Researches on Calendars

Ethiopian / Julian / Gregorian

This research will enables you

- TO orally calculate the days of any year.
- TO change one calendar into another calendar.
- TO know how this research clearly indicates the misconception of Pope Gregarious XIII and others.

By Kinfemichael Daba Ilanso

Acknowledgments

The purpose of the researches I have conducted is to show a new way of calculating calendars. The contributor who had significant impact on my researches was my beloved mother the late W/ro Jonke Insene Areda who provided me with the basic knowledge of knowing by heart the days of a year without any other reference.

This book is dedicated to my beloved children Hirut.. Dawit.. Chala.. Gutama.. Meskerem.. Yeglenesh.. Jonke.. Belehat.. Kasahun.. Lensa and Beza.

I also thank

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A. Major problems related to calendars

1. A judge is not able to make an appointment without referring to a calendar to confirm that the date of appointment is a working day or not. Thus, if he/she fails to get the calendar, the date of appointment made by guessing may result in waste of time by falling on a holiday or on weekends.
2. It is clearly observed that an educated person often faces difficulty to convert his/her date of birth from one calendar into another calendar when this is required to fill in various forms such as DV Lottery.
3. Very often, mass media professionals referring to a date use the Gregorian Calendar as it is, because they cannot convert the date to their own calendar. Thus, confusions often crop up among the audiences.
4. People often rely on their PCs watches or cell phones and, if these fail to function correctly, they face problems.
5. The calendars that are prepared for a limited period of time would certainly expire; thus, extra expenses are incurred to get or to program the new ones. There are also other problems such as lack of knowledge of the days of historical events, days of appointments, days of national and religious celebrations etc.... Thus, in order to overcome the problems indicated above, we must study this book properly, and use it in our daily life.

Nowadays, people need an adding machine for a simple addition and subtraction, a mobile phone to know the days of a month in a year. This over dependence on technological equipment results in creating generations of weak minded people in our world. Thus, it would be better to sustainably develop our knowledge and positive change in ourselves to be thinkers. It is also necessary to build up and develop a free thinking generation. In this connection, vocational schools, institutions, colleges and universities must teach their students, about the calendar as a common course.

B. Preface

It is confirmed in history that the origin of calendars is related to followers of religions. Moreover, it is one of the fields that mankind has strived to discover using its inquisitive urges. My own desire to focus on calendar is presented below.

On Meskerm 1,1977 (September 11, 1984) I travelled from Addis Ababa to my birth place, which is locally known as Elamu Sheimbeti and, is located in Western Showa Zone , some 10kms away from Ambo town, where I was born, to celebrate Inkutatash (Ethiopian New Year) with my mother. After the new year celebration, when I was to return to Addis, my mother reminded me saying:" You have to come for Timket (Epiphany) so that we will celebrate it together."

I declined by saying that I would not get permission or leave from my organization. Then she thought for a moment and said: "The holiday is on Kidame (Saterday),so do join us, as long as Kid(Sat) is not your working day". I did not believe that it was so. Hence I said okay to her and when I arrived in Addis Ababa, I looked for a calendar and surprisingly, the holiday was exactly on Kid(Sat)that isTir11,1977 (Jan 19, 1985).

It was after this incident which I witnessed that my mother, who had never gone to school, knows this, which even archbishops and astrologists often fail to guess. From that day on, my desire to know about the matter has been ignited. Thus, when I visited my mother for the second time and asked her how she could know it, she explained everything to me until I could learn by heart all the calculations of the days of a month to arrive at the exact day and date of a year. I was not satisfied with this alone, and I proceeded to know how the day and the date of the past as well as the future could be determined. After I made a big effort, I succeeded and became perfect in the Ethiopian Calendar.

It was under such a condition that I had found a permanent calendar that enables one to know the dates beginning from the 1st up to the 25th century of Ethiopian Julian and Gregorian Calendars.

Referring to this Calendar alone and through the use of the Ethiopian Calendar as a reference, I have first succeeded in Julian calendar, and then through a big effort I also succeeded in Gregorian Calendar. I have now managed the days of a week in any year, in the Ethiopian, the Julian and the Gregorian Calendars, within less than ten seconds orally without any reference,

I have also managed to convert one type of calendar to another type without a need for any reference; thus, I have come to extend limitlessly the usually limited calendars which would help for only a few centuries.

I have managed to expose the miscalculation which was first recognized by Archbishop Gregarious XIII in 1582 with regard to the Julian Calendar. All these findings may need a regular mathematics education. But, I never had that education. I overcome it through a clear vision and observation as well as a continuous effort .

This new book is written and presented in a clear and concise way. The definitions and exercises are written so as to enable the user to understand quickly and easily the days of any year. During an exercise one cane use the permanent calendars as a reference.

An oral calculation of finding the days of any year can also be advantageous in developing a supper power memory.

I present the results of my researches in which I have managed to know the facts I described above. I hope that every one who will pay attention to and follow the contents of my book step by step and, exercise it continuously can properly grasp the issue at hand.

K.D

C. Causes for the essence of calendar

People had different views and regulations of their own as regards how calendar system has been began .

1. A."Jewish" The Jewish calendar which is presently in use follows the lunar and solar calendar method. The months are lunar months. The years are solar years. The twelve lunar months that interchange by rotation in 29 and 30 days are less by 11 days in the solar year. Because of this, measures have been taken to the effect that the calendar should have several leap years within a period of 19 years. The Jewish calendar starts from 3761 B.C which they believe is the year of genesis. The Jewish new year (Rosh Hashana) falls on the month of September when the length of the day and that of the night are equal.

B. "Greeks":- Their calendar started before the birth of Christ in 776 B.C. This was when The Olympic champion started.

C. "Romans":- Their calendar started during the time when Rome was founded (built) by king Romulus in 1753 B.C.

D."Egyptians" The previous Egyptian Calendar followed the lunar calendar latter on, however, the Egyptians prepared the solar calendar at the outset. The Egyptian Calendar was made up of 12 months with 30 days each, and additional 5 days to totalling to 365 days a year. Thereafter in 239 B.C, the clergymen came together and reached the unanimous decision, that the length of the year should be 365 ¼ days. The ancient Egyptians were perhaps the first ever people who used the solar calendar

E. "Christians" It was possible to make the decision that "Ano Domini" (A.D) be the birthday of Jesus Christ. After the Roman Empire put a stop to chasing Christians and when Christianity became the national religion of the Roman Empire, a monk called Dionasious, who lived in Rome suggested that the Christians Calendar must be started from the date of the birth of Jesus Christ. His proposal have got an acceptance in all the Christian society. Thus begining from 532 A.D, the Christian Calendar starts from the birth of Christ.

F. "The Chinese Calendar"

The Chinese Calendar is a lunisolar Calendar, incorporating elements of a lunar calendar with those of a solar calendar. The people republic of china has continued to use the Gregorian Calendar since 1949.There is no "Epoch" which is universally agreed upon or starting point for the Chinese Calendar. According to traditional beliefs, some form of the calendar has been in use for almost five millennia. Based on archaeological evidence, some form of it has been in use for three and a half millennia. Tradition also holds that the calendar was invented by Emperor Huang-di in the 61st year of his reign in what is now known under preleptic Gregorian Calendars 2637 BCE. Many have used this date as the epoch, i.e. the first year of the first sixty year (sexagesimal) cycle , of the Chinese Calendar but others have used the date of the beginning of his reign on 2697 BCE as the epoch .

The Chinese Calendar has no constant intercalary days to be added on a month to gete a solar year, to correct the deviations of the calendar year from the astronomical year. Thus it is difficult to put down the Chinese Calendar under calculation. Because of this, experts in China call for reform in recent years. They point to the example in Japan, where during the Meji restoration, the nation adopted the Gregorian Calendar, and simply shifted all national festivities onto equivalent dates.

G. "The Islamic Calendar"

The Islamic Calendar or Muslim Calendar or Hijri Calendar is a lunar calendar consisting of 12 lunar months in a year of 354 or 355 days. It is used to date events in many Muslim countries (concurrently with the Gregorian Calendar), and used by Muslims everywhere to determine the proper day on which to celebrate Islamic holy days and festivals. The first year was the year during which the emigration of the Islamic Prophet Mohammed from Mecca to Medina, known as the Hijra Took place before the death of Prophet Mohammed (the pre Islamic era AD 570 – 632) the Arabs used a lunisolar calendar.

The first day of the Muslim month can be determined, be it by physical moon – sighting or predictions. The visibility of the thin lunar crescent is of cultural and religious importance.

'Prophet Mohammed announced the strict use of a lunar calendar shortly before his death in AD 632. It was only in AD 642 when Caliph Umar set up the calendar and took 16 July AD 622 as the starting date of the Islamic era. This era is known as the era of Hijira. (AD 622=AH1)

H. "The Oromos Calendar"

The Oromos which occupy the fifth place in the continent of Africa interms of population have their own believe Waaqeffannaa (worshiping of one God), their own administrative system Gadaa (a democratic administration), their own calendar Dhahaa (an astronomical observation). The Oromos have, throughout the ages, lived under the Geda traditional administrative system, which is democratic. Under this system, they have been practicing power transfer every eight years. This being the case, they attach great importance to time.

The Oromo Calendar is based on astronomical observation of the moon in conjunction with seven or eight particular stars or star group called "Urjii Dhahaa" guiding stars.

The Oromo calendar calculators called "Ayyaantuu" can identify the days of a year as well as the year of the Geda period from memory. In the Oromo calendar calculation, the number of days in a month is 29.5 on average.

There are 12 months in a year, and the day on which the moon is seen for the first time is taken as the first day of the month" the first month of the year with some regional variation is fulbaanaa, cikawa or Birraa meaning September.

The pillars located in north west Kenya in 1978 was an archaeological discovery by scientists named Lich and Robinson, indicate that the Oromos had their own calendar based on the astronomical calculations by looking at the motions of stars and the moon. In accordance with the conclusion reached by researchers, these creative works was done since 3000 years before Christ when the Middle East and Europe were reckoning years with reference to the coronation of their kings. The Oromos are one of the four peoples that invented a calendar and contributed to the world civilization. The rest three are China, India and Maya. Other calendars in use today are derivatives or mixed of these four calendars.

Asmerom leggese (renowned anthropologist) 1973, has the following to say about the Oromo Calendar. "Borana time recording is unique in East Africa and has been recorded in very few cultures in the history of mankind. The best known examples of this type of time recording are the Chinese, Maya and Hindu Calendars. It is very thoughtful that the Borana system derives from any of these calendars."

The Oromos used to have a Calendar with which they reckoning time before 1347 B.C.

D. "To have some knowledge about the Sun and the planets"

During day time in space, we mostly see sunlight. At night, when there is no light, we see twinkling stars in groups or spread out in the universe and , as the case may be, we see the moon. There are countless space bodies in the universe. We, however, see stars which are close to our view. We cannot see the rest because of their distance.

Humanity has so far made a lot of effort to have a knowledge of the creation or origin of Stars, the Sun , the Planets and Satellites which are among those spread out in space. But he didn't conclude his study and has not yet reached to a concrete final result.

The Sun

The Sun is one of the stars in the Milkyway Galaxy. It is moving in space by forming its own solar system, which embraces planets, satellites, comets, asteroids and other bodies. The Sun which produces its own light and warmth is made up of the gas elements Hydrogen 73%, Helium 23%. Its external body temperature is about 6000 °C. Its internal heat is estimated to be more than 10 million °C.

The Sun has a size which amounts to 99% of the solar system. The other bodies added together would only amount to 1%. The diameter of this gigantic star is estimated at 1,400,000 kms

The Composure of the solar system

The solar system is, besides the Sun and the planets, made up of other bodies called, asteroids, comets, meteors and other satellites.

A. Satellites:- Are comparatively small bodies moving in orbit around the planets. The moon is the satellite of the Earth.

The Earth Moon:- Has an area which is much smaller than that of the Earth. No creature lives on the moon, because it is devoid of air and water.

Its average distance from the Earth is 384401 Kms. The Moon takes 27 days to rotate on its own axis and it revolves around the Earth in about the average of 29.5 days. Since the Moon does not have its own light, we see it when it reflects back the light from the Sun. The size of its body is believed to be 1/8 of the Earth.

C. Comets:- Are heavenly small bodies that follow elliptical orbits around the Sun. They consist a nucleus of ice and dust, they have small heads and bright long tails. Comet Halley was visible in 1910 and again in 1986. its next perihelion passage will be in early in 2062. Haley's comet which is one of the well –known comets, moves around the Sun once every 76 years. The comet was named after the scientist called Haley who predicted the time when the comet would complete its orbit around the Sun, but died before he witnessed it personally.

D. Meteors:- Small bodies rushing from outer space into the Earth's atmosphere. Some of them fall on Earth because of Earth gravity. Others burn up because of friction. They are usually called shooting stars.

Planets

Planets are among the heavenly bodies moving round the Sun. The nine planets which move around the Sun are:- 1. Mercury 2. Venus 3. Earth 4.Mars 5. Jupiter 6. Saturn 7. Uranus 8. Neptune and 9. Pluto

These planets are not visible as is the case with stars. They give rather dim reflection of the light which they receive from the Sun. Planets revolve around the sun on their own individual orbits. These orbits are not fully circular but are egg – shaped (elliptical)

Major points about each planet

1. Mercury:- Is the nearest planet to the Sun. It gets strong sun light and heat. Its body temperature is about 400 °C. This being the case, water cannot be found on Mercury. Its diameter is 4880 km. It takes Mercury 59 days to rotate around itself and only 88 days to revolve around the Sun. Its distance from the Sun is 57.9 million kms, its diameter is 4880 kms. It has no satellite.

2. Venus:- It is a bright planet that is visible after the Sun and the Moon. Its distance from the Sun is 108.2 million kms. Because of its relative close distance to the Earth, it is some times visible even during day time. Space scientists estimate that the temperature on this planet could reach 60 °C. Its body has shapes of high mountains and valleys. Most of its body seems to be covered by something like dust. Its diameter is 12104 kms. Venus takes 243 days to rotate around itself and 224.7 days to revolve around the Sun. Venus does not have its own satellite.

3. Earth:- The distance between the Earth and the Sun is 149.6 million kms. This planet is the third farthest planet from the Sun. The earth takes 23 hours 56 minute and 4 seconds. to rotate around its own axis, and takes 365.26 days to revolve around the Sun on its own orbit. This being the case, the Earth has four seasons every year, rainy season, spring, summer and small rains. Its diameter is 12756 kms. The Earth is blessed with life necessities which include water, food and balanced air conditions. Accordingly, studies conducted so far indicates that the Earth is quoted as the sole planet which is inhabited by living things.

4. Mars:- Mars is located at a distance of 227.9 million kms from the Sun. Mars has features similar to those of the Earth. Although there are no proofs yet, it is assumed that living things may be inhabiting on Mars. Its daily temperature may reach 27 °C. Its night time temperature may go down to 53 °C below zero. Its diameter is 6787 kms. Mars takes 24 hours and 37 minutes 23 seconds to rotate around itself and 687 days to orbit the Sun. It has two satellites.

