## FOURTEEN CALENDARS*

BY

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In these days of International Calendar Leagues bent upon uniforming the calendar, it may be heresy to dwell on the aesthetic character of the regularities underlying the apparent irregularities of the current calendar. The calendar now in use is based on the tropical year assumed for all practical purposes to consist of 365·25 days and four years are necessary to round off the fractional part. The rounding is done by the leap year which was made to come, by an ancient Imperial Ordinance, once in four years with an extra day. Since the Sun (or more precisely the Earth) cares very little for an Emperor, ancient or modern and has his (or her) own family troubles to mind, he (or she) chooses his (or her) own rate to travel, and we poor mortals have but to adjust ourselves to the celestial speed. When it was found that our rate was a little too much, it was proposed and adopted that we should drop three days in 400 years. This time the initiative came from a Pope. The century years came in handy for the lopping off, and those that are not divisible by 4 without the help of the last two ciphers were made to pay for their arithmetical privilege. Our prejudices regarding a year are thus based upon its relation to the number 4. Any number can behave with respect to 4 only in four different ways. It may leave a remainder 1, 2, or 3 when divided by 4, or be exactly divisible by it. The number 7 of our weekdays is another arithmetical complicating factor. Still the irregularities are only finite in number, recurring generally in 28 years!

It is easily seen but not sufficiently well known that there are only *fourteen types* of calendars, *seven* ordinary and *seven* leap, which we may for convenience label on the analogy of vitamins:

(A, B, C, D, E, F, G) and (A', B', C', D', E', F', G')

respectively, according as the first day of the year is a Sunday,

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* The interested reader is advised to compare the rules given here with those outlined in the article ' The Elimination of Perpetual Calendars ' by J. L. Roberts in *The Annals of Mathematical Statistics* pp. 44-46, Vol. VII 1936.

Monday, Tuesday, Wednesday, Thursday, Friday, or a Saturday. We shall, now, distinguish three *species* of ordinary years as $O_1$, $O_2$, $O_3$ according as they leave remainder 1, 2, or 3 when divided by 4 and give the following rule for the recurrence of the calendars *in the same century.*

*Write the numbers 6, 11, 11 round a circle and mark against them $O_1$, $O_2$, $O_3$ respectively in the anti-clockwise direction. Going forward in time, you will note that the first period of recurrence is the number marked against it and the other periods follow in the clockwise cyclic order. While reckoning backwards in time, the principle is that the $O_2$ species recurs backwards and forwards in the same manner, while the forward recurrence-periods for $O_1$ are the same as the backward recurrence-periods for $O_3$ and vice-versa. The leap-year recurs only in 28 year periods, backwards or forwards.*

Applying the above rules, we easily verify that the current calendar for 1937 is identical with those of

1909, 1915, 1926, 1943, 1954, 1965, 1971, 1982, 1993, 1999

in the present century.

A note of caution! Since a century year is not considered ordinary or leap in the same way as the other years, the aforesaid principles will not work if a century year intervenes, and they become applicable for any century provided we know the type and species of the first year of the century. The law of succession of the types in any century is given by the following cycle:

ABCD' | FGAB' | DEFG' | BCDE' | GABC' | EFGA' | CDEF' | which contains seven groups of 4 letters.

The letters of a group are associated, in order, with the three ordinary years $O_1$, $O_2$, $O_3$ and a leap year. The letters (ABCDEFG) occur cyclically except after a leap year indicated by a dash, the leap year letter being followed by the alternate letter in the cycle (for example D' is not followed by E but by F). Further in the entire cycle, a letter without a dash occurs once and once only as the first, second, or third letter in the four-letter group.

It is useful to note that all centuries begin as an $O_1$—year and the type of the first year of any century can be determined by noting the type and character (ordinary or leap) of the previous century year. For example, the next century year 2000 being leap, our arithmetic and alphabetic cycles will work right up to 2100 A.D. Since

2100 is an ordinary year, its type determined by our rules must drop the dash. Now 1937 is of the F-type in the $O_1-$ species and the alphabetic cycle starting with FGAB' passes in its sixth course through 2100, and the letter corresponding to it is the 24th from F, viz. F' which must now drop the dash. Thus 2100 repeats the calendar of the current year 1937! The twenty-second century therefore begins with the G-type in the $O_1-$ species and the alphabetic cycle for the century runs

GABC' | EFGA' | · · · ·

In the present depression it may not be wise to waste enormous time and money in printing calendars from year to year, when what we require is after all *Fourteen Standard Calendars*, for instance, those of the years.

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|---|---|---|---|
| 1901 (C), | 1902 (D), | 1903 (E), | 1904 (F') |
| 1905 (A), | 1906 (B), | 1908 (D'), | 1909 (F), |
| 1910 (G), | 1912 (B'), | 1916 (G') | 1920 (E'), |
| 1924 (C'), | 1928 (A') | | |

which will repeat now and again according to the laws indicated above, at least for a millennium, provided no reforms of the calendars come into general use in this period.

## · Addendum ·

If we define the type of a century as the type of the first year of the century, we have according to the original calendar system known as the Old Style, only 7 types A—G and they occur cyclically in the alphabetic or the reverse order according as we proceed backwards or forwards in time. The transition century in which the change from the Old to the New Style took place, has to be assigned two types, one corresponding to each Style, as per rule explained below by an example. The year 1752 when the New Style began to be adopted in the British Dominions by giving the date September 14 to the day after September 2, belongs to a century of the G-type (N.S.) and the type (O.S.) of the same century is read as D from the cycle A—G, by counting 12 places (the difference between the two dates) from G, (which is the same thing as counting four places from A). We are now in a position to read off from the cycle D E F G A B C, the types of all the centuries prior to the 18th until the century when the Old Style came into vogue.

In the New Style, however, there are only 4 types of centuries and they follow the cyclic order of succession C B G E, the type of the twentieth century being C.