



SE-1011 Lab 4: Here comes Peter Cottontail...

Due: Tuesday, October 4, 2011 at 23:00

1. Objectives

- Be able to use integer math to solve real-world problems
- Practice with precedence and other issues related to integer math.
- Apply the printf method to generate formatted printouts.

2. Overview

In this lab, you will gain experience with user input, a variety of operators and how they work on integers, and formatting printouts using the Java API.

3. Requirements

3.1. Part I: Easter Calculation Method

Create a Lab4 class containing the usual main() method.

This method is to calculate and display the date of Easter (e.g., Sunday, April 24, 2011) based on an input argument specifying the year (e.g., 2011) and return that date as a Date object, which your main() method will subsequently display to the console.

Most of North America switched to the modern (Gregorian) calendar, for which the given formula for Easter is valid, in September 1752. Your program can assume that the input year is at least 1753. (For an extra, optional challenge, catch years prior to 1753 and print an error message.).

3.2. Algorithm for calculating Easter

Use the following algorithm from Section 2.13.7 of Claus Tøndering's Frequently Asked Questions about Calendars to calculate Easter based on the year:



$$\begin{aligned}G &= y \bmod 19 \\C &= \frac{y}{100} \\H &= \left(C - \frac{C}{4} - \frac{8C + 13}{25} + 19G + 15 \right) \bmod 30 \\I &= H - \frac{H}{28} \left(1 - \frac{29}{H + 1} \times \frac{21 - G}{11} \right) \\J &= \left(y + \frac{y}{4} + I + 2 - C + \frac{C}{4} \right) \bmod 7 \\L &= I - J \\m &= 3 + \frac{L + 40}{44} \\d &= L + 28 - 31 \times \frac{m}{4}\end{aligned}$$

Figure 1: Easter Equations

...where “mod” is the modulo or integer remainder operator. Also, all divisions are integer divisions.

- y is the year received in an argument.
- m and d represent the month and day found by the algorithm.

All other (capitalized) variables represent intermediate values calculated by the algorithm. Note: Using uppercase identifiers for Java variables is generally considered bad practice; HOWEVER, when translating well-understood mathematical formulas to Java, it is acceptable to use identifiers that match the symbols in the formulas.

In the above formulas, days and months are counted from 1. Easter is always on a Sunday in March (month 3) or April (month 4).

4. "main()" Method and Date Formatting

Write a `main()` method that inputs the year, calculates the date for Easter, and then displays the results in three formats. The first format will list the date simply in numeric format in the form `mm/dd/yyyy`. (Hint: Look at the `printf` statement in section 5.7 for information on doing this formatting.) The second format will abbreviate the month and then list the date and year. The third format will spell out the entire month. For the second and third formats, it may be advisable to use a switch statement to convert the months into their two formats. (Hint: It is likely you can use just a single switch statement set to generate both strings.)

A sample output is shown in Figure 2.



```
Year? 2009
Format 1: 04/12/2009
Format 2: Apr 12, 2009
Format 3: Sunday, April 12, 2009
Enter Another Year? (Y/N)
Y
Year? 1991
Format 1: 03/31/1991
Format 2: Mar 31, 1991
Format 3: Sunday, March 31, 1991
Enter Another Year? (Y/N)
N
```

Figure 2: Sample program execution trace.

4.1. Test Cases

Make sure your program's output concurs with the following list of valid Easter dates, given here in ISO 8601 format (which is NOT the format your application should produce).

- 1989-03-26
- 2008-03-23
- 2009-04-12
- 2011-04-24
- 2030-04-21
- 2060-04-18

5. Lab Deliverables

Submit the following materials in electronically to the course website:

1. A report (in pdf format) which contains the following
 - a. A short description of what you did in this lab
 - b. Samples of the program executing showing the output written to the console.
This output should show correct operation for all test cases given in this document
 - c. A short description of what went wrong and what went right during the lab.
 - d. A description of what you learned from this lab.
 - e. The Java source code you wrote.
2. The source code file Lab4.java containing the source code for your project.