5. Jupiter:- It is located at a distance of 778.3 million kms from the Sun. It is the largest planet of the solar system. The speed with which it rotates on its own axis is much faster than those of all the other planets. As has been witnessed through the telescope, Jupiter's body has the shape of a revolving fog. The planet has many satellites. Its coolness day and night is 150 °C below zero. Jupiter which has a diameter of 142800 kms. It takes 9 hours and 50 minutes and 30 seconds to rotate around itself and, 11.86 years to revolve around the Sun. It has 63 satellites.

6. Saturn:- It is located at a distance of 1427 million kms from the Sun. Saturn has many similarities with Jupiter. What makes Saturn unique is the fact that it is a large planet encircled by ring like beautiful things. It is described as a very beautiful planet. There are speculations that similar rings encircle Jupiter and Uranus. However, such a ring is clearly seen distinctly around Saturn. Saturn's diameter is 120000 kms. It takes Saturn 10 hours and 14 minutes to rotate around itself and 29.46 years to revolve around the Sun. Saturn has 17 satellites.

7. Uranus:- It is located at a distance of 2869.6 million kms from the Sun. It is speculated that the centre of its body is hardened. As compared to the Earth, the starlight which Uranus gets is very much smaller. Its temperature goes down to 210 °C below zero. Its diameter is 51800 kms. It takes 11 hours to rotate around itself and 84.01 years to revolve around the Sun. It has five satellites.

8. Neptun:- It is located at a distance of 4496.6 million kms. from the Sun. Its harder body which is almost equivalent to the Earth is covered with very deep ice. Its temperature is 230 °C , below zero. Its diameter is about 49500 kms. Neptune takes 16 hours to rotate around itself and 164.8 years to revolve around the Sun. It has two satellites.

9. Pluto:- It is located at a distance of 5900 million kms. from the Sun. Pluto is the smallest of all the planets, in terms of its size and weight. The heat that it gets from sunlight is quite minimal, because of its long distance from the Sun. Its temperature goes down to 240 °C below zero. Pluto's diameter is 5000 kms. it takes 6 days and 9 hours to rotate around itself and 247.7 years to revolve around the Sun. Pluto does not have its own satellite.

In the Ethiopian Calendar, the month of *Pagume* has five intercalary days for three consecutive years, and six days in the fourth year, which is referred to as the Year of St. Luke. Because of the increase in the number of days in *Pagume* to six, the date of New Year's, which is usually on consecutive days, jumps with one more day in the Year of St. John. This year is referred to as Leap Year. The twelve months other than *Pagume* have 30 days each, which means 12 X 30 = 360 days plus the 5 days of *Pagume* = 365 for three consecutive years; and 360 + 6 in the fourth year = 366 days in a year.

The Earth takes 365 $^1/_4$ days to complete its rotation around the Sun. Thus, one-fourth of a day (24 hours) means 24 X $^1/_4$ = 6 hours. The cumulative of these hours in four years becomes one full day; and this increases the number of the days of the month of *Pagume* to six.

Seasons

In Ethiopia, each year is sub-divided into 4 seasons that have 3 months each.

Tsedey (Spring) = *Mes (Sept), Tik (Oct) & Hid(Nov).*
Belg (Small rainy season) = *Meg(Mar) , Miy(Apr), & Gin(May).*
Bega (Summer) = *Tah(Dec), Tir(Jan) & Yek(Feb).*
Kiremt (rainy season)=*Sen(Jun), Ham(Jul) & Neh(Aug).*

The latitudes of the Earth tilt by 23 ½ degrees from the longitudes and thus, when the Earth rotates around the Sun, rays of the Sun reach the Earth in various directions. Therefore, the temperature of any given place varies from time to time.

Years

Each one of the years is labelled with the names of the four Apostles of the Gospels: Matthew, Mark, Luke, and John.

If a given calendar year is divided into 4, and the remainder is 1, it is the Year of St. Matthew; if the remainder is 2, it is the Year of St. Mark; if the remainder is 3, it is the year of St. Luke; and if it can be divided without a remainder, it is the Year of St. John. **Exercise 1.** A: What year was 1913?

1913÷ 4 = 478 Rem 1. Therefore, it is the Year of St. Matthew.

B. What year will 2051?

2051 ÷ 4 = 5 1 Rem 3, there for, it is St.Luke

A. The First Day of Every Year

To be able to know the first day of any year means to be able to know the days of the dates in that particular year, or to be able to prepare a calendar.

The first month of an Ethiopian Calendar year is Mes(Sep), and to know the day on which Mes(Sept) 1 falls, I have tried different hypotheses. At last, my effort has come to be successful. I was over taken by great feelings of joy and satisfaction at the moment during which I confirmed this. That feeling of joy was comparable to that of the Greek scientist Archimedes who ran around naked shouting ''Eyorika" (I have got it.) I used the following approach which enabled me to acquire success. I began my research as follows, in order to know the day of Mes(Sept) 1 of first AD by counting backwards from 1998 A.D.

In 1998 Mes(Sep) 1 was on Ehu (Sun)
In 1997 >> >> >> Kid (Sat)
In 1996 >> >> >> Arb (Fri)
In 1995 >> >> >> Reb (Wed)

While I was proceeding in such a manner, before I reach 1900, I came to recognize the number of the years of the turns in which the days coincide with each other, and that the days of the last 28 years are the following.

Table 1

28 = Mak (Tues)	21 = Ehu (Sun)	14 = Arb (Fri)	7 = Reb (Wed)
27 = Ehu (Sun)	20 = Kid (Sat)	13 Ham (Thurs)	6 = Mak (Tues)
26 = Kid (Sat)	19=Ham (Thurs)	12 = Reb (Wed)	5 = Seg (Mon)
25 = Arb (Fir)	18 = Reb (Wed)	11 = Seg (Mon)	4 = Ehu (Sun)
24 = Ham (Thurs)	17 = Mak (Tues)	10 = Ehu (Sun)	3 = Arb (Fri)
23 = Mak (Tue)	16 = Seg (Mon)	9 = Kid (Sat)	2= Ham (Thurs)
22 = Seg (Mon)	15 = Kid (Sat)	8 = Arb (Fri)	1 = Reb (Wed)
0 = Mak(Tue)			

If we carefully look at the table above, we recognize that the days of the week repeat themselves four times.

For example: If we take Mak (Tues) and try to understand after how many years it repeats itself, we shall see that it repeats itself in 28, 23, 17..., and 6 years.

Accordingly, the number of years in which a day repeats itself are 6, 5, 6, 11... and the total sum of these is 6 + 5 + 6 + 11 = 28 years. This method is the one with which I calculated backwards, and to calculate forwards 28 + 6 = 34... 34 + 5 = 39... 39 + 6 = 45 + 11 = 56 etc. and the day on which it will be Mes (Sept) 1 is Mak (Tue). In other words, if any year is divided by 28 and the remainder is 0, it is Tuesday; if the remainder is 1, Reb (Wed); if the remainder is 2, Ham (Thurs); etc., and Table 1 repeats itself.

In conclusion, in order to know the day of Mes (Sept) 1st of any given year, there is a need to divide the calendar year by 28 and, based upon the remainder, to refer to the day that is found parallel to the remainder number in Table 1.

Remainder →	0	6	17	23	Mak (Tues)
>>	1	7	12	18	Reb (Wed)
>>	2	13	19	24	Ham (Thurs)
>>	3	8	14	25	Arb (Fri)
>>	9	15	20	26	Kid (Sat)
>>	4	10	21	27	Ehu (Sun)
>>	5	11	16	22	Seg (Mon)

Ex.2.A. what was the day of Mes (Sept) 1st of 15 A.D? of E.C ? 15÷ 28 = 0, and the remainder is 15. The day in front of 15 in Table 1 is Kid (Sat).

B. What was the day of Mes (Sept) 1st of the year 1988 A.D? 1988÷28 = 71, and the remainder is 0; therefore, it was Mak (Tues).

C.What will be the day of Mes(Sept)1st of the year 2080A.D ? 2080÷28=74, and the remainder is 8; therefore, it will be on Arb (Fri).

NB: When the numerator calendar year is less than the denominator, we should take the numerator as the remainder.

B.THE MULTIPLIERS OF 28

The Multipliers of 28 means those which repeat themselves every 28th year as the similar days of the month and when multiplied 25 times, they make 700 a zero or Mak(Tues) as in Table 1, and start again on the similar day and date of Mes (Sept) 1st on Mak (Tues). The multipliers of 700 such as 1400, 2100, 2800, 3500, etc are, just as 700, begin from Zero again and the day of Mak (Tues) and create Table 1.

E. "Introduction"

Calendars are used to keep track of the motion of the Earth, Moon and Sun. They are formed from the units of the day, month and year. The day arises due to the rotation of the earth about its axis; and it is the sole natural and basic measurement of time. The month arises due to the revolution of the Moon around the Earth; while the year arises due to the revolution of the Earth around the Sun respectively.

"The Earth and the seasonal markers"

The Earth revolves anticlockwise around the Sun in an elliptical orbit in an ecliptic plane, known as the plane of ecliptic. The ecliptic is the path of the Earth around the Sun on the celestial sphere. It makes an angle of 23.5° with the celestial equator. Simultaneously, the earth rotates anticlockwise around an axis that is tilted 23.5° with respect to the line perpendicular to the ecliptic. The tilt of the axis and the revolution of the Earth around the Sun give rise to seasons.

The ecliptic intersects with the celestial equator at two points are known as the equinoxes. The solstices, on the other hand, are where the equator and the ecliptic are furthest apart. The equinoxes and the solstices are known as the seasonal markers.

March equinox (March 21) is the time when the Sun passes the celestial equator from the southern to the northern hemisphere. Here, the length of day and night is equal. After the March equinox, the Sun moves north until the June solstice

June Solstice (June 22) is where the northern most rising position is. Here, people staying in the northern hemisphere experience the longest day, while those staying near the equator experience the same length of day and night because the Sun rises from east to west for about the same length of time. The Sun then continues to move southward as it reaches the September equinox (September 23)

The day and night are almost equal in length again. The days shorten as the Sun moves south until it reaches the December solstice (December 22) where the southernmost rising position is.

At this point, peoples staying in the northern hemisphere experience the shortest day. Perihelion (near December solstice) is the point where the earth is closest to the sun. it occurs around 4th January every year. Aphelion (near June solstice) is the point where the Earth is furthest away from the Sun and occurs around 4th July.

"The Moon Crescent Visibility".:- the moon can be seen because it reflects sun light. It revolves anticlockwise around the earth and this allows as to see the different phase of the moon. When the moon sets at almost the same time as the sun set, we call this moon the new moon. When the moon sets at sunrise and rises at sun set this moon is called full moon. The time period between one new moon and the next new moon is known as lunation and varies between 29.27&29.84 days.

"The tropical year":- The tropical year is the time interval for the sun's mean longitude to increase by 360^0. Its length is about 365.2422 days.

"Solar Calendar" :- Solar Calendars aim to ensure that the seasonal markers do not move in the calendar year by adding leap days. They ignore the movement of the moon and only follow the movement of the sun. One example of such calendar is a Gregorian Calendar, which is the most commonly used calendar today.

"Lunar Calendar":- Lunar Calendar aim to ensure the conjunction crescent visibility, or new moon determines the start of the month. The basic unit of Lunar Calendars is the lunar months. Lunar Calendar follow the lunar phase cycle and ignore the movement of the Sun , hence lunar year do not follow the season. The only Lunar Calendar used today is the Islamic Calendar.

"Lunisolar Calendar":- Lunisolar Calendars aim to approximate the tropical year by adding leap months. One example of such is the Chines Calendar

CHAPTER ONE

1. THE ETHIOPIAN CALENDAR (E.C)

Among the followers of the Ethiopian Orthodox Church, calendar begins as of 5500 B.C. This epoch is usually referred to as "Biluyi" (or "Zib"). The time beginning from the birth of Christ to the present is referred to as Amete Mehiret", which is an equivalent of *Anno Domini*.

Zib + Amete Mihiret = *Amete Alem.*

Zib	=	5500
Amete Mihiret	=	2005
Total	=	7505 *Amete Alem.*

It has been 7,505 years since calendaring began. It is believed among the Ethiopian Orthodox Church followers that, to decide about the date of birth of Christ referring to historical events is not appropriate, and rather the method used is to begin with the end of 5500, which is before Christ. As a result, their calendar delays from the European calendar with seven or eight years. Even though it is claimed that the Ethiopian Calendar is similar to the old Coptic Calendar, it is very much similar to the Julian Calendar with regard to the number of days in a year, and in every 28th and 700th years, the days come to correspond to each other.

Therefore, in this document, the findings that refer to the Gregorian Calendar based upon the Ethiopian Calendar also give similar results if the Julian Calendar is used as reference.

Days of a Week

The days of a week are similar in the Ethiopian, the Julian and the Gregorian Calendars, other than the nomenclatures.

Ethiopian	Julian and Gregorian
Ehude (Ehu)	Sunday (Sun)
Segno (Seg)	Monday (Mon)
Maksegno (Mak)	Tuesday (Tues)
Rebu'e (Reb)	Wednesday (Wed)
Hamus (Ham)	Thursday (Thurs)
Arb	Friday (Fri)
Kidame (Kid)	Saturday (Sat)

Days of a Month

In the Ethiopian Calendar, there are 12 regular months, each of which has 30 days, and *Pagume* is added as 13th month at the end of every year. The days of the months in the Julian and the Gregorian Calendars are the same. The number of days in a year is the same in the three calendars.

The number of days in the months in the Ethiopian Calendar		The number of days in the months in the Julian and Gregorian calendars	
Meskerem (Mes)	30	September (Sept)	30
Tikimt (Tik)	30	October (Oct)	31
Hidar (Hid)	30	November (Nov)	30
Tahisas (Tah)	30	December (Dec)	31
Tir	30	January (Jan)	31
Yekatit (Yek)	30	February (Feb)	28 (29)
Megabit (Meg)	30	March (Mar)	31
Miyazia (Miy)	30	April (Apr)	30
Ginbot (Gin)	30	May	31
Sene (Sen)	30	June (Jun)	30
Hamle (Ham)	30	July (Jul)	31
Nehase (Neh)	30	August (Aug)	31
Pagume (Pag)	5 (6)		
Total	365 (366)	Total	365 (366)

Exercise 7

A. What was the day of Gin (May) 26, 1977 of Ethiopian Calendar?
19÷7=2, and the remainder is 5; taking the remainder as the hundreds, if we combine it with the year, 577 in table 2 the number that is less than 577 is 560 thus 577 -560=17. In Table 1, 17 represents Mak (Tue), Mes (Sept) 1st.
Now if we add the month number in Table 3 for Gin(May) which is 2 to the asked day… 2+26=28...and 28 is the nearest date to 29, among the dates on which it is the first day of the month; thus, 29-1=28 and Mak (Tue)-1 day= Seg (Mon).

