Conversion of Chinese and Western Calendars

Lin, Shih

Computing Center, Academia Sinica

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Principle of Calendar Conversion

- Based on day numbers
  - Assume the day number for Jan 1, 1 AD is 73000, then that for the next day is 73001, etc.
  - The day number for the first day of 西漢平帝元始元年 is 73041, 41 days later then January 1, 1 AD
- For each calendar, two functions are required
  - Map a date to a day number: the first day of 西漢平帝元始元年 => 73041
  - Map a day number to a date: 73041 => the first day of 西漢平帝元始
- Conversion from the date of calendar A to that of calendar B
  - Map the date of calendar A to the day number N
    - The first day of 西漢平帝元始元年 => 73041
  - Map N to the date of calendar B
    - 73041 => Feb 11, 1 AD

Julian Day Number(JDN)

- Count of days since the beginning of the Julian period

- Julian period: $15 \times 19 \times 28 = 7980$ years

- Beginning: January 1, 4713 BC, proleptic Julian calendar

- JDN for January 1, 2000: 2,451,545

Basic of Chinese Calendar

- Combination of solar and lunar calendar

- Lunar month: 30 days for greater month(大月), 29 days for lesser month(小月)

- 12 months for common year, 13 months for leap year

- Divide a solar year into 24 segments(節氣) in average from the winter solstice(冬至) , including 12 中氣

- A month without a 中氣 is a leap month

- The month with the winter solstice is calle 子月

- The first month of year is usually the second month after 子月, called 寅正(月), since about 2,100 years ago

- Seven leap months for 19 years(19年7閏)

  - 235 lunar months for 19 years: 19 * 12 + 7 = 235

  - Length of lunar month: 29.5306 days

  - Length of solar year: 365.2422 days

  - Length of 19 solar years: 6939.6018 days

  - Length of 235 lunar months: 6939.691 days

No Simple Rules for Chinese Calendars

- Measurement errors
  - Length of lunar month
  - Length of solar year
  - Length between adjacent 節氣
- More than 50 calendars, 時憲曆 the last
- Not easy to collect historical measurement data for producing calendars
- Orthodox dynasties
- The first month of year changed a little bit

Produce Chinese Calendars Using Reference Book

- Refer to 兩千年中西曆對照表 written by 薛仲三 and 歐陽頤

- For each year, only the data below is required

  - Greater or lesser month for each month in a year, 12 or 13 months

  - What is the leap month or none?

  - For example: 0 1 0 1 0 1 1 0 1 0 1 0 1/3

- Beginning and end dates of each era name(年號)

  - For example: 清 康熙 1662 1 1 1722 12 29

  - 1662 or 1722 are Chinese year numbers, in parallel with western years

  - There are a little more than 500 era names.

- Decide the date number of the first day.

Western Calendars

- Julian calendar
    - One leap year for every 4 year
    - Since 46 BC
- Gregorian calendar
    - One leap year for every 4 years
    - No leap year for every 100 years, but add one for every 400 years
    - Since Oct 15, 1582 (The previous day is Oct 4, 1582 of Julian calendar.)
- Dates to accept the Gregorian calendar are different
    - Oct 15, 1582: Italy, Spain
    - Dec 20, 1582: French
    - Sep 14, 1752: USA, United Kingdom
- Calendars before 46 BC unknown
    - Proleptic Julian calendar
    - Proleptic Gregorian calendar