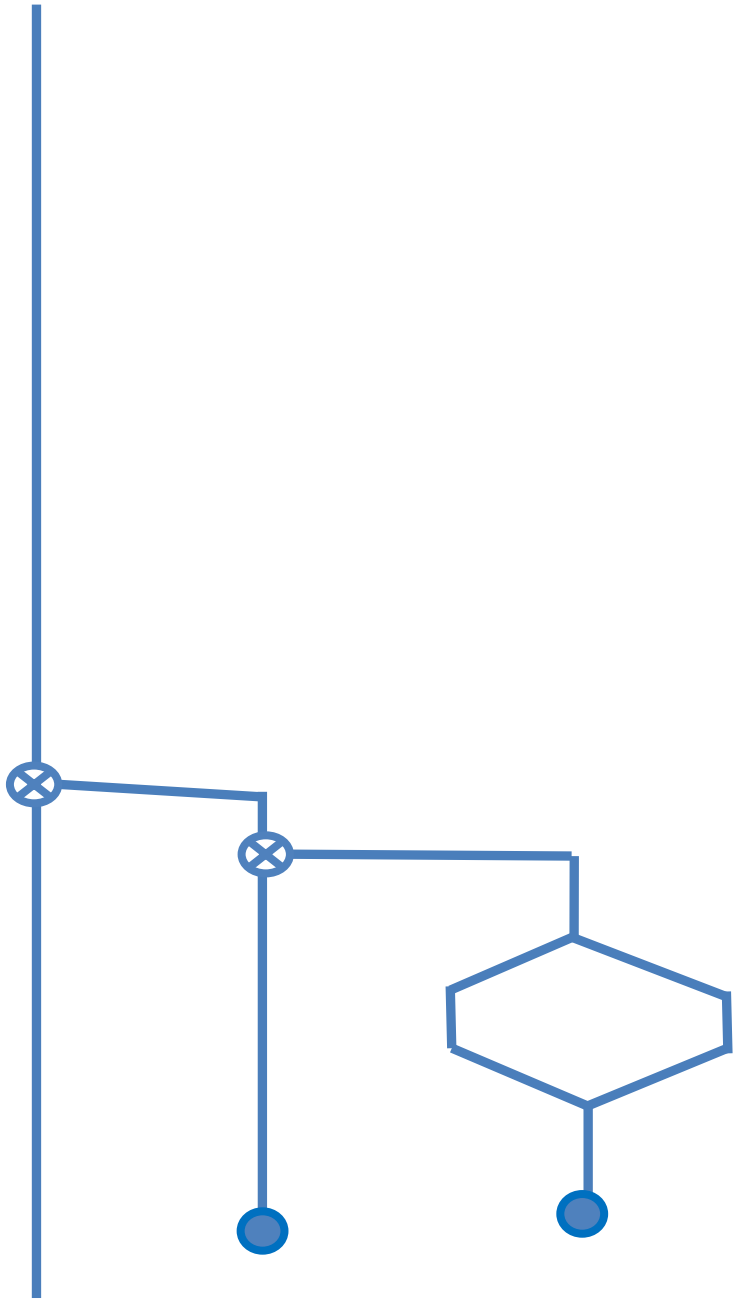


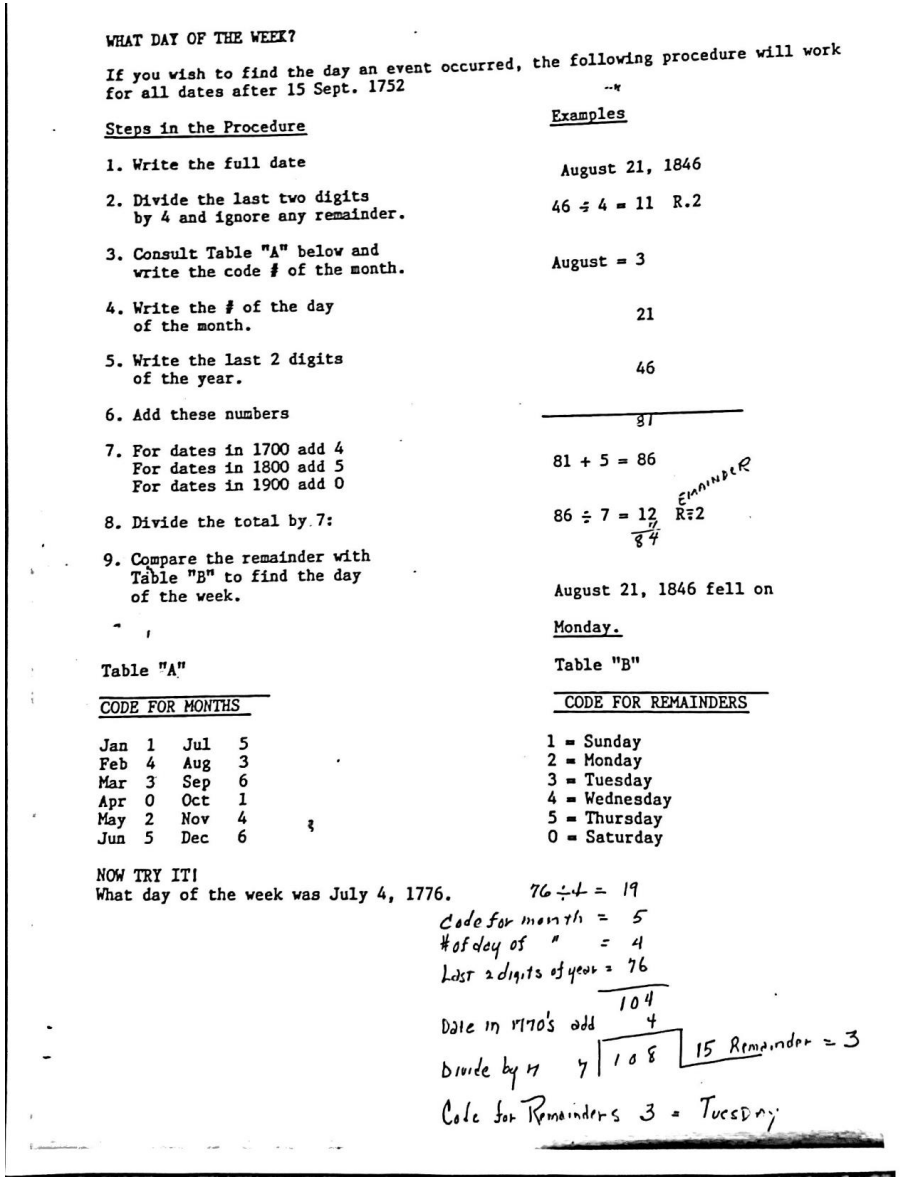
Day Determination

SVFIG

Oct. 28, 2023

Bill Ragsdale

In my mother's records I found a sheet on determining the day for any date.



WHAT DAY OF THE WEEK?

If you wish to find the day an event occurred, the following procedure will work for all dates after 15 Sept. 1752

Steps in the Procedure	Examples
1. Write the full date	August 21, 1846
2. Divide the last two digits by 4 and ignore any remainder.	46 ÷ 4 = 11 R.2
3. Consult Table "A" below and write the code # of the month.	August = 3
4. Write the # of the day of the month.	21
5. Write the last 2 digits of the year.	46
6. Add these numbers	81
7. For dates in 1700 add 4 For dates in 1800 add 5 For dates in 1900 add 0	81 + 5 = 86
8. Divide the total by 7:	86 ÷ 7 = 12 R=2 (Remainder)
9. Compare the remainder with Table "B" to find the day of the week.	August 21, 1846 fell on Monday.

Table "A"

CODE FOR MONTHS

Jan	1	Jul	5
Feb	4	Aug	3
Mar	3	Sep	6
Apr	0	Oct	1
May	2	Nov	4
Jun	5	Dec	6

Table "B"

CODE FOR REMAINDERS

1 = Sunday
2 = Monday
3 = Tuesday
4 = Wednesday
5 = Thursday
0 = Saturday

NOW TRY IT!
What day of the week was July 4, 1776.

76 ÷ 4 = 19
Code for month = 5
# of day of " = 4
Last 2 digits of year = 76
104
Date in 1770's add 4
Divide by 7 | 108 | 15 Remainder = 3
Code for Remainders 3 = Tuesday

History

In programming it I found it did not allow for the ‘400 year rule.’ [More in a bit.]

So I researched and found the Zeller Rule.

It loves integer math, a natural for Forth.

The Basics

To determine the day for a date, you must allow for the extra day in leap years.