B. What will be the day of *pagumae* 6, 2999 E.C ?
29÷7=4, and the remainder is 1...199-196=3 Arb (Fri) Mes (Sept) 1st.
The number of month of Pagumae is 3, the asked date=6...3+6=9..9 is the nearest date to 8 among the dates on which it is the first date of the month. Thus, 8+1=9, or 9-8 =1 hence Arb (Fri) + 1 day= Kid (Sat).

NB. In order to be able to calculate the days of any years in the Ethiopian Calendar, it is mandatory to learn by heart Tables 1, 2, and 3.

E. Permanent Calendar-1

1. It is possible to get the key year number (k.y)of any year by dividing the calendar year by 28 and taking the remainder.(Rem)

Ex	(Rem)	No.Of year (K.Y)		Ex	(Rem)	No. Of year (K.Y)
	1 (.03)	4			15 (.53)	0
	2 (.07)	5			16 (.57)	2
1 →	3 (.10)	6			17 (.60)	3
	4 (.14)	1			18 (.64)	4
	5 (.17)	2			19 (.67)	5
	6 (.21)	3			20 (.71)	0
	7 (.25)	4			21 (.75)	1
	8 (.28)	6			22 (.78)	2
	9 (.32)	0			23 (.82)	3
	10 (.35)	1			24 (.85)	5
2 →	11 (.39)	2			25 (.89)	6
	12 (.42)	4			26 (.92)	0
	13 (.46)	5			27 (.96)	1
	14 (.50)	6			00 (1.00)	3

2. The day of every month (from 1-30) (M.D)

3.Every month has its own key month number (K.M)			**4.Every day has its own key day number (K.D)**		
Ex.	**Month Number**	**(K.M)**	**Ex.**	**(K.D)**	**Days**
	Mes (Sept)& Miy (Apr)	6		1	Ehu (Sun)
	Tir (Jan)- Neh (Aug)	0		2	Seg (Mon)
	Tik(Oct)-Gin(May)	1		3	Mak (Tues)
1 →	Yek(Feb)-Pagumae	2		4	Reb(Wed)
	Hid(Nov)- Sen(Jun)	3		5	Ham (Thurs)
2 →	Meg(Mar)	4	1 →	6	Arb (Fri)
	Tah(Dec)-Ham(Jul)	5	2 →	0	Kid (Sat)

NB. The key number of the year (K.Y) means the first day of any year which is changed into a figure (number) by the key day N° (K.D).

Work Procedure:

{(K.Y) + (M.D) + (K.M)} ÷ 7, then, converting the remainder number with Day number (K.D) to a day.

The Permanent Calendar 1

In order to know the days of any year in E.C, one can use the permanent calendar 1.

A. Divide the calendar year by 28, and find that remainder in the column of the remainder. Move to the right and take its key year N° (K.Y)which is parallel to it.

B. Take the day of the month 1-30 (M.D) that of your interest. C. Look at the month of your interest, and take its key number (K.M) on the right side D. Add the numbers, and divide the sum by 7. E. Convert the reminder N° 0-6 to a day using the day Key N° (K.D)

In other words, it is calculated by adding the key number of the year to the date of the month and the key number of the month; then, to divide the sum by 7 and to convert the remainder to a day through the day key number. **Exercise 8:**1.

Using the calendar, what was the day on which it was Meg(Mar) 17, 1963 E.C? 19÷7=2, and the remainder is 5...563-560=3, or when computed using adding machine, 1963/28=70.10, and parallel to the remainder number 3, or (.10) (K.Y)=6, the asked day (D.M)=17, the number of the month of Megabit (march)=4, total sum= 6+17+4=27..27÷7=3, Rem 6...and the day that is found parallel to 6 in key day number = Arb(Fri)

2. What is the day on which it will be Pagume 3, 2027? (K.M)=2...(M.D)=3…..20÷7=2, Rem. is 6.....627-616=11, the key year number(K.Y) which is found parallel to 11=2 ...2+3+2=7...7÷7=1, remainder 0; when we convert 0 to a day through the key day number(K.D) which is parallel to 0, we get Kid(Sat).

NB.

A. The location of the exercises is shown by arrows.

B. The remainder numbers which are found from 1-00 are calculated without using adding machine; when we compute using this machine, it is possible to identify by using the tow digits which are found after a dot (from .(.03) upto (.00).

" The Millenniums in E.C. can be celebrated by adding 4 days on the day of the previous millennium.

Thus, if Mes (Sept)1st of the year 1000 was on Saturday,

the year 2000 was Saturday +4days = Wednesday,

" " 3000 will be Wednesday +4days = Sunday,

" " 4000 " " Sunday + 4days = Thursday etc.. "

Table 2

00	28	56	84	112
140	168	196	224	252
280	308	336	364	392
420	448	476	504	532
560	588	616	644	672
700				

Table 2 is used for calendar years less than 700 and among the numbers it contains. One can get Mes (Sept) 1st of any year in Table 1 by subtracting one which is less than or equal to the needed one and by referring to the day in front of the remainder in Table 1.

For those which are more than 700 and less than 1400 years, it is required to subtract 700 and, for those more than 1400 and less than 2100 to subtract 1400, etc and by bringing them to less than 700 or by dividing any year by 700, one can refer to the remainder as in Table 2 by subtracting a number which is equivalent to or less, then by converting it to the day in Table 1 so as to be able to know the day of the 1st of Mes (Sept) 1st of any year.

Exercise 3

A. What was the day of Mes(Sept) 1st of 1960 AD?
1960–1400= 560...560-560=0 or, 1960/700 =2, and the remainder is 56...56 – 56=0. In Table 1, 0 represents Mak(Tues), and therefore, it was on Mak(Tues).

The last two digits, tens and units digits, of any year are Referred to as year and those which are found beginning From hundreds and less are known as century.

For example: the century of 5 A.D is 00, because, 5 A.D means 0005. The century of 1968 A.D is 19, and its year is 68. The century of 58214 A.D is 582, and its year is 14.

Thus, as per the exercises above, since it would be difficult to divide all the digits of a year by 28 or 700 easily, we can proceed by dividing the century by 7 and by relating the remainder with the year by putting it in the hundreds place, and by reducing it below 700.Then by deducting the number which is less among those in Table 2, we would be able to know the day of Mes(Sept) 1st of the year by referring to the remainder as in Table 1. I prefer 7 because 7 is a factor of 28 and 700.

Exercise 4

On which day was Mes (Sept) 1st of 1823 E.C?

18÷7=2, and the remainder is 4; so if we put the remainder in hundreds place with the year 23, it becomes 423, and the number which is less than 423 in Table 2 is 420. When we deduct this number, 423-420=3; 3 represent Arb (Fri) in Table 1.

C. The first day of every month:

The first day of every month which is referred to as '*Lideta*' among Ethiopians increases by 2 days or leaps by one day from the first day (*Lideta*) of the previous month.

For instance, if we assume that Mes (Sept) 1st of the year 2015 will be on Ehu (Sun), Tik (Oct) 1st Ehu (Sun) + 2days = Mak (Tues)...Hid (Nov) 1st Mak (Tues) + 2 days = Ham (Thurs)...Tah (Dec) 1st Ham (Thurs) + 2 days = Kid (Sat)... thus, the first day of each month can be known. My mother knows the days of a year by remembering in her mind the first day, that is, the Ethiopian New Year (*Inkutatash*), and by calculating the first day of each month as mentioned above, then by adding 7 days and getting the first day of a month, she can get the wanted day of the month of her interest by counting both backwards or forwards. As indicated above, if we consider the first day of every month by adding 2 days on the day of the 1st of Mes (Sept), with an exception to the month of *Meg* (Mar),

those from Mes (Sept) up to Yek (Feb) and those from Miy (Apr) to *Pagumae* have similar days.Therefore, it is possible to know the first day of any month by assigning few numbers of days to each month. In order to further clarify this, we assume that the day of Mes (Sept) 1st is Ehu (Sun). In order to get the first days of each of the months, it is necessary to know the number of days that we have to add to Ehu (Sun).

Table 3

If the day of 1st of Mes (Sept) is Ehu (Sun),		The month number given to each month.	
Ehu (Sun)	+0 = Ehu(Sun)	Mes (Sept) and Miy (Apr) =	0
››	+1 = Seg(Mon)	Tir (Jan) and Neh (Aug) =	1
››	+2 = Mak(Tues)	Tik (Oct) and Gin (May) =	2
››	+3 = Reb(Wed)	Yek (Feb) and Pagumae=	3
››	+4 = Ham(Thurs)	Hid (Nov) and Sen (Jun)=	4 (-3)
››	+5 =Arb(Fri)	Meg (Mar) =	5 (-2)
››	+6 = Kid(Sat)	Tah (Dec) and Ham (Jul) =	6 (-1)

Exercise 5

A. What was the day of Hid (Nov) 1st of 33 A.D of E.C?
33÷28=1, and the remainder is 5; number 5 represents Seg (Mon) Mes (Sep) 1st in Table 1.
Now, when we add the month number of the month of Hid (Nov) as in table 3, Seg (Mon) + 4 days= Arb (Fri).

B. What will be the day of *pagumae* 1st of the year 3067 A.D?
To calculate in accordance with the sequence of the question, we add the number of dates of the month of our interest to the month number. Thus, 1 + 3= 4…. 4 is greater than the first day of the month which is 1 by 3 or 4 -1=3. Thus we bear in mind 3 days and proceed to calculate the day of Mes (Sept) 1st:
30÷7= 4 and the remainder is 2...267-252=15 Kid (Sat) Mes (Sept)1. Now, we add the 3 days we have in mind and Kid (Sat) + 3 days= Mak (Tues).

D. Days of the dates of every month

Once the day of the first date of a month is known, in order to know the days of the dates in a given month, first, we are required to add 7 days on the first day of the month and to proceed getting similar days.

For example, if the first day of a month is Seg(Mon), we add 7days and:1+7=8..8+7=15..15+7=22..22+7=29..29+7=36; thus, the 1st, 8th, 15th, 22nd, 29th and 36th dates are on Seg (Mon).

Even though there is no 36th date in a month, we use it because it is important for the calculation. Hence, if we are asked about the days in a month, once we have come to know the first day, we consider that the 1st, 8th, 15th, 22nd, 29th and 36th are similar days and we take the day nearest to the date of our interest and we add or subtract the difference between them to get the exact day.

.Exercise 6

A. If Sen (Jun) 1st is on Arb (Fri), what would be the day of Sen (Jun) 24th?

If Sen (Jun) 1st is on Arb (Fri), a date that is Arb (Fri) and that is nearest to 24 is 22, thus: 22+2=24; hence, Arb (Fri) + 2 days = Ehu (Sun).

B. If Tik (Oct) 1st is on Reb (Wed), what would be the day of Tik (Oct) 13?

Since Tik (Oct) 13 is the date which is nearest to 15 among the dates on which it is Reb (Wed), 15-2=13, and Reb (Wed)-2 days = Seg (Mon).

If we have thoroughly understood the explanations given so far, that is, to be able to calculate the first day of every year, Mes (Sept) 1st, as well as the day of the first date of any month, it would be quite easy for us to be able to get answers to the questions that are quite deeper and related to year, month and dates.

CHAPTER TWO

2. HISTORY OF THE JULIAN CALENDAR (J.C)

In 46 B.C it was the Roman Caesar by the name Julius who realized that the hitherto used Roman calendar was not accurate. Thus, he invited the Alexandrian astronomer whose name was Sosigenes to amend it. Based upon the ancient Egyptian calendar as well as the Sun, Sosigenes amended the calendar which had only 365 days so that three consecutive years would have 365 days and the fourth year, which is the leap year, would have 366 days. He also divided the months in a year into 28 -- 31 days and named the months using the names widely used among the Romans. Accordingly, the idea that Sosigenes came up with was accepted by Julius Caesar who afterwards declared a law which made the usage of this calendar official. This calendar had been in use until 1582 without any flaw. It is still in use among followers of the Orthodox Christianity in the Far East. While the Julian Calendar has close similarity to the ancient Egyptian calendar, as mentioned earlier, it also has a considerable similarity to the Ethiopian Calendar in regard to the number of days contained within a year.

The Months and Days in the Gregorian and the Julian Calendars

As mentioned earlier, in relation to the Ethiopian calendar, the numbers of days in the months as well as the weeks of a year in the Gregorian and the Julian calendars are similar.

Sept., Apr., Jun., and Nov., have thirty days each.
The rest of the months have thirty one days each.
Feb. has twenty-eight days and it has 29 days in leap year.

A. The Date January 1st

In regard to the Julian as well as the Gregorian Calendars, it is necessary to know first the day of the first month of a particular year, in order to know the days of every month in that year.

I have come to be familiar with the Julian and the Gregorian calendars for the first time through that regular calendar which was designed by Ato Ashenafi Assefa and which was meant to serve only for the period from the 1^{st} to the 25^{th} century. Thus, in order to be able to identify the days of the dates of the months of any given year in the Julian Calendar, I began to search for a method by which I might be able to find out which day will be the date January 1^{st}. I made attempts in this regard with a question in mind as to the reason why Tir (Jan) 1^{st} of the Julian Calendar does not concur with Mes(Sept) 1^{st} of the Ethiopian Calendar. And the quest with this question in focus led me to a better achievement.

Method 1:

a. Adding three days to Mes (Sept) 1^{st} of the Ethiopian Calendar,
b. I proved that whenever the year could be divided into 4 without any remainder just as is the case with the Year of St. John (Leap Year), it then is possible to know the day of the Julian (Jan) 1^{st} simply by adding only two days.

Exercise 1:

What was the day of the date (Jan) 1 of the year 1730 in the J.C ?

17 ÷7 = 2, and the remainder is 3…330 – 308 = 22, i.e. Seg (Mon) as the day of Mes (Sept) 1; but since the year was not the Year of St. John, Seg (Mon) + 3 days = Ham (Thurs): and therefore, Jan 1 of the year 1730 was on Thursday.

Method 2:

As mentioned earlier, since the Julian Calendar has very close similarity to the Ethiopian Calendar and also returns every 28 years and begins with the same day and date, I assumed that if I could get Mes(Sept) 1^{st} of the Ethiopian Calendar using Table 1, I would also be able to get the Julian January 1 by adding 3 days on the days specified in the same Table.

Example: Whenever the Ethiopian Mes (Sept) 1 is on Reb (Wed), that of the Julian is on Reb (Wed) + 3 days = Saturday….. 2=Ham (Thurs)+3 days= Sunday, and it goes on in this manner.

Any interested person can prepare this Table for himself and use it. But it is important to remember that, whenever it is a leap year, (Jan) and (Feb), each has one day less, from the final result.

