When is Chinese New Year?

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October 23, 2019

Boston Python

Calendar Basics

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- *mean lunation* $= 29.531$ days

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- about 11 days short

Year (cont.)

If we define a year in terms of the...

Moon

- easy to observe
- easy to measure progress

Sun

- regular seasons
- easier to manage agricultural stuff

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- similar to Hebrew calendar

Chinese Calendar

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- both equinoxes and both solstices occur on major solar terms

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- need to account for this when computing holiday dates in the past

Rule 2

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- days are 24 hours long

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- uses computations of time instead of observations as of around 621 BCE

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- contains either 12 or 13 lunar months
- the extra lunar month is an intercalary month to keep the seasons aligned

Rule 4

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- a solar year is a leap solar year if there are 12 complete lunar months between the two 11th months at the beginning and end of the solar year

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- called a fake leap month

Code

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- can use the JPL ephemerides files

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- *Terrestrial Time* is an ideal measure of time that doesn't account for irregularities in the rotation of the earth.
- *Julian Date TT* is the number of julian days since the Julian Period

UTC to JD TT Corrections

```
# table from US Naval Observatory
utc_to_jd_tt.corrections = np.array(
    [
        (T(1700, 1, 1), 32.184),
        (T(1973, 2, 1), 43.4724),
        (T(1973, 3, 1), 43.5648),
        # ...
        (T(2025, 9, 1), 72.0),
        (T(2026, 1, 1), 72.0),
    ],
    dtype=[('time', 'M8[D]'), ('julian_days', 'f8')],
)
# seconds in a julian day
utc_to_jd_tt.corrections['julian_days'] /= 60 * 60 * 24
```

UTC to JD TT

```
def utc_to_jd_tt(ts):
    corrections = utc_to_jd_tt.corrections
    jd_utc = (
       ts.astype('M8[s]').view('i8') / 86400 + 2440587.5
    )
    correction_ix = np.searchsorted(
        corrections['time'],
        ts,
        side='right',
    )
    correction_ix[correction_ix == len(corrections)] -= 1
    return (
       jd_utc + corrections['julian_days'][correction_ix]
    )
```

Getting New Moons

```
def compute_ecliptic_longitude(ob, minutes):
    longitude_degrees = np.array([
        novas.equ2ecl(
            jd_tt,
            # right ascension and declination
            *novas.app_planet(jd_tt, ob)[:2],
            # true equator and equinox of date
            coord_sys=1,
        )[0]
        for jd_tt in utc_to_jd_tt(minutes)
    ])
    return np.deg2rad(longitude_degrees)
```

Getting New Moons (Cont.)

```
moon = novas.make_object(0, 11, 'Moon', None)
lunar_el = compute_ecliptic_longitude(moon, minutes)

sun = novas.make_object(0, 10, 'Sun', None)
solar_el = compute_ecliptic_longitude(sun, minutes)
```

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25th January, 2020

12th February, 2021

1st February, 2022

22nd January, 2023

10th February, 2024

29th January, 2025

17th February, 2026

6th February, 2027

26th January, 2028

13th February, 2029

3rd February, 2030

Thanks

Implementation

`https://github.com/quantopian/trading_calendars/blob/master/etc/lunisolar`

References

- Aslaksen, Helmer. "The Mathematics of the Chinese Calendar"
- NOVAS
- Jean H. Meeus. 1991. Astronomical Algorithms. Willmann-Bell, Incorporated.