riseset_notebook

March 29, 2023

1 `riseset` Examples

This notebook demonstrates the J `riseset` script. `riseset` computes the rise, transit, and set times of named IAU Stars.

To run this notebook you must install a J jupyter kernel. See Martin Saurer's GitHub repository for instructions.

[1]:
```
NB. J version and date
smoutput 9!:14 ''
smoutput 6!:0 ''

NB. set portable box drawing characters
portchars=:[: 9!:7 '+++++++++|-'"_ [ ]
portchars 0
```

```
j9.4.1/j64avx512/windows/commercial/www.jsoftware.com/2023-02-27T15:21:53/clang-15-0-7/SLEEF=1
2023 3 29 22 20 41.553
```

1.1 Installation

`riseset` is distributed as a J addon. It is installed in the J `~addons/jacks` folder. It can be installed from GitHub with:

[2]:
```
load 'pacman'
NB. smoutput install 'github:bakerjd99/jackshacks' NB. uncomment
```

The `jacks` (J-hacks) addons are self contained JOD generated J scripts. Each `ijs` script is accompanied with `pdf` document that describes how to use it. Some scripts, like `riseset` are also packaged with a Jupyter notebook (this file) and a `pdf` version of the notebook. For example, the `riseset` files are:

```
riseset.ijs
riseset.pdf
riseset_notebook.ipynb
riseset_notebook.pdf
```

There are other scripts in `~addons/jacks` and more will be added from time to time. To refresh the folder, reissue the install command.

In addition to these files the subfolder `~addons/jacks/testdata` contains data files. `riseset` files in `testdata` are:

```
Bright_Stars_Meridian_Almanac_23mar27.md
iau_named_stars_2022.txt
Navigation_Stars.txt
```

[3]:
```
NB. addon files
dir '~addons/jacks'
```

```
testdata                 <dir>     28-Mar-23 22:45:21
brandxmp.ijs                 13295 28-Mar-23 22:45:21
brandxmp.pdf                125252 28-Mar-23 22:45:21
gpxutils.ijs                 17079 28-Mar-23 22:45:21
gpxutils.pdf                134365 28-Mar-23 22:45:21
ipynb.ijs                    4699 28-Mar-23 22:45:21
ipynb.pdf                   86966 28-Mar-23 22:45:21
manifest.ijs                 1214 29-Mar-23 13:18:17
riseset.ijs                 34195 29-Mar-23 13:49:12
riseset.pdf                174094 29-Mar-23 13:18:17
riseset_notebook.ipynb       6671 29-Mar-23 13:52:41
riseset_notebook.pdf        35069 29-Mar-23 13:52:19
```

1.2 Using `riseset`

[4]:
```
NB. load riseset
load '~addons/jacks/riseset.ijs'

NB. version
smoutput 'NB. vmd: ' , ,'0,p<; >q<; >0,0' (8!:2) VMDriseset
```

```
NB. (riseset) interface word(s): 20230329j134912
NB. ----------------------------
NB. iau_today  NB. named IAU stars rising/setting today
NB. loadstars  NB. loads riseset star data
NB. riseset    NB. rise, transit, set times of stars

NB. vmd: 0.8.5; 4; 29 Mar 2023 13:49:12
```

[5]:
```
NB. set a location - add your own by cloning and modifying location verbs
location_yellowstone
```

```
3 : 0

NB.*location_yellowstone v-- set parameters for Old Faithful location.
```

```
NB.
NB. monad:  location_yellowstone uuIgnore
NB.
NB.   location_yellowstone 0  NB. set location
NB.   iau_today 0             NB. uses set location with current date
NB.
NB.   NB. uses location with set date
NB.   (location_yellowstone 0) iau_today 0

ymd=. 2013 5 7  NB. mom

NB. longitude, latitude with standard signs
OBSLOCATION_riseset_=: _110.82792 44.46057

UTCOFFSET_riseset_=: 6.0   NB. MST time zone
LIMITMAG_riseset_=:  6.0   NB. stellar magnitude
LIMITHORZ_riseset_=: 10    NB. degrees above horizon

ymd;OBSLOCATION;UTCOFFSET;LIMITMAG;LIMITHORZ
)
```

[6]:
```
location_yellowstone 0

NB. star name, transit altitude, transit time hours, minutes
IAU=: iau_today 0
smoutput #IAU
smoutput 5 {. IAU
```

```
243
+---------------+---------+
|Chertan        |61 0 13  |
+---------------+---------+
|Zosma          |66 0 13  |
+---------------+---------+
|Alula Australis|77 0 17  |
+---------------+---------+
|Alula Borealis |78.5 0 17|
+---------------+---------+
|Denebola       |60 0 48  |
+---------------+---------+
```

Detailed rise and set information is provided by `riseset`.