B. The Day of Date 1^{st} of Each and Every Month

In order to learn what day is the date 1 of each and every month is, as well as what days the dates of the months are, in the Julian and the Gregorian Calendars, we need only to follow one similar method. In both the calendars, once we knew which day was January 1^{st}, we only need to know the numbers corresponding to the months, in order to learn which day would be date 1 of the rest of the months. The numbers that correspond to the months can be used for the Julian as well as the Gregorian calendars, just in the same manner as mentioned in Table 3 in relation to the Ethiopian Calendar. For example, if we assume (Sun) is (Jan) 1^{st}, then the numbers of the months to which we make the additions to get the first day of each month would be as follows:

Table 4

Numbers to be added			Names of month		No. Of the month
(Sun) + 0	=	Sun	Jan . . . Oct	=	0
(Sun) + 6 (-1)	=	Sat	Apr . . . Jul	=	6 (- 1)
(Sun) + 5 (-2)	=	Fri	Sept. . . Dec	=	5 (- 2)
(Sun) + 4(-3)	=	Thurs	Jun	=	4 (-3)
(Sun) + 3	=	Wed	Feb...Mar.. . Nov	=	3
(Sun) + 2	=	Tues	Aug	=	2
(Sun) + 1	=	Mon	May	=	1

When we use Table 4 above, if the year is a leap year, once we have calculated and reached at a required date, we subtract 1 day from the end date for the months of (Jan) and (Feb).

Exercise 2:

a. What day was (Apr) 1 of the Julian year 1953?

19 ÷7 = 2, and the remainder is 5… 553-532 = 21,i.e.,(Sun) (Sept)1st in E.C

Thus, Sun + 3 days = (Wed) (Jan) 1st.

Since the No. of the month, according to table 4, is 6 or -1, we add this to the date and thus learn that (Wed) + 6 or -1 day = Tuesday

b. What will the day for the date Feb 1, 2080 be?

20÷7 = 2, the remainder is 6… 680 - 672 = 8, i.e., (Fri) (Sept) 1 in E.C. Thus, (Fri) + 3 days = (Mon), (Jan) 1. If we then add the No. of (Feb) to the required date, we find 3 + 1 = 4; and since 4 is a close proxy to 1 than the rest of the first dates of the month, and since 1 + 3 = 4, (Mon) + 3 days = Thursday. However, if the year is a leap year, we subtract 1 from our last result i.e. Thursday-1 day = Wednesday.

C. The Days of the Dates of the Months

Just as we have seen in relation to the Ethiopian Calendar, in the case of both the Julian and the Gregorian Calendars, too, in order to know the days of the dates of the months, we should proceed by adding 7 to the 1st days of the months, and then we shall in this way be able to find similar days and reach at the required date. Therefore, we find similar days on 1 ... 8...15...22…29...36. dates.

Exercise 3:

If (Sept) 1 is on (Mon), on what day will (Sept)18 be?

a. Since 18 is closer to 15 than it is to the rest of the first days of the months, and since 15 + 3 = 18 or 18-15 = 3 thus (Mon) + 3 days = Thursday.
b. If (Feb) 1 is on Wednesday, on what day will (Feb) 20 be? 20 is closer to 22 than it is to the other dates which lie on (Wed), and since 22 – 2 = 20 thus (Wed) – 2 days = Monday.

So far, we have been able to understand the ways in which we can get the day of (Jan)1st in any year, the days of the first days of the months, and the dates of each and every one of the dats. In the months, we must thus have been able also to answer any general question as to what the day of any date of any particular month in a given year will be.

Exercise 4:

What day was Apr 26, 1999 of the Julian calendar?
19÷7=2, and the remainder is 5….599–588=11,…in Table 1 11=Monday, thus Monday + 3 days = Thursday January 1st.Then we should add the No. of (Apr) in Table 14 to the required date, and thus we find 6 + 26 = 32; and since 32 is closer to 29, and since 29 + 3 = 32 or 32-29 = 3. Thus….Thursday + 3days = Sunday. Therefore, we conclude that the required date was on Sunday.

Or still we can proceed first by adding the No. of the month to the required date and by identifying the date to which it is more closer to a proxy, and then once we get the day of date 1 of the year i.e., (Jan)1, then we add this to it and be able to solve our question. For the sake of a quicker solution, we can permanently get this into our memory by writing the No's of the months, as given in Table 4, on the joints of the fingers of our left hands, beginning with the lower joint of the little finger and proceeding up to the upper joint of the index finger, and by studying it carefully.

And once we have succeeded to retain the memory, it will surely be of great benefit to us for a very long time. Moreover, it will be of a great help to memorize by heart that 0 = Mak (Tues); 10 = Ehu (Sun); 20 = Kid (Sat); 30 = Ham (Thurs); 40 = Reb (Wed); 50 = Seg (Mon); 60-Ehu (Sun) 70 = Arb (Fri); 80 = Ham (Thurs); 90 = Mak (Tues); 11, 22, 33, and 44, = Seg (Mon); 55, 66, 77, and 88, = Ehu (Sun); 99 = Kid (Sat);112,224,336,448,=Mak(Tues).

100 = Seg (Mon); 200 = Ehu (Sun); 300 = Kid (Sat); 400 = Arb (Fri) 500 = Ham (Thurs);600 = Reb (Wed); 700 = Mak (Tues).

D. Permanent Calendar 2

1. We can get the key No. of any given year (K.Y) based on the remainder we find by dividing the calendar year by 28

Rem	K.Y		Rem	K.Y		Rem	K.Y		Rem	K.Y
1	0		8	2		15	3		22	5
2	1		9	3		16	5		23	6
3	2		10	4		17	6		24	1
4	4		11	5		18	0		25	2
5	5		12	0		19	1		26	3
6	6		13	1		20	3		27	4
7	0		14	2		21	4		0	6

2. Dates of a Month from 1 to 31 (M.D)

The Procedure for the solution

We should calculate [(K.Y)+(M.D) + (K.M)]÷7,and change the remainder number unto a day by using the No. of the date. (K.D)

Thus, it is calculated by adding the key number of a year to the dates of a month and the key number of the month; then to divide the sum by 7 and change the remainder to a day by using the key number of the day.

Ex.:4. A. Using the Calendar, what was the day of June 17, 1325 J.C? 13 ÷ 7 = 1, the remainder is 6…625-616= 9, the month day parallel to the remainder 9 (K.Y) = 3. .. The required date (M.D)=17; the key number of the month of June = 3… 3+17+3=23…23 ÷ 7 = 3, the remainder is 2; so when we check the day which is found parallel to the remainder 2,in (K.D) we get Monday,

B What will be the day of Oct 20, 2096 G.C?

Even though the exposition about finding the days of (Jan) 1st of the Gregorian calendar will be given in the succeeding sections, we say that a day on which it will be (Jan) 1st 2096 is (Mon).

Name of the Months	Month No. (K.M)	Name of the days	4.No. of the days(K.D)
Leap Year January =	5 (-2)	Sun =	1
Leap Year February =	1	Mon =	2
Jan ... Oct =	6 (-1)	Tues =	3
Apr...Jul =	5 (-2)	Wed =	4 (-3)
Sept..Dec =	4 (-3)	Thurs =	5 (-2)
Jun =	3	Fri =	6 (-1)
Feb...Mar...Nov =	2	Sat =	0
Aug =	1		
May =	0		

In days key, (Mon) would be changed to 2. Therefore, the year number (K.Y) = 2, The required month day = 20, the month number of (Oct) = 6… 2+20+6 = 28 . . . 28÷7=4, the remainder is 0 and when we change it to a day by using (K.D) we get Saturday.

NB. When we use this calendar, in a leap year, we are required to take the month numbers which are found parallel to the leap year (Jan) and leap year (Feb). In order to get the exact day.

E. Results Obtained Based upon Hints

In Table 4, which has been used commonly for J.C. and G.C., the numbers of the months were not calculated based upon the day of Mes (Sept) 1st of the Ethiopian calendar. Thus, especially, in Julian calendar, I feel that the process of calculating days is quite long. But since I couldn't help it , even if I hade the desire to improve it, I gave attention to the news that before changing the Julian Calendar to the Gregorian Calendar by Pope Gregory, the first month of a year had been the month of March. Then I began to investigate the mechanism by which I could know the days of (Mar) 1st, if the first month of a year had actually been (Mar). One of the experiments that I made in this regard came to be successful and I confirmed that I could know the days of (Mar) 1st of the Julian Calendar just by deducting 1 day from Mes (Sept) 1 of the Ethiopian Calendar. This method also works for those months that have the same month numbers, such as Nov. and Feb. as in Table 4. With this result, I was surprised and inspired to find the month numbers to stop the long process of finding January 1st. I then successfully drafted all the month numbers as in Table 5.

For example: if we assume that the day of Mes (Sept) 1st of the Ethiopian Calendar will be Ehu (Sun), in order to figure out how many day numbers have to be added (subtracted) on Ehu (Sun) refer to the The next Table.

Table 5

To be added on Ehu (Sun)		Number of each month	
Ehu(Sun)	+3	Jan…... Oct…………….	3
>>	+2	Apr…. July …….…… .	2
>>	+1	Sept …. Dec ………..….	1
>>	+0	June ……………………	0
>>	-1	Nov .. Feb… Mar……	-1
>>	-2	Aug ………………… .	-2
>>	-3	May ……………… . . .	-3

When we use the above table. If the year is a leap year, it would be one day less from our last result in the months of (Jan) and (Feb).

Exercise: 6.

What was the day on which it was (Apr) 2, 1940 J.C? The number for the month of (Apr) is, as in Table 5 = 2, and the day of month required = 2 ….. 2+2 =4; and since 4 is, among the date which it is the first of day a month, the one which is nearest is 1…4-1 =3; when we proceed, to find the day of Mes (Sept) 1st by bearing in mind the 3 days which would be added, 19 ÷ 7 =2, the remainder is 5….540 – 532 = 8; and in Table 1, 8 is (Fri), (Sept) 1. When we add the above 3 days that we bear in mind, (Fri) + 3 days = Monday. For those months having negative month numbers, if you get the result 0,-1, and -2 after subtracting from the day asked, don't forget subtracting the 1st day of the month. Thus (0-1 = -1), (-1-1=-2) and (-2 -1 = -3) must be in mind before calculating the day of Mes (Sept). 1st of the year.

Exercise 7. What is the day on which May 2, 867768 J.C?

The month N^0 for the month of May in table 5 is -3 when we add this with the day asked 2-3 = -1 when we subtract from our result the 1st day of the month -1 - 1= - 2. Be aware of the fact that we bear in mind -2 days and start calculating Mes (Sept). 1st of the year. 8677÷ 7 = 1239 Rem 4 --------- 468 -448 = 20 .... 20 in Table 1 means Saturday, when we subtract from it the -2 days that we bear in mind, Saturday – 2 days = <u>Thursday</u>.

NB. In order to be able to compute the day of every month of each year in the Julian Calendar without option to usage of any adding machine, it is mandatory to learn by heart Tables 1,2, and 5. To be able to remember Table 5, it is advisable to represent it as Table 4, with the fingers of the left hand.

" The Millenniums in J.C can be known by adding 4days as was explained in E.C. Thus, if (Jan) 1st of the year 1000 was on Monday

Thus the year 2000 was Monday + 4days = Friday,

" " 3000 will be Friday + 4days = Tuesday,

" " 4000 " " Tuesday +4days = Saturday etc... "

CHAPTER THREE

3. The Gregorian Calendar (G.C)

In order to know the days of the dates of any year in the G.C, first, it is necessary to be able to identify the day on which it is the 1st of (Jan).Due to its complex character, the Gregorian calendar has posed difficulty to grasp contrary to the Julian calendar. Hence, upon my facing the complexity, I attempted to integrate it, just as I integrated the Julian calendar, with the Ethiopian Calendar. In this endeavour, I assumed that I have managed to confirm that (Jan) 1st of the 15th and 16th centuries coincide with Mes (Sept) 1st of the Ethiopian Calendar. However, I later realized that, in the 17th Century, it took a different trend and, to my disappointment, the difference in days becomes wider. I kept on with the experiment by taking other centuries and this has created, a confusion confounded thrice.It was after all this that I began to consider the situation very scrupulously and to mark the differences between the days on a calendar line. The numbers above the line are from (-2) up to (+4), those which are added to or deducted from Mes (Sept) 1st of the Ethiopian Calendar, so as to give January 1st of the Gregorian Calendar. The numbers below the line are centuries in the G.C.

Calendar Lines

0	0	-1	-2	4	4	3	2	1	1	0	-1	-2	-2
15	16	17	18	19	20	21	22	23	24	25	26	27	28
4	3	2	2	1	0	-1	-1	-2	4	3	3	2	1
29	30	31	32	33	34	35	36	37	38	39	40	41	42

0	0	-1	-2......0	0 -	Number of days to be added on Mes 1st E.C
43	44	45	46... 71	72-	Centuries in the G.C

If we closely consider the above calendar line, each century repeats itself after every 28th century and enables to add or deduct equivalent number of days. For instance, the 15th and 16th centuries come to lose any addition on 43rd and 44th, as well as 71st and 72nd centuries. Therefore, I arranged the leap centuries which can be divided evenly by 4 without remainder as follows:

A. Leap Centuries and their Consecutives

15	16	25	34	43	44	53	62	71	72
23	24	33	42	51	52	61	70	79	80
22	31	32	41	50	59	60	69	78	87
21	30	39	40	49	58	67	68	77	86
19	20	29	38	47	48	57	66	75	76
18	27	28	37	46	55	56	65	74	83
17	26	35	36	45	54	63	64	73	82

As we can see above, if each leap year repeats itself every 28th century and gives similar day number, in order to know the number of days that are to be added by merely dividing the leap century by 7, on the Ethiopian Calendar, Mes(Sept) 1st, to arrive at (Jan) 1st of the Gregorian Calendar, I have drawn up the following Table.

Table 6

Leap centuries	Remainder of Leap century divided to 7	Days to be added to or Subtracted from Mes (Sept) 1st
16…..44…72….100.., etc	2	0
24….52….80….180.., etc	3	1
32….60….88….116…etc	4	2
40….68….96….124… etc	5	3
20….48….76….104… etc	6	-3
28….56….84….112….etc	0	-2
36….64….92….120….etc	1	-1

In leap years and in the months of February and January, one day is to be subtracted from every century that can be divided evenly or without remainder, after some years. The century behind the leap century delays only with 1 number, while the remaining centuries vary from each other with 9 units. Accordingly, it would take 9 + 9 + 9 + 1 = 28 centuries to arrive at the next leap century from one century.

For example: if we take the 16th leap century: 16 + 9 = 25
25 + 9 = 34 … 34 + 9 = 43 . . . 43 +1 = 44. In order to fully understand this, it is necessary to thoroughly consider the Table of leap centuries and their consecutives.

Exercise: 1

A. What was the day of January 1, 1816 G.C?

18÷7=2, the remainder is 4…416-392=24 Ham (Thurs), Mes(Sept) 1st.

The leap century of the 18th century: is 18 + 10 = 28… 28 ÷ 7 = 4, the remainder is 0. When the remainder is 0, according to table 6, it is necessary to subtract 2 days Thus Ham (Thurs) – 2 days = Mak(Tues). Because of a leap year,…. Tuesday – 1 day = Monday

What will be the day of (Jan) 1st, 2190?

