Calendars

Julian Calendar

Around 46 BC the Romans adopted a calendar based on 365 days in most years, but with 366 days every fourth year, giving a mean year length of 365.25 days. The extra day (falling on February 24th in our terms) was added by repeating the day six days (counting inclusively) before the first of March. After some confusion over many years the pattern settled in such a way that years AD were leap years if divisible by four.

Gregorian Calendar

In1582 Clauvius proposed to Pope Gregory a calendar with a mean year length of 365.2425 days, in which there were 97 leap years every 400 years. The years divisible by 100 were not leap years unless they were divisible by 400. The correction was to be back-dated to the Council of Nicaea (325 AD), when the date of Easter had been defined. The year was to start on January 1st (previously it had started on March 25th). Over the following years all countries previously using the Julian Calendar adopted the Gregorian Calendar, some not until the early 20th century. Because of the back-dating some days had to be dropped at the time of change, depending on when the change was made. In Britain the Gregorian Calendar was adopted in 1752 and eleven days were dropped when September 2nd was followed by September 14th.

Julian date (JD)

The Julian day number is based on the Julian cycle of 7980 years, using an origin of 1 January 4713 BC devised in 1583 by Joseph Justus Scaliger from calculations of the birth date of Christ. The astronomer John Herschel in 1849 extended this idea to give a simple integer count of days, which followed the astronomical convention in use at that time of running from noon to noon. The Julian day number provides a convenient and simple basis for reconciling disparate historical calendars and it is independent of the sometimes complex rules of the various calendars still in use. The Julian Date for the day starting at noon on 2000 January 1 is 2 451 545.

Modified Julian Date (MJD)

The modified Julian day number, or MJD, was adopted by the Smithsonian Astrophysical Observatory in 1957. It is defined as Julian Day minus 2 400 000.5, with the fractional part changing the start of the day from noon to midnight. It provides a simple five-decimal-digit day count that can be used whenever appropriate in time-keeping and astronomy. Its origin is at 0 h UT on 1858 November 17, so, for example, 2006 January 1 is MJD 53736. A four-decimal-digit Truncated Julian Date

is also in use. The fractional part of the day is now sometimes included to specify time-of-day, for example MJD 53736.25 to represent 06:00 UTC on that day, and MJD is then generally referred to as Modified Julian Date.

Leap Year rule

In the Gregorian calendar, in use in Britain since 1752, every year that is exactly divisible by 4 is a leap year, except for years that are divisible by 100; these centurial years are leap years only if they are exactly divisible by 400. So although 1800 and 1900 were not leap years, 2000 is a leap year. This rule makes the calendar repeat every 400 years, as this is an exact number of weeks. As it happens, the 13th of the month falls on a Friday 688 times in 400 years, more times than on any other day of the week.

Earth rotation

GMT

Greenwich Mean Time (GMT) is the local time on the Greenwich meridian based on the hypothetical mean sun. As the Earth's orbit is elliptical and its axis is tilted, the actual position of the sun against the background of stars appears a little ahead or behind the expected position. The accumulated timing error varies through the year in a smoothly periodic manner by up to 14 minutes slow in February to 16 minutes fast in November. The use of a hypothetical mean sun removes this effect. Before 1925 astronomers and navigators measured GMT from noon to noon, starting the day 12 hours later than in civil usage which was also commonly referred to as GMT. To avoid confusion astronomers agreed in 1925 to change the reference point from noon to midnight, and a few years later adopted the term Universal Time (UT) for the "new" GMT.
GMT remains the legal basis of the civil time for the UK.

UT

Universal Time (UT) is mean solar time on the Greenwich meridian with 0 h UT at mean midnight, and since 1925 has replaced GMT for scientific purposes. By the mid-1950s astronomers had much evidence of fluctuations in the Earth's rotation and decided to divide UT into three versions. Time derived directly from observations is called UT0, applying corrections for movements of the Earth's axis, or polar motion, gives UT1, and removing periodic seasonal variations generates UT2. The differences between UT0 and UT1 are of the order of thousandths of a second.
Today, only UT1 is still widely used as it provides a measure of the rotational orientation of the Earth in space..

Atomic Time

The SI Second

Since 1967 the second has been defined in terms of a specified atomic transition in caesium atoms. More information can be found The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two

hyperfine levels of the ground state of the caesium 133 atom. Note: This definition refers to a caesium atom in its ground state at a temperature of 0 K.

International Atomic Time

A continuous international time scale based on atomic clocks has been generated since the late 1950s, and is known as International Atomic Time (TAI). This time scale is maintained by the International Bureau of Weights and Measures (BIPM), and is based on the intercomparison of more than 200 frequency standards located in national measurement standards institutes around the world, which are combined to form a standard time scale more stable than any single atomic clock can produce.

The world time standard (UTC):

Although TAI provides a continuous, uniform, and precise time scale for scientific reference purposes, it is not convenient for everyday use because it is not in step with the Earth's rate of rotation. A time scale that corresponds to the alternation of day and night is much more useful, and since 1972, all broadcast time services distribute time scales based on Coordinated Universal Time (UTC). UTC is an atomic time scale that is kept in agreement with Universal Time. Leap seconds are occasionally added to or subtracted from UTC to keep it within 0.9 seconds of UT1.

Standard Representation of Dates and Times

Both the British Standards Institution (BSI) and the International Organization for Standardization (ISO) publications describe a common format for the standard representation of date, time of day, and combinations of dates.

For example, the standard notation for the date is the sequence

YYYY-MM-DD
or YY-MM-DD.

References

BS EN 28601 : 1992
Specification for representation of dates and times in information interchange'
(NB. BS EN 28601 replaced BS 7151 : 1989)

ISO 8601 : 2004
'Data elements and interchange formats - information interchange - Representation of dates and times'