[7]:
```
LB=:  _116.375956 43.646775   NB. Meridian
YMD=: 2023 3 27
UO=:  6                       NB. MST UTC offset
```

```
NB. star name, (0=rises/sets), altitudes, times fractional day, times hours,␣
  ↪minutes
smoutput Rs=: (YMD;UO;LB) riseset 'Algol';'Rigel';'Spica'
```

```
+-----+-+------------------------------+
|Algol|0| 0.5  0.2910386461449466  6 59|
|     | |87.5  0.6908345293917257 16 35|
|     | | 0.5 0.09337060171945516  2 14|
+-----+-+------------------------------+
|Rigel|0|  1   0.5527905462948185 13 16|
|     | | 38   0.7780712498266437 18 40|
|     | |0.5 0.006088476753742347  0  9|
+-----+-+------------------------------+
|Spica|0|  1  0.9012706582406574 21 38 |
|     | | 35 _0.8793144933635634  2 54 |
|     | |0.5  0.3373585646884121  8  6 |
+-----+-+------------------------------+
```

The stars listed by `riseset` come from IAU named stars.

[8]:
```
NB. leading characters from UTF-8 CSV IAU star data file
800 {. read jpath '~addons/jacks/testdata/iau_named_stars_2022.txt'
```

```
IAU_Name,Designation,HIP,Bayer_Name,Nm,WDS_J,Vmag,RA_J2000,Dec_J2000,Origin,Sou
rce,ID,Const,Etymology_Note
Absolutno,XO-5,XO-5,_ Lyn,_,_,12.13,116.716506,39.094572,2019 IAU100
NameExoWorlds,https://www.nameexoworlds.iau.org/2019approved-names,_,Lyn,Czech
Republic proposal;Absolutno is a fictional miraculous substance in the sci-fi
novel Továrna na absolutno (T…
Acamar,HR 897,13847, 1 Eri,A,02583-4018,2.88,44.565311,-40.304672,,, 1,Eri,
Achernar,HR 472,7588,  Eri,A,-,0.45,24.428523,-57.236753,Arabic,, ,Eri,The name
was originally Arabic:       ʾāẖir an-nahr ('river's end').
Achird,HR 219,3821,  Cas,A,00491+5749,3.46,12.276213,57.815187,,, ,Cas,"first
applied to  Cassiopeiae in the Skalnate Pleso
```

[9]:
```
loadstars~ 2
smoutput 'Named stars:', ":#IAU_Name
smoutput 10 {. IAU_Name
```

```
Named stars:449
+---------+------+--------+------+-----+-----+-------+--------+------+-----+
|Absolutno|Acamar|Achernar|Achird|Acrab|Acrux|Acubens|Adhafera|Adhara|Adhil|
+---------+------+--------+------+-----+-----+-------+--------+------+-----+
```

Additional stars/objects can be added by editing the IAU file or by doing the following.

New objects need a name, right acension (RA), and declination (Dec) for the J2000.0 epoch.

[10]:
```
NB. meeus pg. 99,100
LB=: _71.0833 42.3333  NB. Boston
YMD=: 1988 3 20
UO=: 0
NB. add objects not in IAU names - needs - name, ra, dec
AOB=. (<;:'Venus'),(<41.73129),<18.44092
AOB=. ,&.> (;:'OBJ_Name OBJ_RA_J2000 OBJ_Dec_J2000') ,. AOB
DeltaTsOveride_riseset_=: 56
Vrs=: (YMD;UO;LB;<AOB) riseset 'Venus'
0 0$erase 'DeltaTsOveride_riseset_'
smoutput Vrs
```

```
+-----+-+----------------------------+
|Venus|0|  1 0.5211284270665463 12 30|
|     | | 66 0.8169433896164773 19 36|
|     | |0.5 0.1154978057116963  2 46|
+-----+-+----------------------------+
```

1.3 Maintaining and modifying `riseset`

All `riseset` code, documentation and test scripts are stored in the JOD dictionary `futs`. To change the code or run the test cases you need to install the JOD dictionaries `futs` and `utils`.