21÷7=3. The remainder is o. Thus there is no number to be put in hundredth place with the year 90. Thus, 90-84=6 Tuesday, Mes (Sept) 1st. The leap century of the 21st century: 21-9=12…12÷7=1. The remainder is 5. When the remainder is 5 according to table 6 three days are to be added. Thus, it was Tuesday +3 days = Friday.

B. How to Get leap Centuries

Even though people have been using the term "leap year," I was compelled to use the leap century for the first time due to my formula to get (Jan) 1st of Georgian Calendar, based upon Mes (Sep) 1st of Ethiopian Calendar. Indeed, I am a trailblazer of this matter.

January 1st of the Julian & Gregorian Calendars are not leaps over the days of a year which are consecutively being referred to as the year of St. John (Leap year) according to the Ethiopian Calendar, when the year can evenly be divided by 4 without remainder but with a remainder of 1.

For example:2080, January 1st would be (Mon) for G.C & (Sun) for J.C

2081, January 1st would be (Wed) for G.C & (Tues) for J.C

2082, January 1st would be (Thurs) for G.C & (Wed) for J.C

2083, January 1st would be (Fri) for G.C & (Thurs) for J.C

2084, January 1st would be (Sat) for G.C & (Fri) for J.C

2085, January 1st would be (Mon) for G.C & (Sun) for J.C

Thus, the years which are leaped over are 2081 and 2085. This happened because, in a given leap year, the months of January and February are less by one day.

For example: If we take the centuries that require addition of one day on Meskerm 1st of the Ethiopian Calendar, in order to get January 1st of the Gregorian Calendar, it proceeds as 23-24-33-42-51-52, etc. Those which can be divided by 4 evenly without remainder, which delays by 1 century, 23 and 51, have the leap century which is also the leap century before them. Hence, 23=24,51=52. In order to arrive at the leap centuries of those centuries beyond the centuries which are less by one century, such as 22 and 42, 9+1=10 centuries would be added so as to get their leap centuries =32 and 52.

The centuries before the leap centuries, such as 33 and 61 are arrived at by subtracting 9. Thus, it is necessary to subtract 9 centuries from them 33-9=24……61-9=52. To arrive at a leap century from another leap century, as indicated previously, it is necessary to keep in mind that adding 9+9+9+1= 28 is required. As stated above, if we can get the leap century, we can then divide it by 7 and, using the remainder, we can refer to table 6 to know the number of days we have to add/subtract from Mes (Sept) 1st of the Ethiopian calendar in order to know the day on which it is January 1st Gregorian Calendar.

> Leap centuries are always computed based upon the centuries in the Gregorian Calendar

C. History of the Gregorian Calendar

The major reason that led the Italian Pope Gregory 13th of the Roman Church to amend the Julian Calendar in 1582 was the fact that the Julian Calendar had extra minutes and seconds. These extras had been accumulated to the extent that their cumulative sum resulted in the disruption of the exact timings of the religious holidays of the year. The pope was assisted by two professionals whose names were Christopher Clavius a Bavarian Jesuit and Aloysius, a Neapolitan astronomer and physician. Together, they started to adjust the 365 days and 48 minutes and 46 seconds which had already got an approval for its exactness. They indicated the difference between the two calendars as follows:

	Days	Hours	Minutes	Seconds
J.C	365	5	59	60
G.C	365	5	48	46
Difference	-	-	11	14

The following discrepancy of 11 minutes and 14 seconds is observed based upon the year of the Sun. Yet there is discrepancy in the months of a Moon too.

	Days	Hours	Minutes	Seconds
J.C	29	12	44	25
G.C	29	12	44	3
Difference	-	-	-	22

The discrepancy of 11 minutes and 14 seconds indicated above had been accumulated and reached 10 days since the time when the 325 Nicean Dite was held upto 1582. Therefore, the Pope decided to deduct these extra days and to make corrections as follows:

1. He deducted the extra 10 days so that (Oct) 5 should become (Oct) 15.

2. In order to prevent the accumulation of such extras in the future, he declared a proclamation which was referred to as the Gregorian rule. It was stated in the proclamation that "any year which can be divided by 4 evenly would be taken as a leap year and the number of days in it shall be 366, as it had been the case with the Julian Calendar. However, when it is a multiplier of 100 and cannot be divided evenly by 400, it should not be taken as a leap year; accordingly, the number of days shall be 365, and every 400th year, 3 days can be deducted which help to balance the extra minutes and seconds."

D. Exposing the Gregorian Calendar

a) Unlike what many people claim and write, the pope must have deducted 10 days so that (Oct) 15 would become (Oct) 5. Otherwise, the pope must have added 10 additional days.

b) If the Julian calendar gives extra 11 minutes and 14 seconds, the cumulative sum of these in 400 years must be only 3 days or 72 hours. When we consider this, there are 2 hours, 50 minutes and 24 seconds extra. There should have been due concern for the effect of the accumulation of these extras too.

According to the Gregorian correction, the 10 days which were deducted were so made by counting the years which cannot be divided evenly by 400, beginning from the Nicean Dite, such as 300,500---1500. Using a line which I have created by integrating the Gregorian Calendar with the Ethiopian Calendar, I extended the Gregorian Calendar backwards so that its century starts from 00.

2	+4	+3	+2	+2	+1	0	-1	-1	-2	+4	+3	+3	+2	+1	0
00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15

According to this line of calendar, the 10 centuries from the 3rd century up to the 15th century which were claimed to have been not divided by 400 evenly are, according to the Ethiopian Calendar, the years of St. John (leap year) and, therefore, 10 days have been leaped over.

However, according to the Gregorian Calendar, they were not considered as leap years. Hence, in order to prove that 10 days have been deducted, when they are added to get Tir (Jan) 1st, based upon Mes(Sept) 1st of Ethiopian Calendar, we leave those which are leap years in accordance with the Ethiopian Calendar. Then, if we consider those which had been deducted; in the 7th century, it was (-1), in 9th century (-2), and when we add them up, it was -3 days. Those which were added; 2 days in the 3rd, 1 in 5th, 4 in 10th, 3 in 11th, 2 in 13th and 1 in14th are 13 days; and the difference is13-3= 10 days. Thus, it is equivalent to the Ethiopian Calendar; and therefore, there was no discrepancy of 10 days which had been deducted. On the other hand, in order to know the date of the Gregorian Calendar when it is Mes (Sept) 1 of the Ethiopian Calendar, and how this varies from one century to another, how it again comes to coincide with each other, it is necessary to consider by taking the remainder of the division of the leap century of each century by 7 as follows;

Table 7

Centuries	Leap centuries	Remainder	Sep.	Days to be added
15 16	16………44	2	8(9)	0
17	36. 64	1	9(10)	-1
18	28………56	0	10(11)	-2
19 20	20………48	6	11(12)	+4
21	40……….68	5	12(13)	+3
22	32………..60	4	13(14)	+2
23 24	24………..52	3	14(15)	+1
25 26	16……….44 36……….64	2 1	8(9) 9(10)	0 -1
34 35. 36	44………72 36………64	2 1	8(9) 9(10)	0 -1
43 44 45	72………100 64………92	2 1	8(9) 9(10)	0 -1

The numbers in brackets are the years of St. John according to the Ethiopian Calendar. In table 7, the 7 days in 15th century and 24th century from Mes(Sept) 8(9) to Mes(Sept) 14(15) increase by one day in the Gregorian Calendar and they had never been deducted. Such an event repeats itself every 9th century. Therefore, there is no such a thing as the deducted day as the Pope had claimed. In order to make it clear, let us see the numbers which are the multipliers of 100 from which it had been claimed that deductions were made.

Table 8

Years	Eth. Calendar	Julian Calendar	Gregorian Calendar
1500	Segno	Wed	Mon
1600	Ehud	Tues	Sat
1700	Kedame	Mon	Fri
1800	Arb	Sun	Wed
1900	Hamus	Sat	Mon
2000	Rebu'i	Fri	Sat
2100	Maksegno	Thurs	Fri
2200	Segno	Wed	Wed
2300	Ehud	Tues	Mon
2400	Kedame	Mon	Sat
------	--------	--------	--------
4300	Segno	Wed	Mon
4400	Ehud	Tues	Sat
7100	Segno	Wed	Mon
7200	Ehud	Tues	Sat

Table 8 above shows years that are the multipliers of 100, from 1500 up to 7200 the days of Mes (Sept) 1st in the Ethiopian Calendar and (Jan) 1st in the Julian and Gregorian calendars. Accordingly, in the 15th century, Mes(Sept) 1st of the Ethiopian Calendar was on Seg(Mon); in the Julian calendar (Jan) 1st was on (Wed) and in Gregorian calendar, (Jan) 1st was on (Mon).

In this way, the Ethiopian Calendar and the Julian Calendar repeat the same day after 7 hundred years, while Gregorian Calendar does so after 400 years. All leap years in the G.C are on (Sat). Its cycle was short , because (Sun), (Thurs), or (Tues), were jumped over. Thus the G.C could not count the days of a week correctly backward as that of the E.C and J.C

This means, therefore, that the Pope subtracted the days, not from the correct number of days in a year, but from the cycle. Consequently, the Ethiopian and the Julian Calendars roll round the cycle four times in every seven centuries and reach the 28th century. The Gregorian Calendar, too, cycles seven times in every four centuries and reaches the 28th century. And thus, all the three calendars again come at a parallel and uniform distance in the time their dates and days begin to match.

We can conceive this with the help of the following examples: If we put a sign (e.g., a drop of ink) on the surfaces of two barrels, the one with the circumference of 70cm, and the other with 40cm, and make them roll after aligning the signs at the same position or direction, the number of the complete rolling cycles at which the signs on both the barrels come again to match each other at the initial position will be the fourth for the bigger barrel and the seventh for the smaller barrel. To take another example: If two airplanes set off to fly one full circle around the world, each one making its leave in Addis Ababa Bole Airport, on the same day and at exactly the same time as the other, also carrying the same amount of weight, e.g., $365^1/_4$ kg of coffee, and if the one has to land 4 times to fill up fuel and the other 7 times, they would return to their initial place at the same time and, therefore, it is impossible that any one of them would outdo the other. Therefore, if this was the case, as the Pope and his allies would have liked us to believe, that there had been any day that was subtracted and had not been accounted for, both the Ethiopian as well as the Julian Calendars would have been lagging behind.

Though the Gregorian Calendar had gained acceptance among the Catholics since 1582, it could not have been accepted among the German Protestants until 1700 A.D And the Ethiopian Orthodox Church has never given it any recognition or approval so far.

Therefore, as it was believed and got an acceptance all over the world, including in the greatest encyclopaedia, as the pope had made any actual correction to the Julian Calendar by subtracting 3 days in 400 years, must be left out of any account.

E. Replacing a Century with a Century

As I have the feeling that the previous methods I presented, as to how we might be able to know the months and dates of any year in the G.C are not easy to grasp, I should like to venture to provide another easier method. Having been examining it carefully, I succeeded and was able to, discover that it will be easier and more efficient a method to replace all the leap-centuries with the 16th century, I followed this notion and ventured to replacing all the centuries (e.g., 19th, 23rd, 27th, etc centuries) that are less than the leap-centuries by one century, with the 15th century as well as those centuries greater than the leap centuries by 1 century, e.g. (21st, 25th, 29th centuries) by the 17th century and those centuries next to the century above the leap centuries (e.g. 22nd, 26th, 30th, centuries) by the 18th century. With this method, I could solve any problem with regard to the date Tir (Jan) 1st. The reason why this method, is easier and better than the previous ones is that there is no need for any addition to Mes(Sept) 1 of the Ethiopian calendar for the 15th and 16th centuries, and it lags behind only by 1 day in the 17th and by 2 days in the 18th centuries.

Table 9

Replaceable centuries	Number of the days to be subtracted
15	0
16	0
17	- 1
18	- 2

In leap years, 1 day should be subtracted from Tir (Jan) as well as Yek(Feb).

Exercise 1:

a. On what day was (Jan) 1 of the Gregorian year 1999?
19th century is less than the 20th century by 1 century, and thus it is to be replaced by the 15th century, becoming 1599. To find the required date by using the replacing century, 15 ÷7 = 2, and the remainder is 1. . 199 – 196 =3 Arb(Fri) = Mes (Sept) 1.
Then we refer to table 9 to find the number of days to be subtracted, and that is 0; that means, there is no number of days to be added to Friday; and therefore, the date Jan 1st was on Friday.

On the other hand, it is possible to solve the same problem by dividing any given century by 4, and using the remainder to identify the century it should replace.

Therefore, if the remainder is 3 by the 15th century, or if the remainder is 0 by the 16th century, if 1 by the 17th century and if 2, we can replace them by the 18th century; and thus we find Mes(Sept) 1, after which we shall be able to refer to Table 9 in order to find out the number of days to subtract and the day on which it was Tir(Jan) 1st.

b. What day will be (Jan) 1, 407025?
Taking the tenths and units digits of the century, which is 70, then 70 ÷ 4 = 17, the remainder being 2. Since the remainder is 2, 70 should be replaced by 18th century, and then if we parallel it with 25, we find 1825. Now we find (Sept) 1 of 1825. Thus: 18 ÷7 = 2, and the remainder is 4;.... 425 – 420 = 5, i.e., Monday , Mes(Sept) 1; then we refer to table 9 and find out that we should subtract 2 days from this, thus (Mon) – 2 days = Saturday.

C. Once we have been able to solve such problems as in the above examples, it should then be easier for us also to solve any question with regard to particular months and days.

What day will be December 30, 17654984?

49÷4 = 12, the remainder being 1; therefore, it should be replaced with the 17th century, and when we match it with the year, it can be 1784....17÷ 7= 2, and the remainder is 3; therefore,384-364 = 20, i.e., Saturday, Mes(Sept)1.Since we should subtract 1 for the 17th century,(Sat)–1day= (Fri), (Jan) 1; then we take 5, which is the number corresponding to (Dec) in table 4, we add 30 to it, and we find 30 + 5 = 35; since 35 is proxy to 36 from among the days on which the first date of the months lie, and since 36 - 1 = 35, we are able to learn that Fri – 1day = Thursday.

F. The Magical Formula

We have so far seen somehow complex and yet helpful methods by which we can learn how to get the days of any given year. However, I ventured farther with the aim to come up with still better methods.

First supposed that, if it had been possible that (Jan) 1st of the 15th and the 16th centuries match with Mes(Sept)1 of the Ethiopian Calendar, it should be possible also that there is a way for the 17th and 18th centuries to match in the same manner. From this, I proceeded to find out if there was any century that could work by replacing the 17th century but this did not bring the success I hoped for. However, I did not lose hope; I set myself at finding another alternative. Then I resorted to the notion that it should be better to leave the century rather than depend on it. This way I could succeed at finding the Gregorian (Jan) 1st by adding 3 days to the Ethiopian Mes(Sept) 1. This success somehow led me to another. I sought a century that could replace the 18th century, and found one that would require me to add only 1 day. Though these two are adequate enough as far as I am concerned,

I sought a number of a day that could replace the 15th and 16th century, and I have come to realize that I needed to subtract only 1 from the 15th century and only 2 from the 16th century.

