Predicting Day of Christmas Day
Cariño's cd-Algorithm

Dave Ryan T. Cariño
MSU – GSC Alumni, Mathematician
January 22, 2018
carinodaveryan@gmail.com

Abstract. This study is an algorithm of predicting the day of Christmas 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 Christmas. 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 December 25 of any year, y denotes for year of either Gregorian & Julian calendar.

2 The Formula

Formula for Gregorian calendar in original form,

$$cd = \left[y + 2 + \left\lfloor \frac{y}{4} \right\rfloor - \left\lfloor \frac{y}{100} \right\rfloor + \left\lfloor \frac{y}{400} \right\rfloor \right] mod\ 7$$

where

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

3 Examples

Several examples are presented/shown to illustrate the algorithm.

3.1 December 25, 1582, first Christmas of Gregorian calendar.

$y = 1582$

$$cd = \left[1582 + 2 + \left\lfloor\frac{1582}{4}\right\rfloor - \left\lfloor\frac{1582}{100}\right\rfloor + \left\lfloor\frac{1582}{400}\right\rfloor\right] mod\ 7$$

$$= [1582 + 2 + \lfloor 395.5 \rfloor - \lfloor 15.82 \rfloor + \lfloor 3.955 \rfloor] mod\ 7$$

$$= [1582 + 2 + 395 - 15 + 3] mod\ 7$$

$$= [1967] mod\ 7$$

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

So, The First Christmas Day of Gregorian Calendar is Saturday

3.2 December 25, 1900, latest centennial that is not a leap-year

$y = 1900$

$$cd = \left[1900 + 2 + \left\lfloor\frac{1900}{4}\right\rfloor - \left\lfloor\frac{1900}{100}\right\rfloor + \left\lfloor\frac{1900}{400}\right\rfloor\right] mod\ 7$$

$$= [1900 + 2 + \lfloor 475 \rfloor - \lfloor 19 \rfloor + \lfloor 4.75 \rfloor] mod\ 7$$

$$= [1900 + 2 + 475 - 19 + 4] mod\ 7$$

$$= [2362] mod\ 7$$

$$= 3\ ;\ \boldsymbol{Tuesday}$$

So, Christmas Day of 1900 is Tuesday

4 The Algorithms

4.1 Gregorian Calendar:

$$cd = \left[y + 2 + \left\lfloor\frac{y}{4}\right\rfloor - \left\lfloor\frac{y}{100}\right\rfloor + \left\lfloor\frac{y}{400}\right\rfloor\right] mod\ 7$$

4.2 Julian Calendar:

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

Acknowledgements

This work is dedicated to my family especially to my wife Melanie and two sons, Milan and Mileone.

References

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