Use J's package manager to install the JOD addons `general/jod`, `general/joddocument`. If you have installed all the addons JOD is already on your system.

After installing JOD do:

1. Download the JOD dump scripts:

   https://github.com/bakerjd99/joddumps/blob/master/utils.ijs

   https://github.com/bakerjd99/joddumps/blob/master/futs.ijs

   and put them in a `~temp` folder.

2. Start JOD and check for the presence of `futs` and `utils`.

```
NB. start JOD
load 'general/jod'
(;:'futs utils') e. od''
```

3. **Only if both dictionaries are missing do:**

```
newd 'utils'  NB. creates utils dictionary in '~user/joddicts/utils'
newd 'futs'   NB. creates futs in '~user/joddicts/futs'
```

4. Load the dictionares:

```
NB. load utils first
od 'utils' [ 3 od ''
0!:0 <jpath '~temp/utils.ijs'
NB. rebuild references
0 globs&> }. revo ''
```

```
NB. take first binary backup
packd 'utils'

NB. load futs with utils on path
od ;:'futs utils' [ 3 od ''
0!:0 <jpath '~temp/futs.ijs'
NB. rebuild references
0 globs&> }. revo ''
NB. take first binary backup
packd 'futs'

NB. close dictionaries
3 od ''
```

The rest of this notebook *assumes* you have installed `futs` and `utils`.

It also assumes a basic knowledge of JOD. See the JOD Manual for details. The JOD Manual is distributed in the `general/joddocument` addon - see:

```
~addons/general/joddocument/pdfdoc/jod.pdf
```

`jod.pdf` is also available on The JOD Page

1.4 `riseset` test suite

Many `riseset` test cases are in `futs`. Groups of test cases are called suites. The contents of the `riseset` suite is:

[11]:
```
NB. open futs and utils - assumed open until notebook end
load 'general/jod'
od ;:'futs utils' [ 3 od ''
```

```
+-+-----------------+----+-----+
|1|opened (rw/ro) ->|futs|utils|
+-+-----------------+----+-----+
```

[12]:
```
NB. list test cases in (riseset) suite
,. 3 grp 'riseset'
```

```
+--------------------+
|1                   |
+--------------------+
|riseset_atan2_smoke |
+--------------------+
|riseset_espenak_smoke|
+--------------------+
|riseset_meeus_smoke |
+--------------------+
|riseset_riseset_smoke|
+--------------------+
```

```
|riseset_tanner_smoke |
+---------------------+
```