Therefore, one could replace the 15th, 16th, 17th, and 18th centuries, by -1, -2, +3, and +1, and by adding the replaced numbers on Mes(Sept) 1 of the Ethiopian years from 00 to 99, it is possible to know Jan 1st in G.C

Table 10

Remainders for centuries divided by 4	The number of the days to be subtracted/added on Mes(Sept) 1st
3	-1
0	-2
1	+3
2	+1

In leap years, 1 day should be subtracted from the result in the month of (Jan) and (Feb).

Exercise 2:

What day will be (Jan) 1, 2582?

25÷4 = 6, the remainder being 1; according to table 10, we should add to these 3 days. Mes(Sept)1 will, therefore, be: 82 – 56 = 26, which is Saturday in Table one and according to Table 10, we add 3 days to (Sat). Thus Saturday + 3 days = Tuesday.

NB. In order to be able to solve, only with mental workout, any problem regarding the day of the month of any year in G.C, we can extend Table 1 up to 99, and study by heart and memorize the days of Mes (Sept) 1 and Table 10 and 4 as well.

G. The Days of January 1st

Years				Rem 0	Rem 1	Rem 2	Rem 3
00	-	-	-	Sat	Fri	Wed	Mon
01	29	57	85	Mon	Sat	Thu	Tue
02	30	58	86	Tue	Sun	Fri	Wed
03	31	59	87	Wed	Mon	Sat	Thu
04	32	60	88	Thu	Tue	Sun	Fri
05	33	61	89	Sat	Thu	Tue	Sun
06	34	62	90	Sun	Fri	Wed	Mon
07	35	63	91	Mon	Sat	Thu	Tue
08	36	64	92	Tue	Sun	Fri	Wed
09	37	65	93	Thu	Tue	Sun	Fri
10	38	66	94	Fri	Wed	Mon	Sat
11	39	67	95	Sat	Thu	Tue	Sun
12	40	68	96	Sun	Fri	Wed	Mon
13	41	69	97	Tue	Sun	Fri	Wed
14	42	70	98	Wed	Mon	Sat	Thu
15	43	71	99	Thu	Tue	Sun	Fri
16	44	72		Fri	Wed	Mon	Sat
17	45	73		Sun	Fri	Wed	Mon
18	46	74		Mon	Sat	Thu	Tue
19	47	75		Tue	Sun	Fri	Wed
20	48	76		Wed	Mon	Sat	Thu
21	49	77		Fri	Wed	Mon	Sat
22	50	78		Sat	Thu	Tue	Sun
23	51	79		Sun	Fri	Wed	Mon
24	52	80		Mon	Sat	Thu	Tue
25	53	81		Wed	Mon	Sat	Thu
26	54	82		Thu	Tue	Sun	Fri
27	55	83		Fri	Wed	Mon	Sat
28	56	84		Sat	Thu	Tue	Sun

In the above Table, the columns on the left side are years running from 00 to 99 and those on the right side are numbers, 0 up to 3, which we have as remainders whenever we divide a given century by 4.

According to Table 6. We need 7 columns but since that had been solved for us in the process of replacing one century by anther century, we only need 4 columns to prepare a Table and easily find January 1 of any Gregorian year. Since all the 1st dates of Januaries for leap years had already been correctly put, we do not need to subtract any number during leap years.

Exercise 3:

a. What day was January 1st of the Gregorian year 1500?

15÷4 = 3, and the remainder is 3; on the days of January 1st, if we look at the last raw on the right side among the numbers under remainders to find which corresponds to the year 00, we find Monday.

b. What day will January 1 of the Gregorian year 2440 be?

24 ÷ 4 = 6, and the remainder is 0; looking under the column for 0 remainder and in front of the particular year 40 ,we find that the day will be Sunday.

NB until there is a variation of a century the days of (Jan) 1st repeats themselves on the 6+5+6+11=28years.

Thus , 2001=Mon, 2007=Mon, 2012=Sun, 2018=Mon, 2039=Mon,

2045=Mon, 2040=Sun, 2046=Mon, etc..

H. Permanent Calendar 3

1. In the Gregorian Calendar, we can find the key number of any year (K.Y), by dividing the century by 4. Under the remainder(Rem) numbers 0 up to 3
2. The last two digits of any calendar year are called years.

Key numbers of the year (K.Y)				
Rem 0	Rem 1	Rem 2	Rem 3	Years
0	5	3	1	05 11 16 22 33 39 44 50 61 67 72 78 89 95
1	6	4	2	00 06 17 23 28 34 45 51 56 62 73 79 84 90
2	0	5	3	01 07 12 18 29 35 40 46 57 63 68 74 85 91 96
3	1	6	4	02 13 19 24 30 41 47 52 58 69 75 80 86 97
4	2	0	5	03 08 14 25 31 36 42 53 59 64 70 81 87 92 98
5	3	1	6	09 15 20 26 37 43 48 54 65 71 76 82 93 99
6	4	2	0	04 10 21 27 32 38 49 55 60 66 77 83 88 94

2. Dates of a month from 1 to 31 (M.D)

3. Name of the Month		(K.M)	4. Name of the day(K.D)		
Leap Year January	=	5 (-2)	Sun	=	1
Leap Year February	=	1	Mon	=	2
Jan ... Oct	=	6 (-1)	Tues	=	3
Apr...Jul	=	5 (-2)	Wed	=	4 (-3)
Sept...Dec	=	4 (-3)	Thurs	=	5 (-2)
Jun	=	3	Fri	=	6 (-1)
Feb...Mar...Nov	=	2	Sat	=	0
Aug	=	1			
May	=	0			

The procedure for the solution

We should calculate [(K.Y) + (M.D) +(K.M)] ÷7, and change the remainder into date by using number, of the day (K.D)

The use of the permanent calendar 3

In order to get the days of any year in G.C as indicated on the permanent calendar 3

A. Divide the century of any calendar year by 4 and, looking at its remainders 0 upto 3, take the key number of the year (K.Y) that can be parallel to the last two digits of the calendar year.

B. Take the date of a month 1-31 (D.M) of your interest.

C. Take the key number of the month (K.M) of your interest. By adding them together, divide the sum by 7.

D. Change the remainder number 0-6 to a day using (K.D).

Exercise: 4

. What was the day of July 20 in the Gregorian year of 1849? 18÷4 = 4, and the remainder is 2; when we take a number which is found parallel to the year 49, we find year number = 2, the required day of the month = 20, the number of the month of July = 5. Therefore, 2 + 20 + 5 = 27.... 27÷7 = 3, the remainder is 6; when we change the remainder 6 to a day,using (K.D) we find Friday.

B. What will be the day of Feb 18, 2080 G.C?

20÷4=5 Rem 0--- under the Rem. 0 the number that is parallel to the year 80=3. Thus , (K.Y) = 3--- (M.D = 18 Since the calendar year is a leap year , and the month of our interest is Feb. (K.M) = 1… 3+18+1=22…22÷7=3 Rem 1… 1 in (K.D) **Sunday.**

NB.: During a leap year if you take the number of a month parallel to leap year Jan and Feb, we are not required to deduct 1 day from the calculation.

" The Millenniums In G.C. is always fall on (Wed) and (Sat).

CHAPTER FOUR

4. Converting from One Calendar into Another Calendar

A. Converting from the Ethiopian Calendar into the Gregorian Calendar

The Ethiopian Calendar delays by seven years in all centuries from the Gregorian Calendar from Mes(Sept) 1st to Tah(Dec) (18) 19 upto Tah(Dec) (24) 25, based upon a specific century. However, in the 19th century and the 20th centuries, the delay lasts until Tah(Dec) (21) 22. On the other hand, it delays by 8 years beginning from Tah(Dec) (22) 23 up to Pagume 5 or 6. In the centuries indicated above, Mes(Sept) 1st of the Ethiopian calendar coincides with (Sept) 11(12) of the Gregorian Calendar. In the other months, the beginning of the first day and the permanent discrepancies in the dates, are shown in Table 11.

Table 11&12

The days of months in Ethiopian Calendar	The beginnings and ends of the days of the months of G.C	Permanent differences in days
Mes (1 to 30)	Sept 11 (12) to Oct 10 (11)	10(11)
Tik >>	Oct 11 (12) to Nov 9 (10)	10(11)
Hid >>	Nov 10(11) to Dec 9(10)	9(10)
Tah >>	Dec 10(11) to Jan. 8 (9)	9(10)
Tir >>	Jan 9(10) to Feb 7 (8)	8(9)
Yek >>	Feb 8(9) to Mar 9	7(8)
Meg >>	Mar 10 to Apr 8	9
Meyaz >>	Apr 9 to May 8	8
Ginb >>	May 9 to Jun 7	8
Sen >>	Jun 8 to Jul 7	7
Ham >>	Jul 8 to Aug 6	7
Neh >>	Aug 7 to Sept 5	6
Pag (1 – 6)	Sep 6 to Sept 10 (11)	5

The remainder of the division of the leap century of G.C to 7	(Mes)1st in E.C related to the days of (Sept) in G.C	The number of days to be added on the permanent differences in days in Table 11
6	11(12)	0
5	12(13)	+1
4	13(14)	+2
3 ← ← 0	14(15)	+3
1	10(11)	-1
2	9(10)	-2
	8(9)	-3

Note: The No. in brackets referred to Ethiopians leap year.

In the months of (Jan and (Feb) when it is not a leap year in G.C, specially when the calendar year lasts with two or three zeroes, the monthly permanent day difference we should use as indicated in Table 11, must be the one which is out of the brackets, 8 and 7

Exercise 1:

A. What date was Mes (Sept)1,1773 E.C in G.C?

The difference in years in the month of Mes(Sept) is 7. Therefore,1773 + 7 = 1780 G.C The leap year of the 17th century: 17 – 9 = 8.... 8÷7 = 1. The remainder is 1. According to table 12,we must subtract (-2) from the permanent difference in days in the month of Mes(Sept) in Table 11, since it is not a leap year in E.C . When we take the one outside of the bracket which is 10....10-2 = 8. Eight is the real monthly day difference that should be added to the day required in E.C which is one ...1+8 = 9. Thus it was Sept 9,1780 G.C. The days were matching on Kid (Sat).

B. What date will be Neh(Aug) 19, 2069 in the E.C, in the G.C?

The difference in years is 8, thus 2069+8=2077 G.C. Since the 20th century is itself a leap century, 20 ÷ 7 = 2, Rem 6; according to Table 12, there is no addition of days. Therefore, when we add the permanent day difference in Table 11 which is 6 to the required date, it is 19 + 6 = 25. Therefore, Aug 25, 2077 G.C. Days Reb(Wed) .

C. What is the day on E.C Tah(Dec) 26,26992 in G.C?

26992+8 = 27000 G.C....270+10=280...280 ÷7=40 Rem 0. When the Remainder is zero according to Table 12, we subtract 1 from the permanent day difference, since 27000 is not a leap year, and in taking the figure outside the bracket in Table 11 parallel to Jan is 8. Thus,8- 1=7...when we add this difference to 26, 26+7=33, and this means Jan 3, 27000 G.C days Arb(Fri).

When converting the E.C into the G.C, if we pass into the next or the following month after adding their monthly day difference, we can get the exact date in the G.C according to the addition (Sum), only by adding the monthly day difference of the following month we pass into. If we add the day difference of the previous month in which we are, and if the month date in which we are has 31 days, we should deduct 1 day, if we pass from Feb. to March. And if it is a leap year, we must add one day and if not two days on the sum.

D. What date was Tik(Oct) 25, 1925 in the E.C in the G.C?

Their year difference is 7 years.Thus, 1925+7=1932 in G.C. The leap century of the 19th century is 20. Therefore, 20÷7= 2, the remainder is 6. According to table 12, there is no day to be added, since the year was not a leap year, in the E.C.

We take the monthly day difference in the month of Tik (Oct) the one outside the bracket in table 11, which is 10; hence, when we add 10 to Oct 25, the sum is 35. This means we are passing to the next month of Nov by 5 days above 30.

Since the month of October has 31 days, we subtract one day. And therefore, we get Nov. 4,1932. G.C. The days are matching on Arb (Fri). If we also add the monthly day difference of the following month of November which is 9 ....34-30=4, which is the exact date of November

B. Converting the Gregorian Calendar into the Ethiopian Calendar

As we had seen earlier, the difference between the Gregorian and the Ethiopian calendars is 7 and 8 years respectively. And in the 19th and 20th centuries from Sept, 11 (12) to Dec, 31, the G.C. exceeds the E.C by 7 years. And from Jan 1st to Sept, 10 (11), the G.C exceeds the E.C by 8 years.

In order to convert the Gregorian Calendar into the Ethiopian Calendar, we should proceed in the inverse order of the procedure which we followed when we converted the Ethiopian Calendar into the Gregorian Calendar.

As we have seen in table 12 on which the date of September of the G.C would be related to Meskerem 1st of the E.C, we can also know on what date of Tahsas in E.C Would be January 1st of the G.C.

Table 13

Remainders when leap-centuries are divided by 7	In the G.C	In the E.C
2	Jan 1	Tah (25) 26
1	>>	>> (24) 25
0	>>	>> (23) 24
6	>>	>> (22) 23
5	>>	>> (21) 22
4	>>	>> (20) 21
3	>>	>> (19) 20

Note : The numbers in brackets are dates in leap years.

Since, in the 19th and 20th centuries, the Gregorian dates from Jan 1 to 31 match with the Ethiopian dates from Tahisas (22) 23 to Tir (22) 23, it is possible to work out the same for the rest of the months according to Table 11, that is, the one we prepared for the dates from Jan 1 to Dec 31.

Exercise: 2

A. On what day, in the E.C, was Jan 1, 1956 In the GC ?.

Beginning on Jan 1, the G.C exceeds the E.C by 8 years; therefore, 1956 – 8 = 1948 E.C. Referring to Table 11, we find the permanent difference in days parallel to Tir (Jan), and that is 8 (9), and the year is a leap year. Therefore, we take that number, inside the bracket which is 9 and we take also Jan 1 as 31, and subtract from it: thus we find 31-9=22. Which is Tah 22, 1948 E.C. The days are Sun(Ehu).

B. What will the date, in E.C, of October 9, 2818 G.C. be?

The difference in years is 7, thus 2818-7=2811 E.C. To find out the difference in days, since the 28th century is by itself a leap century, according to Table 12, 28 ÷ 7 = 4, the remainder is 0 and this would lead to deducting (-1) as from the 10 permanent day difference in October which is in Table 11, thus 10-1 = 9 days difference. We take October 9 as 39 and, when we deduct the day difference 39-9=30. Thus, it will be Mes 30, 2811 E.C, days Tues (Mak).When we change the G.C into the E.C in deducting the day difference of the preceding month, we will get the exact day of the previous month in the E.C.

C. What will be June 5, 2050 G.C in E.C?

The Permanent monthly day difference of June in the 20th century is 7 assuming that each month has 30 days.

