

CS 210 - Fundamentals of Programming I
Fall 2019 – Programming Project 1
20 points

Out: August 29, 2019

Due: September 5, 2019 (Thursday)

Problem Statement

For this assignment, we would like to write a program that computes when Easter is in any given year. The following table describes an algorithm for computing the month and day. Many more details may be found at Wikipedia (<http://www.wikipedia.com>). This algorithm comes from <http://www.davros.org/misc/easter.html>.

Divide		to get		Explanation
this	by	quot.	rem.	
<i>year</i>	19		<i>a</i>	$a + 1$ is the golden number.
<i>year</i>	100	<i>b</i>	<i>c</i>	Split the year into century and remnant
<i>b</i>	4	<i>d</i>	<i>e</i>	Find the place in, and the number of, 400 year cycles. 400 years is an exact number of weeks.
<i>c</i>	4	<i>f</i>	<i>g</i>	Find the number of leap years so far this century (ignoring the century year if it was one), and the number of ordinary years since.
$8b + 13$	25	<i>h</i>		Determine the number of days to shift the full moons because of the lunar correction. The 8 ensures that we get a total of 8 days every 2500 years, and the 13 ensures that we start at the right point.
$19a + b - d - h + 15$	30		<i>j</i>	<i>j</i> encodes the unadjusted date of the Paschal full moon. $b - d$ is the number of century years that are not leap years, and so $b - d - h$ is 7 more than the number found from Table II. Meanwhile $19a$ gives the position of a specific number (8) in the appropriate column of Table III, and the constant 15 corrects for the two offsets 7 and 8.
$a + 11j$	319	<i>m</i>		<i>m</i> will be 1 if the full moon needs to be adjusted back one day, and 0 otherwise.
$2e + 2f - g - j + m + 32$	7		<i>k</i>	$k + 1$ is the number of days from the Paschal full moon to Easter Sunday. The best way to see how it is derived is to first note that the days of the week repeat exactly every 400 years, and then to rewrite it as: $4 - [124e + 5f + g] - (j - m) + 7 * 92$ The term in square brackets represents the day of the week for March 21st, the third term advances this to the Paschal full moon, the constant 4 represents Saturday, and the last term makes the result positive. Then reduce as much as possible modulo 7.

Divide		to get		
this	by	quot.	rem.	Explanation
$j - m + k + 90$	25	<i>month</i>		We now have $j - m + k$ representing the date of Easter Sunday, with 0 being March 22nd; the constant 90 derives from 10 representing April 1st.
$j - m + k + 19 + month$	32		<i>date</i>	And finally we get the date in a similar way; adding in the month allows us to skip April 0th seamlessly.

Assignment

Write a C program that asks the user for a Common Era year, then computes the date of Easter in that year using the algorithm above, and displays the result in date format. Remember that the `/` operator on two integers returns the quotient, and the operator that returns the remainder of two integers is the `%` operator (also known as the modulus operator). **Please note** that copying from PDF files does not work well. In particular, there are embedded non-breakable spaces and some of the operators become non-regular characters when the document is converted to PDF. Most text editors including the one in CodeBlocks will display the characters, but the compiler will complain about unknown characters.

The output of the program must conform to the following examples (user input in **bold**). This first example shows all of the intermediate values printed out to help you debug your program. Be sure to comment out (or remove) any such debugging statements before you submit your program.

```
Easter Calculator
Enter the year to calculate easter for: 2004
a = 9
b = 20
c = 4
d = 5
e = 0
f = 1
g = 0
h = 6
j = 15
m = 0
k = 5
Easter is on 4/11/2004
```

Here is the output for several other years. Each set of lines is **a single, complete run** of the program.

```
Easter Calculator
Enter the year to calculate Easter for: 2011
Easter is on 4/24/2011
```

```
Easter Calculator
Enter the year to calculate Easter for: 2010
Easter is on 4/4/2010
```

Easter Calculator
Enter the year to calculate Easter for: **2004**
Easter is on 4/11/2004

Easter Calculator
Enter the year to calculate Easter for: **2005**
Easter is on 3/27/2005

Easter Calculator
Enter the year to calculate Easter for: **1776**
Easter is on 4/7/1776

Easter Calculator
Enter the year to calculate Easter for: **1973**
Easter is on 4/22/1973

Easter Calculator
Enter the year to calculate Easter for: **2002**
Easter is on 3/31/2002

REMINDER: Your program must compile for it to be graded. Submissions that do not compile will be returned for resubmission and assessed a late penalty. Submissions that do not substantially work also will be returned for resubmission and assessed a late penalty.

Follow the program documentation guidelines in the [C Programming Style Guideline](#) handout. As stated in the syllabus, part of the grade on a programming assignment depends on how well you adhere to the guidelines. The grader will look at your code and grade it according to the guidelines. **For this assignment, and this assignment only, you may use non-descriptive variable names since the algorithm in the table uses variables named a, b, c, etc.**

What to Submit

Electronically submit a zipfile containing **main.c** (only) as explained in the handout [Submission Instructions for CS 210](#). The submission system will start accepting assignments by the evening of Sunday, September 1.