[13]:
```
NB. show test case
disp 'riseset_riseset_smoke'
```

```
NB.*riseset_riseset_smoke t-- (riseset) smoke tests.
NB.
NB. created: 2023mar27
NB. changes: ------------------------------------------------------

load 'riseset'

NB. meeus pg. 99,100
LB=: _71.0833 42.3333  NB. Boston
YMD=: 1988 3 20
UO=: 0
NB. add objects not in IAU names - needs - name, ra, dec
AOB=. (<;:'Venus'),(<41.73129),<18.44092
AOB=. ,&.> (;:'OBJ_Name OBJ_RA_J2000 OBJ_Dec_J2000') ,. AOB
DeltaTsOveride_riseset_=: 56
Vrs=: (YMD;UO;LB;<AOB) riseset 'Venus'
0 0$erase 'DeltaTsOveride_riseset_'

NB. values are within 10 minutes of the meeus book
NB. result - not great but good enough for demo work
Meeusmin=:  +/" 1 ] 60 1 *"1 ] 12 25 , 19 41 ,: 2 55
10 > >./|Meeusmin - +/" 1 ] 60 1 *"1 ] _2 {."1 ;2 {"1 Vrs

LB=:  _116.375956 43.646775   NB. Meridian
YMD=: 2023 3 27
UO=:  6                       NB. MST UTC offset

Rs=: (YMD;UO;LB) riseset 'Algol'
Rs=: (YMD;UO;LB) riseset 'Algol';'Rigel';'Spica'

NB. Bright Stars for 2023 3 27 Meridian
NB. https://www.almanac.com/astronomy/bright-stars/zipcode/83646/2023-03-27
Bs=: ;:'Altair Deneb Fomalhaut Algol Aldebaran Rigel Capella Bellatrix'
Bs=: Bs,;:'Betelgeuse Sirius Procyon Pollux Regulus Spica Arcturus Antares Vega'

Rs=: (YMD;UO;LB) riseset Bs

NB. transits match fairly well rise/sets differ 5 to 10 minutes
BsTransit=: 9 18,10 8,12 25,16 35,18 2,18 41,18 43,:18 51
BsTransit=: BsTransit , 19 21,20 11,21 5,21 11,23 34,2 54,3 44,5 58,:8 4

NB. transit altitude degrees
```

```
BsAlt=: 55 88 16 87 62 38 87 52
BsAlt=: BsAlt,53 29 51 74 58 35 65 19 85

TMP=: {:"1 Rs
ALT=: ((<1;,0)&{&> TMP) ,. BsAlt
TRT=: ((<1;2 3)&{&> TMP) ,. BsTransit

NB. altitudes match to 1 degree
1 = >./ -/"1 ALT

NB. transit times match to 1 minute in worst case
1 = >./ | (60 #:^:_1 ] 0 1 {"1 TRT) - 60 #:^:_1 ] 2 3 {"1 TRT

'IAU NAV'=: loadstars 0
({."1 NAV)=: {:"1 NAV
({."1 IAU)=: {:"1 IAU
Navrs=: (YMD;UO;LB) riseset Nav_Star_Name
Iaurs=: (YMD;UO;LB) riseset IAU_Name

NB. default
Meridianrs=: iau_today 0

NB. date of Uluru star party diner
uYMD=: 2022 10 19
ULURU=: 131.01941 _25.34301
uUTC=: _9.5
uLMAG=: 6.0
uLHORZ=: 5
Ulururs=: (uYMD;ULURU;uUTC;uLMAG;uLHORZ) iau_today 0


0 0$erase 'AOB Meeusmin Vrs LB YMD UO Rs Bs BsTransit BsAlt TMP ALT TRT Navrs
Iaurs'
0 0$erase (;:'IAU NAV') , ({."1 NAV), {."1 IAU
0 0$erase 'uYMD ULURU uUTC uLMAG uLHORZ Meridianrs Ulururs'

smoutput 'PASSED:: riseset_riseset_smoke'
```

[14]:
```
NB. run all the test cases in the suite
NB. suppressing all but (smoutput) output
NB. Each test will show PASSED:: if OK.
4 rtt 'riseset'
```

```
NB. (riseset) interface word(s): 20230329j134912
NB. ----------------------------
NB. iau_today  NB. named IAU stars rising/setting today
NB. loadstars  NB. loads riseset star data
NB. riseset    NB. rise, transit, set times of stars
```

```
PASSED:: riseset_atan2_smoke
NB. (riseset) interface word(s): 20230329j134912
NB. ----------------------------
NB. iau_today  NB. named IAU stars rising/setting today
NB. loadstars  NB. loads riseset star data
NB. riseset    NB. rise, transit, set times of stars

PASSED:: riseset_espenak_smoke
NB. (riseset) interface word(s): 20230329j134912
NB. ----------------------------
NB. iau_today  NB. named IAU stars rising/setting today
NB. loadstars  NB. loads riseset star data
NB. riseset    NB. rise, transit, set times of stars

PASSED:: riseset_meeus_smoke
NB. (riseset) interface word(s): 20230329j134912
NB. ----------------------------
NB. iau_today  NB. named IAU stars rising/setting today
NB. loadstars  NB. loads riseset star data
NB. riseset    NB. rise, transit, set times of stars

PASSED:: riseset_riseset_smoke
NB. (riseset) interface word(s): 20230329j134912
NB. ----------------------------
NB. iau_today  NB. named IAU stars rising/setting today
NB. loadstars  NB. loads riseset star data
NB. riseset    NB. rise, transit, set times of stars

PASSED:: riseset_tanner_smoke
1
```

1.5 Building `riseset`

There are a number of test scripts in `futs` that build and distribute `riseset`. These scripts are tuned to my environment but they do illustrate how to *make* a distribution script.