And June 5 is over 30 days by five days. Taking that into consideration we deduct 7 from 35, we are left with 28. And since the year difference i 8, 2050-8=2042. Therefore, the exact day in E.C is Gin (May) 28, 2042

C. Conversions of E.C into J.C

The E.C is lagging by 7 years from the J.C from Mes(Sept)1 up t Tir(Jan) 5(4) and lagging by 8 years from Tir(Jan)6(5) up to Pagumen : or 6 . The permanent days difference of each month are indicated in tabl 14 which are constant and do not vary as that of the G.C in each century And when we change from E.C to J.C in deducting the day differenc from the E.C and adding the year difference to the E.C, we get the exac date of the J.C

Table 14

The constant day difference of each moth in the E.C and J.C		
Ethiopian months	Julian months	Permanent day differences
Mes	Sept	3(2)
Tik	Oct	3(2)
Hid	Nov	4(3)
Tah	Dec	4(3)
Tir	Jan	5(4)
Yek	Feb	6(5)
Meg	Mar	4
Mia	Apr	5
Gin	May	5
Sen	Jun	6
Ham	Jul	6
Neh	Aug	7
Pag		8

Figures in bracket indicate when it is a leap year in E.C

Exercise 3.

A. What will Meg (Mar) 13, 2060 E.C be in Julian Calendar?

The difference in years in Meg (Mar) is 8. Thus, 2060+8=2068. The difference in days in the month of Mar (Meg) is, as indicated in Table 14, 4 days. Thus, 13-4=9 and it will be Meg (Mar) 9,2068 J.C The days are matching on Ham(Thurs).

When we convert E.C into J.C, after deducting the monthly permanent day difference, if we pass to the previous months with 31 days, we add 1 day on the number we get. If we pass into the month of Feb. from Mar, we subtract 1 day from the date we get in leap year, and 2 days in the others to arrive at the exact date. Or we must subtract the previous month day difference to get the exact day in J.C

B. What will Meg (Mar), 3, 3070 E.C be in J.C?

As indicated in Table 14, the difference in days in the month of Mar (Meg) between E.C and J.C is 4 and thus, when we take Meg (Mar) 3 as 33 and subtract 4, 33-4=29. This means we pass to the date of the previous month of Feb. Since it is not a leap year, when we subtract 2 days from our result, 29-2=27; the difference in years is 8 years, 3070+8=3078. Thus, it will be Feb 27, 3078 days Reb (Wed).

D. Converting the Julian Calendar to the Ethiopian Calendar

The Julian Calendar exceeds the Ethiopian Calendar by 7 years from Aug 29(30) to Dec 31, and by 8 years from Jan 1 up to Aug 28 (29).

In order to convert the Julian Calendar into the Ethiopian Calendar, we follow steps that are the opposite of the steps we follow when we convert from the E.C to the J.C

That is, we subtract the years we would have to add previously, and we add the days we would have to subtract.

Exercise 4:

A. What will be the date of Nov 20, 2025 J.C in E.C?

The difference in years is 7 and thus, 2025-7=2018 in E.C

As indicated in Table 14 the difference in days in the month of Nov, is 4 (3).

And since it is not a Leap year in E.C, when we add the number outside the bracket, 20+4=24. Thus, it will be Hid 24, 2018 E.C; Wed (Reb).

To convert J.C into E.C, the months of E.C have 30 days and when we add the difference in days, we get the exact date, in E.C even if we pass to the days of the next or the following month.

B. What will be the date of Feb 28,2828 J.C in E.C?

2828-8=2820, E. C. The permanent difference in days in Feb is 6(5). And since the year is a leap year, we take the number in the brackets which is 5 and we add to Feb 28. Thus: 28+5=33. Now it is in the month of Meg by 3 days. Therefore, it will be Meg 3, 2820 E.C. days Sat (Kid).

E. Converting The J.C into the G.C

I have come to know how to convert the J.C to the G.C. It is through the calculation which I did by relying on the E.C. here. I first converted the J.C. to the E.C and then the E.C to the G.C. Thus, through my computation based upon the 20th and 19th centuries, I have come to understand that, in order to convert the J.C. to the G.C. 13 days have to be added. I found out that the difference in days between J.C and G.C vary from one century to another century. Thus, first I took the 13 days difference as a permanent difference and, to deter the variation from one century to another; I proceeded in similar manner as I proceeded to resolve the obstacle in the E.C and G.C, as indicated in Table 12. In order to be able to know the number of days to be added to the 13 days permanent difference, I divide the leap century of any century by 7 and take the remainder number. Accordingly, I have drawn up Table 15 to use it in this process.

Table 15

The remainder of the division of the leap century to 7	The difference in days between J.C and G.C	The days to be added to the monthly permanent difference in days
3	16	+3
4	15	+2
5	14	+1
6	13	0
	12	-1
		-2

Exercise 5

A. What was Feb 1, 1908 J.C in G.C?

The leap century of the 19th century is 20, thus 20÷7=2, and the remainder is 6. Hence, according to Table 15 or Table 12, there would not be any addition to the permanent day difference when its remainder is 6. Thus, the monthly permanent day difference is 13 and when we add this to the required date 1, 13+1=14. Therefore, it was Feb 14, 1908 G.C; the days are matching on Friday.

What will be July 26, 6251 of J.C in G.C?

The leap century of the 62 century is 62+10=72, thus 72÷7=10, Rem 2. Hence, according to Table 15, the day to be added to the permanent day difference is (-3). So, the day difference is 13-3=10 days and, when we add this to the required date, 26+10=36. The month of July has 31 days. Thus when we subtract 1 day from the number of days that pass to the month of August which is 6 … 6-1=5 .Thus it will be August 5, 6251G.C; days Tuesday.

When we convert the Julian Calendar to the Gregorian Calendar, after we have added the permanent difference in days, if it passes to the next month and if the month in consideration or the month in which we are have 31 days, we are required to subtract 1 day from the sum. If it has 28 days, we add 2 days, and if it has 29 days, we add 1 day to our sum to get the exact date in the G.C.

F. Converting The Gregorian Calendar into Julian Calendar

The G.C and J.C have no year differences except in the month of December when the G.C is leading the J.C by one year until the J.C concludes its day difference of maximum 16 and minimum 10 days as indicated in Table 15, and start Jan. 1st. When we convert the G.C to J.C, we are required to subtract the difference in days which we previously added.

Exercise 6

A. What will be August 27, 9907 G.C in J.C?

The leap century of the 99th century is 100, thus 100÷7=14, Rem 2. The day to be subtracted from the permanent day difference is (-3). So, the day difference is 13-3=10 days. when we subtract this from the required date, 27-10=17. Therefore, it will be August 17, 9907 J.C; days).

B. Change Jan, 3, 1700 in G.C into E.C and J.C

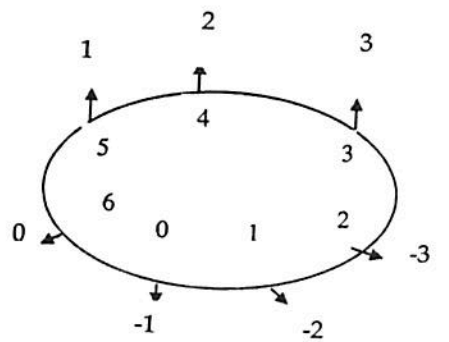
The year difference in G.C and E.C= 8...1700-8=1692. The leap century of 17 is 17-9= 8……8÷7=1 .Rem1. When the remainder is one, we must subtract (-2) from the permanent day difference which is 8(9) since 1700 is not a leap year in G.C when we take 8 which is outside the bracket 8-2 =6---when we subtract this taking Jan 3 as 33…33-6 = 27 this means we pass to the previous month of Tah 27,1692 in E.C Since the G.C leads the J.C by one year until the J.C overcomes, it's day difference in the month of December and start January. 1….1700-1 = 1699 in J.C

As was indicated earlier if G.C and J.C haven't the same year and one of it is a leap year and the other is not, the permanent day difference must be 12 not 13. As the result of leap century calculation as in Table 12 when we subtract (-2) from it 12-2= 10. Taking Jan 3 as 33 ---- 33-10 = 23 since the month of December has 31 days when we add one day on it 23+1 = 24 Therefore (Dec) 24, 1699 was the exact date. All the days are matching on Ehu (Sun) .

Easy Method

In finding the leap century of any century, I felt that the process of calculating by adding 10 and subtracting 9 centuries is quite long. I desired to improve it. Thus, I gave attention to the consecutive arrangement. In order to easily arrive at the number of days needed to be added to the permanent day difference by dividing the nearest leap century of any century by 7, it is recommendable to study the figures indicated with the circular table below as in Table 12 or 15 in the clockwise and ant-clockwise direction. The numbers 0 to 6 represent the remainder numbers; while in the numbers outside the circle are the number of days to be added to or subtracted from the monthly permanent difference in days. Thus, dividing the nearest leap century and knowing the days to be added means to know easily the day number to be added to the nearest century.

The circular Table 1



When we convert G.C to J.C, after we have subtracted the permanent difference in days if it passes to the previous month and if the month in consideration has 31 days, we are required to add 1 day to the sum. If the month is Feb and if it is a leap year, we subtract 1 day. Otherwise, we subtract 2 days from our result to get the exact date in the J.C. This was done due to the assumption, that every month have only 30 days like the E.C.

B. What will be Jan 7, 5052 G.C in J.C?

The leap century of the 50th century is 50+10=60, and 60÷7=8, Rem 4. The day to be added to the permanent day difference is 2. So, the day difference is 13+2=15 days. And when we subtract this from the required date, which is Jan taking 7 as 37 . . . 37-15=22. The month of Dec has 31 days. Hence, when we add 1 day, rs22+1=23. Now the J.C is in the month of Dec and the G.C is in January. Thus, until the J.C completes its day difference and passes to the month of January, it remains behind by 1 year. Therefore, it will be December 23, 5051. The days are matching on Wednesday.

> If we are required to change the Julian calendar to the Gregorian Calendar , or vice versa, if the years which contain two or three zeros in their last digits are not the leap years, in the G.C, the number we have to use as permanent day difference between them is 12 and not 13.

General Questions

1. Change Mes 5,5050 in E.C into G.C and J.C ?

Since the year difference between E.C and G.C in the month of Mes is 7 year, 5050+7=5057 in G.C the leap century of 50 is 50 + 10 = 60…….. 60÷7= 8 Rem 4 .When the remainder is 4 as was indicated in table 12, we should add on the permanent day difference = 2, since the permanent day difference is 10 (11) as indicated in Table 11 for the month of September. When we take the number outside the bracket because it is not a leap year in E.C and add 2 on it 10+2 = 12 when we add with the required date in E.C 12+5 = 17, this means, Sep 17,5057 in G.C

Since the year difference in between E.C and J.C is the same as in G.C 5050+7 = 5057 in J.C. The monthly permanent day difference = 3(2) as indicated in table 14. Since it is not a leap year in E.C when we subtract 3 from the day asked in E.C 5-3 = 2. This means, the exact day and year will be Sep 2, 5057 in J.C. All the days are matching on Ham (Thurs).

2. Change Feb., 28, 2828 J.C into E.C and G.C

The year difference in J.C and E.C= 8….2828-8=2820. The permanent day difference is 6(5) as indicated in Table 14. Since 2820 is a leap year, when we take 5 and add to the day required in J.C 5+28=33. This means the E.C passes to the month of Meg (mar) with 3 days above the months date which are 30. Thus the exact day will be Meg 3, 2820 E.C

Since the J.C and G.C have the same year 2828 and 28 is a leap century by itself, when we divide it by 7…28÷7=4 rem 0. When the remainder is zero. In Table 12. means (-1) thus when we subtract from the permanent day difference which is 13…13-1=12 when we add this with the day required in J.C, 12+28=40. This means the G.C passes to the month of March by 40-30=10 days.Since the month of Feb.

During a leap year has 29 days, we must add one day. 10+1=11 days. Thus, the exact day is March 11,2828in G.C. the days are matching on kid (sat).

3. Change Jan, 3, 1700 in G.C into E.C and J.C

The year difference in G.C and E.C =8…1700-8=1692. The leap century of 17 is 17-9=8…..8 ÷7=1 Rem 1. when the remainder is 1 as indicated in Table 12, we must subtract (-2) days from the permanent day difference which is 8(9) in Table 11, since 1700 is not a leap year in G.C. when we take 8 which is outside the bracket 8-2=6….when we subtract this taking Jan 3 as 33…33-6=27 this means we pass to the previous month of Tah 27, 1692 in E.C.

Since the G.C leads the J.C by one year until the J.C overcomes, it's day difference in the month of December and starts January 1….1700-1=1699 in J.C As was indicated earlier, if the G.C and the J.C haven't the same year or one of it is a leap year and the other is not , the permanent day difference must be 12 not 13. As the result of leap century calculation of Table 12. When we subtract (-2) from it 12-2=10. Taking Jan 3 as 33….33-10=23 since the month of December has 31 days, when we add one day on it 23+1=24. Thus, (Dec) 24, 1699 J.C was the exact date. All the days are matching on Ehu (Sun).

G. How to Prepare a Calendar

If we want to prepare a calendar of any year, we need to identify the names of each month and the days of a week, and to prepare a Table containing the list of the numbers of dates in a months. (i.e 30, 5(6) in E.C and 28 (29), 30, 31 in J.C, G, C.) We match the first day and date of the 1st month (Mes in E.C and Jan in J.C, G.C) of the year, and continue to fill it in a consecutive way in the prepared Table, the dates of the months until the end of the last month (i.e Pag in E.C and Dis in J.C, G.C). If we want to prepare it in integration with other calendars, we need to convert the first day of the year of the calendar to the one we need to be integrated, by making sure that each day matches with one another.

Example1. Draw a sample calendar for the year 3000 in E.C and interconnect it with the G.C.

The 1st month of the year or Mes 1, 3000 in E.C. will be on Ehud. When we convert Mes 1,3000E.C into G.C the exact date in G.C will be sept.13,3007. The days are matching on Ehud(Sun).

3000 E.C						3007/3008 G.C	
Mes...Sep/Oct	Ehu sun	Seg mon	Mak Tue	Reb Wed	Ham Thu	Arb Fri	Kid Sat
	$1._{13}$	$2._{14}$	$3._{15}$	4_{16}	$5._{17}$	$6._{18}$	$7._{19}$
	$8._{20}$	$9._{21}$	10_{22}	11_{23}	12_{24}	$13._{25}$	$14._{26}$
	$15._{27}$	$16._{28}$	$17._{29}$	$18._{30}$	19_{1}	$20._{2}$	$21._{3}$
	22_{4}	$23._{5}$	$24._{6}$	$25._{7}$	$26._{8}$	$27._{9}$	$28._{10}$
	$29._{11}$	$30._{12}$					

The next month Tik--- Oct/Nov will start on $1._{13}$

Example 2. Draw a sample calendar for the year 4000 in G.C and interconnect it with the E.C.

