered
some problems with the IDL-provided routines CALDAT and JULDAY.

JULDAY seems to return Julian date values with an offset
of 0.5 from the accepted definition, when hours, minutes,
and seconds are passed in as arguments Integer julian
day numbers correspond to 12:00 noon UT.

CALDAT does not correctly return the month/day/year
values for Julian day numbers that correspond to leap days
(Feb 29) in the leap years 1584 through 1604. (It also
mishandles preceding leap years, but those are before the
the Gregorian calendar took effect in 1582 and it becomes
increasingly difficult to make sense of those dates anyway.)
Instead of Feb 29, (Year), it returns Feb 31, (Year+1).

The problems are easy enough to work around, if you know
what the problems are. I have attached a small sample
procedure to demonstrate what I've found. Does anyone
know of other problems, or a better pair of routines,
or a plan to update these two?

John Boia

```
PRO TIMETEST

  FORWARD_FUNCTION JULDAY

  B = julday( 1,1,1970,0,0,0 ) - 0.5D
  PRINT, B, FORMAT="(' Jan 1 1970 0h UT --> JD ',F15.3//)"

  FOR I = 2299160L, 2307639L DO BEGIN
    CALDAT, I, MON, DAY, YR
    JD = JULDAY( MON, DAY, YR )
    IF I NE JD THEN BEGIN
      FOR J = I-2, I+2 DO BEGIN
   CALDAT, J, MON, DAY, YR
   PRINT, J, MON, DAY, YR, FORMAT="(' JD =',I8,6x,'Cal:',3I5)"
      ENDFOR
 PRINT
    ENDIF
  ENDFOR
```

END

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Subject: Re: Problems with JULDAY and CALDAT
Posted by Dr. G. Scott Lett on Wed, 07 Apr 1999 07:00:00 GMT
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John,
The off-by-a-half day problem was fixed in version 5.1 of IDL.
Cheers,
Scott Lett

John J. Boia <jboia@iasdev1.gsfc.nasa.gov> wrote in message
news:370BC459.167E@iasdev1.gsfc.nasa.gov...
> Wayne, thanks for the references. Will have a look.
>
> I checked JULDAY just like your example and got different results
> from what you got!
>
> IDL> print,julday(4,7,1999,0)
> % Compiled module: JULDAY.
> 2451276.0
> IDL> print,julday(4,7,1999,12)
> 2451276.5
> IDL> print, !version
> { mipseb IRIX unix 5.0.2 Aug 19 1997}
>

Subject: Re: Problems with JULDAY and CALDAT
Posted by thompson on Thu, 08 Apr 1999 07:00:00 GMT
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landsman@stars.gsfc.nasa.gov (Wayne Landsman) writes:

> In article <370B879B.41C6@iasdev1.gsfc.nasa.gov>, "John J. Boia"
<jboia@iasdev1.gsfc.nasa.gov> writes...

>> CALDAT does not correctly return the month/day/year
>> values for Julian day numbers that correspond to leap days

>> (Feb 29) in the leap years 1584 through 1604.

> John,

> As a replacement for CALDAT, you might look at DAYCNV.PRO available at
> http://idlastro.gsfc.nasa.gov/ftp/pro/astro/daycnv.pro. It passes your time
> test for all years except for the peculiar year 1582 itself.

> (I don't know what the algorithm error in CALDAT is, since it uses a
> different algorithm from DAYCNV.PRO. But CALDAT does have a most un-IDL like
> programming style, with a special subroutine that only does scalar calculations
> that is called in a loop. Ugly.)

> Although not directly to your question, you might also look the time utilities
> in IDL written by Bill Thompson at
> http://sohowww.nascom.nasa.gov/solarsoft/gen/idl/time/

Wayne, thanks for the plug, although I never expected to see that software used for dates as long ago as 1582. Since the main thrust is to handle leap seconds for conversion between TAI and UTC, it really isn't valid (at the one-second level) for dates earlier than 1972.

There is one important distinction between JULDAY/CALDAT and our respective software packages. It appears that the routines JULDAY and CALDAT try to handle the conversion between Julian dates and Gregorian dates. Dates starting with 15 Oct 1582 and onward are assumed to be in the Gregorian Calendar, while earlier dates are assumed to be in the Julian Calendar. CALDAT applies the reverse of this process, converting Julian day numbers greater than or equal to 2299170 into the Gregorian Calendar, and smaller numbers into the Julian Calendar. Thus, there's a jump from 4 Oct to 15 Oct 1582. This isn't explained in the documentation for either routine.

On the other hand, both DAYCNV and my own software work exclusively in the Gregorian system. The extension of the Gregorian Calendar to dates earlier than 15 Oct 1582 is known as the Proleptic Gregorian Calendar. In the Proleptic Gregorian Calendar, the day before 15 Oct 1582 would be 14 Oct 1582, even though somebody living at the time would have called it 4 Oct 1582. DAYCNV and its counterpart JDCNV explicitly state that they work in the Gregorian Calendar system. Unfortunately, I don't believe I was so precise in my documentation. But then, we didn't have a whole lot of satellites up prior to 1583 (that I know about). ;^)

William Thompson

Subject: Re: Problems with JULDAY and CALDAT

William Thompson, thompson@orpheus.nascom.nasa.gov writes:

> But then, we didn't have a whole lot of satellites
> up prior to 1583 (that I know about). ;^)

You probably know this, but in case anyone is tempted to relate, say, Kepler's planetary observations to more modern ones it is necessary to bear in mind that:

a) Not all European countries changed calanders in the same year.

b) At that time, the 'year' did not necessarily change on the night of Dec31/Jan1 - and the change day could also be different for different countries. Within one country this can vary with the type of record - rather as if modern fiscal years were recorded using only the start year so that Feb '99 becomes Feb '98.

There are books with tables that will let you calculate the 'date' for any given day in any given country, but with published records you need to do a bit of archival digging to find out if the published date uses the calander of the author, his sponsor or the publisher - all three could in theory be different - and with private letters all bets are off.

Struan