Calculating Number of Days Passed Since the Introduction of Gregorian Calendar
Calendar dp Algorithm

Dave Ryan T. Cariño
MSU – GSC Alumni, Mathematician

January 15, 2018

Abstract

This study is an algorithm of calculating number of days passed since the introduction of Gregorian Calendar for any given date using simplified formula. It consists of nine algebraic expressions, five of which are integer function by substituting the year, month and day. This formula will calculate the \( n^{th} \) days which gives a number from 1 to \( \infty \) (October 15, 1582 being the day one), that determines the exact number of days passed. This algorithm has no condition even during leap-year and 400-year cycle.

1 Introduction

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

For any calendar date, \( m \) denotes for month, \( d \) for day and \( y \) for year; \( m \) is the number of months in the calendar year, i.e., \( m = 1 \) for the month of January, \( m = 2 \) for the month of February and \( m = 12 \) for the last month of the year which is December; \( d \) on the other hand, is the day in a given calendar date, i.e., 1 until 31. Lastly, \( y \) is the calendar year in Gregorian calendar.

2 The Formula

This is the formula for this algorithm.

In original form,

\[
dp = 31m + 365y + d - 578131 - \left[ \frac{3m}{7} \right] - 2 \left[ \frac{m+7}{10} \right] + \left[ \frac{(12y+m-3)}{48} \right] - \left[ \frac{(12y+m-3)}{1200} \right] + \left[ \frac{(12y+m-3)}{4800} \right]
\]

where

- \( dp \) is the number of days passed (1 to \( \infty \))
- \( m \) is the month (1 = January, 2 = February, ........, 12 = December)
- $d$ is the day of the month
- $y$ is the Gregorian year

### 3 Simplified formula

In original form,

$$dp = 31m + 365y + d - 578131 - \left[ \frac{3m}{7} \right] - 2 \left[ \frac{m+7}{10} \right] + \left[ \frac{(12y+m-3)}{48} \right] - \left[ \frac{(12y+m-3)}{1200} \right] + \left[ \frac{(12y+m-3)}{4800} \right]$$

then,

$$dp = 31m + 365y + d - 578131 - \left[ \frac{3m}{7} \right] - 2 \left[ \frac{m+7}{10} \right] + |p| - \left[ \frac{p}{25} \right] + \left[ \frac{p}{100} \right]$$

where
- $p = \frac{(12y+m-3)}{48}$

### 4 Examples

Several examples are presented/shown to illustrate the algorithm.

**Example 1:** October 15, 1582, first day of Gregorian calendar.

$m = 10, \quad d = 15, \quad y = 1582$

$$p = \frac{(12\{1582\} + 10 - 3)}{48}$$

$$= \frac{18991}{48}$$

$$= 395.64583$$

$$dp = 31(10) + 365(1582) + 15 - 578131 - \left[ \frac{3(10)}{7} \right] - 2 \left[ \frac{(10+7)}{10} \right] + \left[ 395.64583 \right] - \left[ \frac{395.64583}{25} \right]$$

$$+ \left[ \frac{395.64583}{100} \right]$$

$$= 310 + 577430 + 15 - 578131 - 4.29 - 2[1.7] + [395.64583] - [15.83] + [3.95]$$

$$= 310 + 577430 + 15 - 578131 - 4 - 2 + 395 - 15 + 3$$

$$= 1; \text{ nth day}$$

So, October 15, 1582 is the 1st day of Gregorian Calendar

**Example 2:** February 28, 1900, latest centennial that is not a leap-year

$m = 2, \quad d = 28, \quad y = 1900$

$$p = \frac{(12\{1900\} + 2 - 3)}{48}$$

$$= \frac{22799}{48}$$
\[ dp = 31(2) + 365(1900) + 28 - 578131 - \left\lfloor \frac{3(2)}{7} \right\rfloor - 2\left\lfloor \frac{2+7}{10} \right\rfloor + \left\lceil \frac{474.97916}{25} \right\rceil + \left\lfloor \frac{474.97916}{100} \right\rfloor \]
\[ = 62 + 693500 + 28 - 578131 - [0.86] - 2[0.9] + [474] - [18.999] + [4.75] \]
\[ = 62 + 693500 + 28 - 578131 - 0 - 0 + 474 - 18 + 4 \]
\[ = 115919; \text{\textit{n}th day} \]
So, February 28, 1900 is the 115919th day since the introduction of Gregorian Calendar.

5 The Algorithm

\[ p = \frac{(12y + m - 3)}{48} \]

Gregorian Calendar:
\[ dp = 31m + 365y + d - 578131 - \left\lfloor \frac{3m}{7} \right\rfloor - 2\left\lfloor \frac{m+7}{10} \right\rfloor + \left\lfloor p \right\rfloor - \left\lfloor \frac{p}{25} \right\rfloor + \left\lfloor \frac{p}{100} \right\rfloor \]

Acknowledgements

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

References