When we find the first day of the year Jan 1, 4000 G.C, it will be on **Saterday**. When we convert Jan 1, 4000 G.C into E.C the exact date in E.C will be Tah 21, 3992. The days are matching on Sat (Kid)

Jan…Tah/Tir	4000 G.C					3992 / 3993 E.C
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
						$1._{21}$
$2._{22}$	$3._{23}$	$4._{24}$	$5._{25}$	$6._{26}$	$7._{27}$	$8._{28}$
$9._{29}$	$10._{30}$	$11._{1}$	$12._{2}$	$13._{3}$	$14._{4}$	$15._{5}$
$16._{6}$	$17._{7}$	$18._{8}$	$19._{9}$	$20._{10}$	$21._{11}$	$22._{8}$
$23._{13}$	$24._{14}$	$25._{15}$	$26._{16}$	$27._{17}$	$28._{18}$	$29._{19}$
$30._{20}$	$31._{21}$					

The next month Feb--- Tir/Yek will start on $1._{22}$

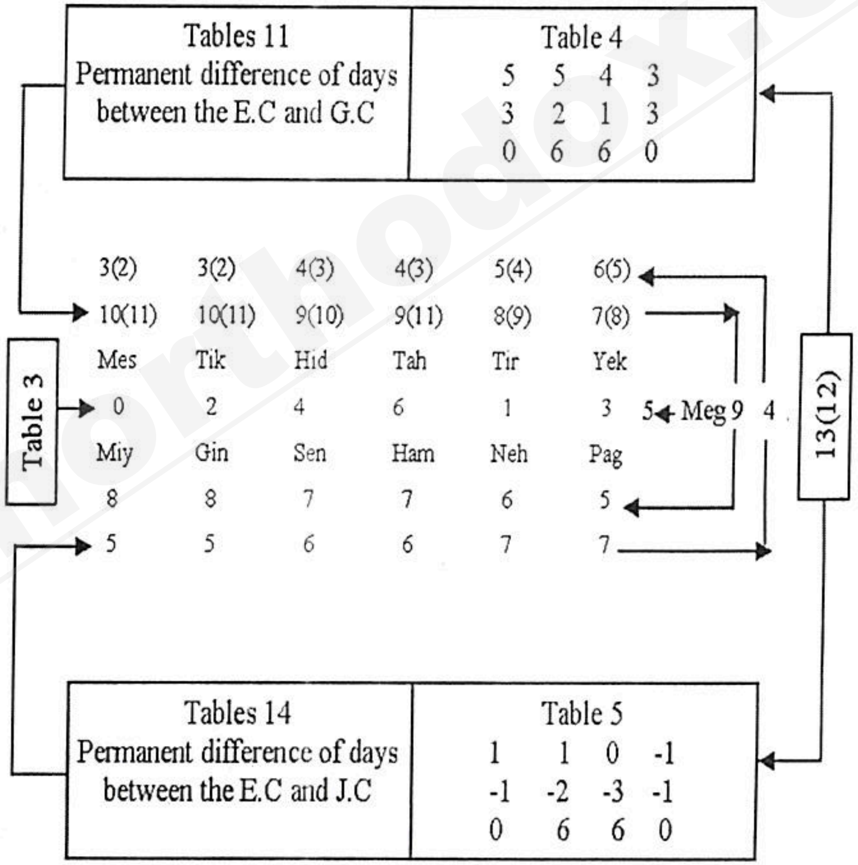
Example 3. Draw a sample calendar for the year 5000 in J.C and interconnect it with the G.C.

The first day of the year Jan 1, 5000 J.C will be on **Wednesday**. When we convert Jan.1, 5000 J.C in to G.C we can get Jan 15, 5000 G.C. The days are matching on Wednesday.

Jan---Jan/Feb	5000 J.C					5000 / 5001 G.C
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
			$1._{15}$	$2._{16}$	$3._{17}$	$4._{18}$
$5._{19}$	$6._{20}$	$7._{21}$	$8._{22}$	$9._{23}$	$10._{24}$	$11._{25}$
$12._{26}$	$13._{27}$	$14._{28}$	$15._{29}$	$16._{30}$	$17._{31}$	$18._{1}$
$19._{2}$	$20._{3}$	$21._{4}$	$22._{5}$	$23._{6}$	$24._{7}$	$25._{8}$
$26._{9}$	$27._{10}$	$28._{11}$	$29._{12}$	$30._{13}$	$31._{14}$	

The next month Feb --- Feb/Mar start on $1._{15}$

H. General Tables



In order to get the days of any year, in E.C. J.C. and G.C one can use this table as a reference.

NB: Look at the numbers patterns and the arrows carefully.

CHAPTER FIVE

5. Baha'i Calendar or Badi Calendar (B.E)

After I reached a stage where I was ready to publish this book, I got a letter from Ato Zelalem Mulugeta. He give me his appreciation on the 2nd edition of my Amharic book and admired me for the way I calculate the days of any year in the (E.C), the (J.C),and the (G.C). His wish was to enable me have more knowledge about the Bahai or Badi Calendar (B.E). Thus, I contacted him and he gave me 167 B.E and 120 B.E calendars as well as other descriptions.

The Baha'i Calendar, or Badi calendar was first established by the Iranian Bab in the Kita'b-i- Asma' (The Book of Names) Baha' u'llah later confirmed the calendar. The Baha'i Era , or Badi Era, began at sunset on March 20,1844. The calendar is made up of 19 months of 19 days each with an intercalary day period of four days (five during leap years). The New Year (Naw-Ruz) begins on March 21st of the Gregorian Calendar, but is tied to the spring equinox.

Months of the year

Each of the 19 months of the Baha'i year was given one of the names of God from the Islamic tradition. The intercalary days are, as their name would suggest, separated and are not contained within any of the months. Each day of the month has the same name as the twelfth would be named 'Ilm, and so forth. The last month of the Baha'i year is designated as a month of fasting. Fasting takes place from sunrise to sunset during which time no food or drink can be consumed.

Calendar Dates	Baha'i Month -	Translation
Mar 21-Apr 8	Baha'	Splendour
Apr. 9 – Apr 27	Jala'I	Glory
Apr 28 – May 16	Jama'I	Beauty
May 17-June 4	'Azamat	Grandeur
Jun 5- Jun 23	Nu'r	Light
Jun 24-jul 12	Rahmat	Mercy
Jul 13- jul 31	Kalima't	Words
Aug 1- Aug 19	Kama'I	Perfection
Aug 20-Sep 7	Asma'	Names
Sep 8 – Sep 26	'Izzat	Might
Sep 27-Oct 15	Mashiyyat	Will
Oct 16 – Nov 3	'Ilm	Knowledge
Nov 4 – Nov 22	Qudrat	Power
Nov 23 Dec 11	Qawl	Speech
Dec 12- Dec 30	Masa'il	Questions
Dec 31 Jan 18	Sharaf	Honour
Jan 19 – Feb 6	Sulta'n	Sovereignty
Feb 7- Feb 25	Mulk	Dominion
Feb 26 – Mar 1	Ayya'm –i-Ha'	'The Days of Ha'
March 2-Mar. 20	'Ala'	Loftiness

Days of the Week

Each day of the week has its own name. In the Baha'i calendar, Friday is the day of rest. Coincidentally (or not) its name is "independence". The week, in the Baha'i calendar, is still seven days though, technically, it begins on Saturday and ends on Friday. In order to maximize utility and avoid considerable confusion, we have omitted this structure on the visual Baha'i Calendar.

Days of the week	Baha'i Day	Translation
Saturday	Jala'l	Glory
Sunday	Jama'l	Beauty
Monday	Kama'l	Perfection
Tuesday	Fida'l	Grace
Wednesday	'ida'l	Justice
Thursday	Istijla'l	Majesty
Friday	Istiqla'l	Independence

I would like to express my deep appreciation to Ato Zelalem, for this devotion. I went on through my researches. Through my experience of comparing one calendar with the other, I first started to have a knowledge of the number of days in the B.E calendar has in a year. Thus, if 19 months have 19 days each and an additional 4 (5) intercalary days after the 18th month, the days in a year look like the following.

19 x 19 = 361
361 +4 = 365 days for 3 consecutive years
361 +5 = 366 days on the 4th year (leap year)

It is similar or the same to the number of days in a year with the E.C the J.C and the G.C calendars.

Second, I wanted to know the year difference between the B.E and the G.C. As was indicated in the above description, if the 1st day of the 1st month Baha' starts on March 21st, 1844 G.C their year difference looks like the following.

B.E	G.C	
1	1844	1844 – 1843 = 1
2	1845	1845 -1843 = 2
3	1846	1846 – 1843 = 3

Thus, the year difference in between them is 1843. We can change from the G.C to the B.E by subtracting 1843 years. And, if we want to change from the B.E to the G.C, we must add 1843 years, or if x is a calendar year to be add or to be subtracted from 200 B.E or 2043 G.C then (200 $\pm$ x) = (2043 $\pm$ x)

Ex 1. A. What year was 45 B.E be in G.C?

45 + 1843 = 1888 G.C
Or 200 - x = 45… - x = 45 -200 . . . –x = -155 . . . x = 155
2043 – 155 = <u>1888</u> G.C

B. What year will, 2128 G.C be in B.E?

2128 - 1843 = 285 B.E
Or 2043 + x = 2128….x = 2128 – 2043 …x = 85
200 + 85 = <u>285 B.E</u>

A. THE 1ST DAY OF ANY YEAR IN THE B.E

As was described above, one can simply change the B.E year into the G.C year, and then calculate its March 21st to know the 1st day of Baha' 1 in B.E.

Ex. 2 What day was the 1st day of the 1st month Baha'1,64 in B.E ?

64 + 1843 = 1907 G.C- -When we calculate March 21, 1907 G.C we will get Thursday. Thus if the 1st day of March 21, 1907 G.C is on Thursday, Baha' 1, 64 B.E is also Thursday.

B. The 1st day of any month in the B.E

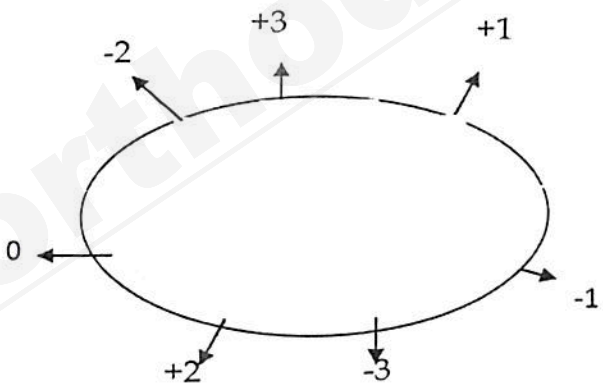
Knowing the 1st day of the 1st month Baha' in any year means, knowing the days of all the other months. In the B.E calendar, all the months have 19 days. If one knows the 1st day of the month, by adding 7 days on the 1st day …1st…8th…15th and 22nd date have the same days. Thus if the 1st day of the 1st month Baha' starts on Wednesday in order to know the 19th day, since 22 is Wednesday and 22-3 = 19… Wednesday – 3 days = Sunday. Knowing the last day of the month means knowing the starting day of the next month which is Monday.

If the 1st day of the 1st month Baha is on Wednesday

1. Thursday (+1)	8 = thu +1	15 = thu + 1
2. Tuesday (-1)	9 = tue -1	16 = tue - 1
3. Sunday (-3)	10 = sun -3	17 = Sun - 3
4. Friday (+2)	11 = Fri -2	18 = Fri + 2

5. Wednesday (0)	12 = Wed 0	19 = Wed 0
6. Monday (-2)	13 = Mon - 2	20 = Mon - 2
7. Saturday (+3)	14 = Sat +3	

The circular Table 2



When we look at the numbers +1,-1,-3 +2,+0,-2,+3 as indicated above, they are repeating themselves. After counting 7 days starting from the 1st day of the month, in a circular form, I take Wednesday as the basic day for the B.E and arrange the 1st day of the month. If the 1st day of the month is Thursday …This means Wednesday + 1day = Thursday = (+1). The next month starts, on Tuesday. This means Wednesday – 1 day = Tuesday = (-1). The 3rd month starts on Sunday. This means Wednesday– 3 days = Sunday = (-3) etc…Thus, if the 1st day of the 1st month Baha' starts on Sunday, we start from -3 for the 1st month which is Sunday.

The 2nd month starts on (+2) Friday. The 3rd month starts with zero which is Wednesday etc. In the Badi calendar those months having the same starting days are the following.

Grouping Table 16

1. Baha' = Kama'l = Masa'il 1st 8th 15th	5. Nu'r = 'ILM = Ay am – i – Ha' 5th 12th 19th "
2. Jala'l = Asma' = Sharaf 2nd 9th 16th "	6. Kalima't = Qawl 7th 14th
3. Jama'l – 'Izzat = Sulta'n 3rd 10th 17th "	7. Rahamat = Qudurat 6th 13th
4. 'A zama't = Moshiyyat = Mulk 4th 11th 18th "	8. 'Ala' 20th

The 1st day of 'Ala' is always depending on the the last or the first day of the month Ayam-i-Ha' . If the first day of Ayam-i-ha is known we can simply subtract 3 days (2 day during a leap year) to get the first day of 'Ala'.

Ex.3A On what day will Ayam –i-ha 3, 228 B.E be?

228 +1843 =2071 G.C

When March 21,2071 is calculated in G.C. the day is on Saturday. Thus the first day of the first month Baha in B.E is also Saturday. Since Saturday means Wednesday +3 days, starting from

(+3), the second month starts by (+1) ,the third by (-1) ,The fourth by (-3) and The fifth by (+2) If the fifth is (+2) Means Wed +2 days=Friday. As indicated above The fifth, twelve's and ninth months start on the same day Ayam –i-ha first is also Friday. The required date is 3. Thus 1+2 =3…. Friday +2 day=Sunday

EX.4 Based on the Badi Calendar 2000 B.E. What day is Oct25 In G.C?

Solution: 2000 +1843 =3843 G.C. By Finding The First Day of the first month of Jan 1, 3843 we can get Sunday, and when we calculate Oct. 25,3843 we can get Wednesday.

NB. a. In order to get the days of any year in the B.E,with mental workout, we must know how to get the 1st day of any year as well as any month. It is also mandatory to learn by heart the Circular Table 2 and the Grouping Table 16.

b. In order to change from the B.E calendar into the E.C and the J.C, we must change the B.E into the G.C, and then change the G.C into the E.C and the J.C.

References

- Yezemen akotater ke-Asrat G/Mariam ina G/Hiwot Meharie Addis Ababa 1987 E.C
- Yegeda Melba Oromia Ye Oromo Hizb Tarik Tirgum be Harro Biyansa 1985 E.C Page 28.
- The new Encyclopaedia Britannica V.2 P.740.
- Collier's Encyclopaedia V.5, P.137-139
- Oromo Wisdom in Black Civilization. Dirribi Demissie Bokku MTA President page 159-171.
- The solar system, the Sun, Planets and life. Roman Simoluchowski 1983