Predicting Day of New Year's Day
Cariño's ny-Algorithm

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Abstract. This study is an algorithm of predicting the day of New Year's Day for any given year in Gregorian & Julian calendar using simplified formula. It consists of five algebraic (2 for Julian) expression, three of which are integer function by substituting the year. This formula will calculate the modulo 7 which gives a number from 0 to 6, i.e., 0=Saturday, 1=Sunday, and so on, that determines the exact day of New Year This algorithm has no condition even during leap-year and 400-year cycle.

1 Introduction

1.1 This algorithm is devised using basic mathematics, without any condition or modification to the formula, it will provide a direct substitution to the formula.

1.2 For any calendar date of January 1 of any year, y denotes for year of either Gregorian & Julian calendar.

2 The Formula

Formula for Gregorian calendar in original form,

$$ny = \left[y + 1 + \left\lfloor \frac{y-1}{4} \right\rfloor - \left\lfloor \frac{y-1}{100} \right\rfloor + \left\lfloor \frac{y-1}{400} \right\rfloor \right] mod\ 7$$

where

- ny is the day of New Year ($0 =$ Saturday, $1 =$ Sunday, …., $6 =$ Friday)
- y is the Gregorian year

3 Examples

Several examples are presented/shown to illustrate the algorithm.

3.1 January 1, 1583, first New Year of Gregorian calendar.

$y = 1583$

$$ny = \left[1583 + 1 + \left\lfloor\frac{1583-1}{4}\right\rfloor - \left\lfloor\frac{1583-1}{100}\right\rfloor + \left\lfloor\frac{1583-1}{400}\right\rfloor\right] mod\ 7$$

$$= [1583 + 1 + \lfloor 395.5\rfloor - \lfloor 15.82\rfloor + \lfloor 3.955\rfloor] mod\ 7$$

$$= [1583 + 1 + 395 - 15 + 3] mod\ 7$$

$$= [1967] mod\ 7$$

$$= 0\ ;\ \boldsymbol{Saturday}$$

So, The First New Year's Day of Gregorian Calendar is Saturday

3.2 January 1, 1900, latest centennial that is not a leap-year

$y = 1900$

$$ny = \left[1900 + 1 + \left\lfloor\frac{1900-1}{4}\right\rfloor - \left\lfloor\frac{1900-1}{100}\right\rfloor + \left\lfloor\frac{1900-1}{400}\right\rfloor\right] mod\ 7$$

$$= [1900 + 1 + \lfloor 474.75\rfloor - \lfloor 18.99\rfloor + \lfloor 4.7475\rfloor] mod\ 7$$

$$= [1900 + 1 + 474 - 18 + 4] mod\ 7$$

$$= [2361] mod\ 7$$

$$= 2\ ;\ \boldsymbol{Monday}$$

So, New Year's Day of 1900 is Monday

4 The Algorithms

4.1 Gregorian Calendar:

$$ny = \left[\ y + 1 + \left\lfloor\frac{y-1}{4}\right\rfloor - \left\lfloor\frac{y-1}{100}\right\rfloor + \left\lfloor\frac{y-1}{400}\right\rfloor\right] mod\ 7$$

4.2 Julian Calendar:

$$ny = \left[\ y + \left\lfloor\frac{y-1}{4}\right\rfloor\right] mod\ 7$$

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References

1 https://en.wikipedia.org/wiki/Gregorian_calendar
2 https://en.wikipedia.org/wiki/Julian_calendar