If the year is evenly divisible by 400 is it a leap year. If the year is evenly divisible by 4 and not 100 it is a leap year.

2000 YES, 1900 NO, 1984 YES

Introduction

The Zeller rule uses a calculation year beginning on the first day AFTER a leap day, Feb. 29.

It continues for four years ending on the next Feb. 29, in a leap year.

This can cause a bit of confusion calculating the month and year offsets.

At least it did for me.

The Zeller Year

The Zeller year begins on the first day AFTER a leap-day, Feb. 29 and runs for 1461 days, ending on a leap-day.

3/1/2000 --- 2/28/2001

3/1/2001 --- 2/28/2002

3/1/2002 --- 2/28/2003

3/1/2003 --- 2/29/2004

Adjustments

The adjusted month number runs from March as month 1 to December as 10 and then the following January as 11 and February as 12.

The year adjustment means for January and February you use the prior year, as these months conclude the prior Zeller year.

Adjustments

	Jan.	Feb.	Mar.	Apr.	May	Jun.
Month Number	1	2	3	4	5	6
Adjusted Month	11	12	1	2	3	4
Adjusted Year	2003	2003	2004	2004	2004	2004

	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Month Number	7	8	9	10	11	12
Adjusted Month	5	6	7	8	9	10
Adjusted Year	2004	2004	2004	2004	2004	2004

Adjustments

```
: adjustedYear ( -- aY )
  \ allowing for month 1 and 2
  year month 1 = month 2 = or if 1- then ;


: adjustedMonth (  -- aM )
 \ months run 11 12 1 2 . . . 10
   month 10 + dup 12 > if 12 - then ;
```

The Zeller Rule

Sum the following ignoring decimal fractions:

```
                          day +
(26 * adjustedmonth - 2)/10 +
  mod(adjustedyear,100)     +
  mod(adjustedyear,100)/4   +
      adjustedyear/400      +
-   2*adjustedyear/100
```

And take modulo(7) of the total

Individual Factors

```
: factorA  ( -- A  )  day ;  \ d in formula

: factorB  ( -- B )          \ calculate from m
   adjustedmonth 26 *  2 -  10 / ;

: factorC ( -- C )      \ last two digits of the year
     adjustedYear 100 mod ;

: factorD ( -- D )           \ four year cycle y/4
    factorC 4 / ;

: factorE ( -- E )           \ the century / 4
   adjustedYear 100  /  4 / ;

: factorF ( -- F )           \ century c * 2
   adjustedYear 100 / 2 * ;
```

The Final Summation

```
: Summation ( -- day ) \ factors A...F
      factorA
      factorB +
      factorC +
      factorD +
      factorE +
      factorF -
      7 mod  ;

0 = Sunday through 6 = Saturday
```

My Diagnostic Printout

```
  k 26
  m 8
  A 26
  B 20
  C 23
  D 5
  E 5
  F 40
sum 39          Day  26 Month 10 Year 2023
day 4           Thursday ok
```

Input

```
: Accept ( --- ) \ load day, month, year
    ." Input the day number "    get-day    to day
cr ." Input the month number  " get-month  to month
cr ." Input the year in four digits "
       get-year to year  ;
```

Output

```
: Report  show cr summation $Day type ;

: Live  Accept Report ;
```

Interactive Input

```
Accept
Input the day number 26
Input the month number  10
Input the year in four digits 2023      ok

Report
Day  26 Month 10 Year 2023
Thursday ok
```

Tests

```
Day  26 Month 10 Year 2023
Thursday ok

Day  4 Month 7 Year 1776
Thursday ok

Day  7 Month 12 Year 1941
Sunday ok
```

Conclusions

- In took several passes to get the month and year adjustments.
- The interactive input took significant poking around in Win32Forth.
- After looking at several other methods, I suspect Zeller's rule (or derivations) is used by most operating systems today.

References

- https://beginnersbook.com/2013/04/calculating-day-given-date/
- https://en.wikipedia.org/wiki/Determination_of_the_day_of_the_week

Challenge

- The ISO 8601 Standard week is used for planning business finance and operations.
- The ISO weeks, beginning on Monday, are numbered 1 to 52 or 53 with Week One containing the first Thursday of the year.
- Challenge: Program the ISO week for any date. Consider using Zeller's rule. Check with the Excel ISOWEEKNUM.

Win32Forth Cosmology

The Complete Forth Textbook