Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge 39, Massachusetts

SUBJECT: CALENDAR DEMONSTRATION ROUTINE

To: S&EC Group Staff

From: R.J. Hamlin and E. Raiffa

Date: March 2, 1955

ABSTRACT: Description and operation of a calendar program for audience participation at WWI demonstraions.

Introduction

A calendar program has been prepared for use in demonstrations. It computes the day of the week for a given calendar date and checks the input date for fixed or variable holidays. If the date requested falls on any of 15 holidays, the name will be printed out. For the specific holiday Easter Sunday, the routine will give the calendar date when requested in proper form.

Inputs

The inputs (dates) are to be supplied by the participating audience. The input Flexo tape does not require any identifying symbols. The date typed must observe only 5 restrictions:

1. The month must be in alphabetical form.
2. The day must be in numerical form.
3. The year must be preceded by a comma.
4. Only one comma (no. 3) is allowed.
5. The year must have four digits.

The date supplied may be in the form day month, year or month day, year.

Abbreviations and misspellings are allowed so long as the month is uniquely determined by the letters presented.

For example:

Ju 6, 1949 will print error

but 17 f, 1955 will print

February 17 1955 Thursday

To request Easter only the following is essential

e, (year 4 digits)

Of course the routine will work equally well if Easter Sunday, (year 4 digits) is written.

The input date may be in lower or upper case or mixed in any fashion.

Any attempt to "fool" the machine by requesting illogical dates such as 37 Mar, 1955 will result in the reply Date is in Error.

The holidays that the machine will check for are:

Fixed Date	Variable Date
1. New Years date	1. Easter
2. Lincoln's birthday	2. Mother's day
3. Valentines day	3. Father's day
4. Washington's birthday	4. Labor day
5. St. Patrick's day	5. Thanksgiving
6. Memorial day	
7. Independence day	
8. Columbus day	
9. Veteran's day	
10. Christmas	

All "day of the week" computations are only accurate for the Gregorian Calendar. For dates previous to 1582, the Gregorian system is still employed but the routine will print out the information that this assumption is being made. The dates may range from Mar 1, 0001 to Dec 31, 9999.

Output

The output will be printed on the direct typewriter and will print the requested date and day of the week.

Month Day Year Day of week
Name of Holiday (if any)

The request for Easter Sunday will be printed out

Easter
Month Day Year Sunday

Operating Instructions

The audience prepares the input data tape, no identification is necessary.

E, fb 131-98-1, RI, RS

Insert audience tape in PETR, RS, sp 0 at 1600, start at 40 for each new date.

Day of the Week Calculation

Let y = the year

" $\frac{y}{4} = Q_1 + R_1$ where Q_1 = number of leap years

" $\frac{y}{100} = Q_2 + R_2$ where Q_2 = number of centuries

" $\frac{y}{400} = Q_2 + R_3$ where Q_3 = number of 4 century cycles

" M_i = factor for month ($i = 1, 2, \ldots, 12$)

" D = the day

Assume Mar 1, 0001 to be the base date. Then for each year, 1 additional part of a week, namely 1 day is added, since 365 divided by 7 equals 52 weeks + 1 day. Each leap year adds an additional day, and each century year subtracts one day unless it is divisible by 400. Since each month is not an exact multiple of 4 weeks, we can find how many days must be added for the month to the base date. For example, March which has 31 days will have 3 days left over which then will be considered as the additive factor for dates in April. The number of days of the requested date are then added to give a final summation of additional days to our base date. Dividing the total by 7 and then considering the remainder, we can determine what day of the week the given date falls on.

$$\frac{Y + Q_1 - Q_2 + Q_3 + M_i + D}{7} = Q_4 + R_4$$

(R_4 being the fraction of the week.)

For dates in January and February Y-1 must be substituted in place of Y in all the calculations. Starting with today's date and working backward, Mar 1, 0001 will be found to be a Tuesday.

The calculation for Easter is much more complicated theoretically since it is based on a lunar-solar combination. 19 solar years approximately equals 235 lunations. After 19 solar years, the same phases of the moon again fall on the same day of the year or nearly so. Easter Sunday is defined to be the Sunday immediately after the first full moon following the Spring Equinox (Mar. 21). For a complete analysis of how Easter is derived, see Uspensky's Elementary Number Theory pages 212-220.