[15]:
```
NB. show main riseset maker
smoutput 1 disp 'build_riseset'
3 od ''
```

```
NB.*build_riseset t-- build (riseset) and distribute.
NB.
NB. created: 2023mar09
NB. changes: ------------------------------------------------------

coclass tmploc_AAAbuild999_=: 'AAAbuild999' [ coerase <'AAAbuild999'
coinsert 'ijod'
```

```
scrn=: 'riseset'

>0{OPENDIC=: did 0

NB. if (imex) is first dictionary on path include it
headdic=: ('imex'-:>1{OPENDIC)#'imex '

>0{od ;: headdic,'futs utils' [ 3 od ''

>0{tmploc get ;:'gettxt getmd read write showpass sha256 afterstr beforestr jnow
jnowpost timestamp VMD',scrn,' ',scrn,'_hashdateurl'

NB. insert/replace build time stamp on post processor
>0{'rc ncv'=: MACRO_ajod_ get 'POST_',scrn
>0{MACRO_ajod_ put (<jnowpost ;2 { ncv) 2} ncv=: ,ncv

NB. update VMD
vmd=: ".'VMD',scrn
builddtm=: timestamp ''
('VMD',scrn)=: (0{vmd),(<1+>1{vmd),<builddtm
>0{tmploc put 'VMD',scrn

smoutput 'building version -> ';".'VMD',scrn

NB. get history document
NB. (histmd,'_md')=: MACRO_ajod_ disp (histmd=: 'HISTORY_',scrn),'_md'

NB. get todo document
NB. (todomd,'_md')=: MACRO_ajod_ disp (todomd=: 'TODO_',scrn),'_md'

NB. generate load script
rc [ 'rc msg file'=: mls scrn

NB. generate companion - contains words used to test main group
rc [ 'rc msg2 file2'=: mls scrn,'Utils'

NB. update hash
ghash=: ".scrn,'_hashdateurl'
(scrn,'_hashdateurl')=: ((sha256 read file);builddtm) (0 1)} ghash
>0{tmploc put scrn,'_hashdateurl'

NB. update distribution files
(3 : 0) file
if. IFWIN do.
  smoutput 'saved in ~JACKSHACKS'

  djacksd=. jpath '~JACKSHACKS/'
```

```
  scr=. djacksd,scrn,'.ijs'
  (toHOST file) write scr

  NB. copy associated files
  'Dname Dobj'=. ({. , {:) 0{DPATH__ST__JODobj
  if. Dname -: 'futs' do.
    NB. local (futs) document directory
    docd=. ". 'DOC_',Dobj,'_'
    (read docd,'riseset.pdf') write djacksd,'riseset.pdf'
  end.
  jtmpd=. jpath '~temp\'
  (read jtmpd,'riseset_notebook.ipynb') write djacksd,'riseset_notebook.ipynb'
  (read jtmpd,'riseset_notebook.pdf') write djacksd,'riseset_notebook.pdf'

  dtestd=. jpath '~JACKSHACKS/testdata/'
  dtestd gettxt 'iau_named_stars_2022_txt'
  dtestd gettxt 'Navigation_Stars_txt'
  dtestd getmd 'Bright_Stars_Meridian_Almanac_23mar27_md'
elseif. IFUNIX do.
  smoutput scr=. 'NIMP: save in ~JACKSHACKS'
  NB. scr=. jpath '~/git/jackshacks/',scrn,'.ijs'
  NB. (toHOST file) write scr
elseif.do.
  1 [ showpass 'distributed on WIN/UNIX only' return.
end.

if. fexist scr do.
  1 [ (read y) write showpass scr
else.
  1 [ showpass 'missing distribution script ->';scr
end.
)

cocurrent tmploc_AAAbuild999_
>0{od }. OPENDIC [ 3 od ''

cocurrent 'base'
coerase <tmploc_AAAbuild999_

+-+---------+----+-----+
|1|closed ->|futs|utils|
+-+---------+----+-----+
```

1.6 All done - thanks for playing

[ ]: