

CALENDAR

[illegible]

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I. Introduction

*The Calendar which we currently follow is called the **Gregorian Calendar**. It is named after Pope Gregory XIII, who introduced it in October 1582.*

The calendar was a refinement to the Julian calendar amounting to a. The motivation for the reform was to stop the drift of the calendar and set the date for Easter celebrations. Transition to the Gregorian calendar would restore the holiday to the time of the year in which it was celebrated when introduced by the early Church.

The reform was adopted initially by the Catholic countries of Europe. Protestants and Eastern Orthodox countries continued to use the traditional Julian calendar and adopted the Gregorian reform after a time, for the sake of convenience in international trade.

The last European country to adopt the reform was Greece, in 1923.

The Gregorian reform modified the Julian calendar's scheme of leap years as follows:

- 1. Every year that is exactly divisible by four is a leap year, except for years that are exactly divisible by 100, but these centurial years are leap years if they are exactly divisible by 400. For example, the years 1700, 1800, and 1900 are not leap years, but the years 1600 and 2000 are.*
- 2. In addition to the change in the mean length of the calendar year from 365.25 days (365 days 6 hours) to 365.2425 days (365 days 5 hours 49 minutes 12 seconds)*

II. What are Ordinary and Leap years??

The time taken by the Earth to make one complete revolution is said to be a complete Year, which is equivalent to exactly

365.2425 days.

*But ignoring the **.2425** we generalize an **ordinary** year to be of **365** days.*

*Further for approximate calculation we assume the 365.2425 days to be **365.25** days.*

*This extra **0.25** days in **4 years** becomes **1 full day**. Hence that extra day is added to a year **every 4 years**. That particular year is called a **leap** year, which has one extra day than the ordinary year, which means a leap year has **366 days** in total.*

365.2425

0.0025 when ignored

365.24

0.24 approximated to 0.25 for
simpler calculation

365.25

Only the 365
days taken

The 0.25 becomes 1
extra day in 4 years

Ordinary year

365 days

Leap year

= Ordinary year + (0.25×4)

= 365 + 1

= **366 days**

How to check for a leap year?

1. Non Century Years:

If any non-century year (not ending with “00”) is divisible by 4 (last two digits of the year should be divisible by 4), then it is said to be a leap year.

Reason: As explained in the previos slide, the 0.25 extra days of 365.25 days become one extra day every 4 years ($0.25 \times 4 = 1$).

Hence every 4 years we have one leap year.

Ex: 1844, 1892, 1996, 2004, 2012, 2016 etc

2. Century Years:

But in case of a century year (Years ending with “00”, ex: 1400, 1600, 2000, etc), the year will be a leap year only if it is divisible by 400.

Reason:

Let us take an example. The 100th year is divisible by 4. But it is not a leap year.

Why???



The approximation we make while assuming 365.24 days to be 365.25 days (increasing the value by 0.01), leads to an extra 1 day which does not exist in real. Hence this extra 1 day which is forming every 100 year should be removed from the 100th year. So, although the hundredth year is divisible by 4 and should be a leap year, we remove that extra one day of the leap year from the 100th year. Hence it ends up as an ordinary year only.

But why is the 400th year a leap year then???

So, till now we learnt that the 100th year (Ex: 100,200,300 etc) is not a leap although it is divisible by 4.

But why is 400th year a leap year then???

*This answer also lies in the value **365.2425** days which is the time taken by the earth for one revolution.*

*In 365.24**25** we initially ignore **0.0025**. which is a negligible value for one year. But in 400 years, this **0.0025** becomes 1 complete day (**$0.0025 \times 4 = 1$**) and we add this extra day every 400th year.*

Although like every 100th year, 400th year also should have been an ordinary year, but because of the addition of this extra day(mentioned above), every 400th year is a leap year.

And that is why every century leap year is divisible by 400.

Example: 400,1200,1600,2000 etc.

Let us take a quick quiz(Ask the students)

Q1. Is 1996 a leap year? Why?

Q2. Are all the years divisible by 4 leap years? Why?

Q3. How do you check for a century year, whether it is a leap year or not? Why?

III. Odd day concept

*If we are supposed to find the day of the week on a given date, we use the concept of 'odd days'. **In a given period, the number of days more than the complete weeks are called odd days .***

For example the number of odd days in 15 total days = 1, since remainder when 15 is divided by 7 is 1.

*Similarly the number of odd days in the month of January is 3. Since January has 31 days,
 $31/7 = R(3)$.*

Note: The odd day value will always lie from 0 to 6. If the odd day value is more than 6, keep dividing it by 7 until the remainder value comes below 7. The remainder value smaller than 7 is the final odd day value.

Finding odd days

1. In a single year

Now that you know what are odd days, can you find out how many odd days are there in an ordinary year and a leap year respectively???

1. Ordinary year:

Total no. of days=365 days

$$365/7 = R(1)$$

Odd days = 1

2. Leap year:

Total number of days= 366

$$366/7 = R(2)$$

Odd days= 2

Finding odd days

2. Through out a century/year span

Let us see through examples how to find the number of odd days through out a century or year span.

Ex: Find the number of odd days in the first 35 years in a century.

Step1: *Let us first find the number of leap years and ordinary years in these 35 years. 35 years have **8 leap years** ($4 \times 8 = 32$, closest to 35).*

Therefore no. of ordinary years = $35 - 8 = \mathbf{27 \text{ years}}$.

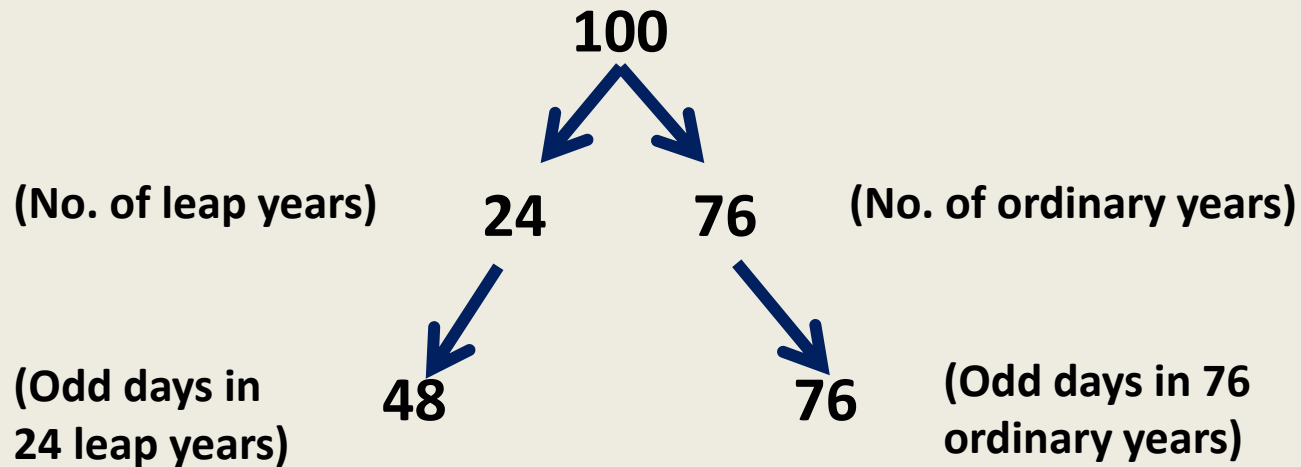
Step2: *Odd days in 8 leap years = $8 \times 2 = \mathbf{16}$ (Since 1 leap year has 2 odd days)*

Odd days in 27 ordinary years = $27 \times 1 = \mathbf{27}$ (Since 1 ordinary year has 1 odd day)

Step3: *Total number of odd days = $(16 + 27) = 43 = 43/7 = R(1)$*

*Therefore number of odd days in 35 years = **1***

Following the same steps, find the number of odd days in the first century(first 100 years).



$$\text{Total no. of odd days} = (48 + 76) = 124$$

$$124/7 = R(5)$$

Hence, the first 100 years(century) have 5 odd days in total.

Note: The first 100 years have 24 leap years, not 25.

Because 100th year is not a leap year as discussed in **slide no.8**.

Odd days in the centuries

Since first 100 years is having 5 odd days, we can say:

First 200 years have $5 \times 2 = 10$, $10/7 = R(3)$

First 300 years have $5 \times 3 = 15$, $15/7 = R(1)$

First 400 years have $5 \times 4 = 20$, $20/7 = R(6) + 1 = 7 = R(0)$

And the cycle keeps repeating for the next centuries from here.

Note: 1 extra day has been repeated for 400 years, since 400th year is a leap year as mentioned in earlier slides.

Until Century	Up to Year	Odd days	Similar centuries	
1 st	100	5	500	>
2 nd	200	3	600	>
3 rd	300	1	700	>
4 th	400	0	800	>

Odd days in the months

Month	No. of days	Odd days
January	31	3
February	28,29	0,1
March	31	3
April	30	2
May	31	3
June	30	2
July	31	3
August	31	3
September	30	2
October	31	3
November	30	2
December	31	3

Concept Review Question

Q. If May 10, 1997 was a Monday, what will be the day on Oct 10, 2001?

- A. Wednesday**
- B. Thursday**
- C. Friday**
- D. Saturday**

Solution:

In this question the reference point is May 10, 1997 and we have to find the number of odd days from May 10, 1997 up to Oct 10, 2001.

Now, from May 11, 1997 - May 10, 1998 = 1 odd day

May 11, 1998 - May 10, 1999 = 1 odd day

May 11, 1999 - May 10, 2000 = 2 odd days (2000 was leap year)

May 11, 2000 - May 10, 2001 = 1 odd day

Thus, the total number of odd days up to May 10, 2001 = 5.

Now, the remaining 21 days of May will give 0 odd days.

In June, we have 2 odd days; in July, 3 odd days; in August, 3 odd days; in September, 2 odd days and up to 10th October, we have 3 odd days.

Hence, total number of odd days = 18 i.e. 4 odd days.

Since, May 10, 1997 was a Monday, then 4 days after Monday will be Friday. So, Oct 10, 2001 would be a Friday.

IV. 1. a) Finding the day for a particular date

1. *Odd days in the year(Actual year-1)*
2. *Odd days in the month(Actual month-1)*
3. *Odd days in the date*

Get the sum of the odd days and the final odd day value from it.

Ex: 15/07/2016

1. ***Odd days in 2015***
2. ***Odd days in January to June***
3. ***Odd days in the date(15/7= R(1))***

Sum%7=Odd day value

Odd day value	1	2	3	4	5	6	7 or 0
Day of the week	Mon	Tue	Wed	Thu	Fri	Sat	Sun

Concept review Questions:

*Using the above mentioned **conventional method**, find the day for the following dates:*

1. Independence day of India
2. Republic Day of India

IV. 2 b) Shortcut to find the day

1. Month Code:

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

2. Year Code

Years between	Code/Odd days
1600-1699	6
1700-1799	4
1800-1899	2
1900-1999	0
2000-2099	6

Steps:

Find the sum of:

1. Date
2. Last 2 digits of the year
3. Quotient of last two digits of the year when divided by 4
4. Code of month
5. Odd days of the year

The odd days in the above sum value will give the day

Note:

Incase of months of January and Februray in a leap year, subtract one odd day from the total odd days.

Concept review Questions:

*Using the **Shortcut-method**, find the day for the following dates:*

1. Independence day of India
2. Republic Day of India

IV.3. Finding years with similar calendars

For two different years having the same calendar, the following conditions should be satisfied:

1. Both years must be of the same type. i.e., both years must be ordinary years or both years must be leap years.

2. 1st January of both the years must be the same day of the week.

It simply means that for a year to have the same calendar with X year, the total odd days from X should be 0.

Let us understand with an example.

Example:

For a year to have the same calendar with 2007 ,the total odd days from 2007 should be 0.

As we know how to recognize an ordinary and leap year, and also we know the number of odd days they have, we can make the below table:

Year	:	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Odd Days	:	1	2	1	1	1	2	1	1	1	2	1

*Since up to 2017 the number of odd days become 0, **hence the next year(2018)** will have the same calendar as 2007.*

And also both the years are ordinary years, hence the first condition is also satisfied.

Shortcut (Only when you are not crossing a an ordinary century year) :

Leap year calendar repeats every 28 years.

LY	1ST	2ND	3RD	LY
28	6	11	11	28

Here 28 is distributed as 6+11+11.

Rules:

*a) If given year is at 1st position then next repeated calendar year is **Given+6.***

*b) If given year is at 2nd position then next repeated calendar year is **Given+11.***

*c) If given year is at 3rd position then next repeated calendar year is **Given+11.***

Example:

Find the year which as same calendar as that of 2007 after it.

Sol:

LY	1ST	2ND	3RD	LY
28	6	11	11	28

Given year is 2007

*According to the above above **Rule:***

2007 is at the 3rd position. So add 11 yr

2007+11=2018

so the same Calendar after 2007 is 2018.

Concept Review Question

Find the year after 2015 which has the same calendar as 2015.

- A. 2019
- B. 2023
- C. 2026
- D. 2029

Ans: C

Concept Review Question

The year after 1996 having the same calendar as of 1996 will be

- A. 1999
- B. 1998
- C. 2001
- D. None of these

Ans: D

PRACTICE QUESTION

Q1. *If today is Monday, what will be the day one year and 50 days from now? (Tech Mahindra-2011)*

- A. Tuesday
- B. Wednesday
- C. Thursday
- D. Can not be determined

Ans: D

Q2. *Bunny's brother of Sunny is 562 days older to him while his sister Jenny is 75 weeks older to him. If Jenny was born on Tuesday, on which day was Bunny born? (Tech Mahindra-2015)*

- a) Monday
- b) Tuesday
- c) Friday
- d) Saturday
- e) Thursday

Ans: e

Q3. *If day before Yesterday it was Monday, What day will fall on day after tomorrow ?* **(Tech Mahindra-2013)**

- a. Sunday
- b. Tuesday
- c. Saturday
- d. Friday

Ans: d

Q4. *Radha remembers that her father's birthday is after 16th but before 21st of March, While her brother Mangesh remembers that his father,s birthday is before 22nd but after 19th of March. On which date is the birthday of their father?*

(Tech Mahindra-2015)

- a) 19th
- b) 20th
- c) 21st
- d) Cannot be determined
- e) None of these

Ans: b

Q5. *1.12.91 is the first Sunday. Which is the fourth Tuesday of December 91?*

(TCS-2015)

- (a) 31.12.91
- (b) 24.12.91
- (c) 17.12.91
- (d) 26.12.91

Q6. *If the third day of the month is Monday, Which of the following will be the fifth day from 21st of that month? (Tech Mahindra-2015)*

- a) Tuesday
- b) Monday
- c) Wednesday
- d) Thursday
- e) None of these

Ans: c

Q7. *If 8th Dec, 2007 was Saturday then what day of the week was it on 8th Dec, 2006? (Capegemini-2015)*

- (a) Monday
- (b) Thursday
- (c) Friday
- (d) Sunday

Ans: C

Q8. *Two brothers were expected to return here on the same day. Rajat returned 3 days earlier but Rohit returned 4 days later. If Rajat returned on Thursday, what was the expected day when both the brothers were to return home and when did Rohit Return?* **(Infosys 2015)**

- a) Wednesday, Sunday
- b) Thursday, Monday
- c) Sunday, Thursday
- d) Monday, Friday

Ans: C

Q9. *8th Dec 2009 was Tuesday, what day of the week was it on 8th Dec, 2006? (SSC,2016)*

- A. Sunday
- B. Tuesday
- C. Friday
- D. Tuesday

Ans: C

Q10. *Miley went to party nine days ago. She goes to party only on Thursday. What day of the week is today? (Tech Mahindra-2013,2015)*

- a) Sunday
- b) Tuesday
- c) Thursday
- d) Saturday
- e) Friday

Ans: d

Q11. *What was the day of the week on January 1, 1998? (Tech Mahindra-2016)*

- a. Wednesday
- b. Monday
- c. Friday
- d. Thursday

Ans: d

Q12. *What was the day of the week on December 26, 1995?*
(Tech Mahindra-2015)

- a) Friday
- b) Tuesday
- c) Sunday
- d) Monday
- e) None of the above

Ans: b

Q13. *The day of week on July 1,2000 was*
(Tech Mahindra-2014)

- a) Monday
- b) Friday
- c) Saturday
- d) Tuesday
- e) None of the above

Ans: c

Q14. *On what dates of August 1980 did Monday fall?* **(TCS-2014)**

- A. 4th, 11th, 18th, 25th
- B. 3rd, 10th, 17th, 24th
- C. 6th, 13th, 20th, 27th
- D. 9th, 16th, 23rd, 30th

A.

Q15. If we suppose the 60th independence day of India was on Thursday, then the 85th independence day would have been on?

- A. Monday
- B. Wednesday
- C. Friday
- D. Sunday

Ans: A

Q16. *If 1 Jan 2015 is Thursday then probability of 22nd October 2015 to be Wednesday will be? (Infosys-2015)*

- A. 0
- B. 0.5
- C. 1
- D. Can not be determined

Ans: A

Q17. *The calendar for 1992 is the same as for (Tech Mahindra-2012,2015)*

- a) 1997
- b) 2020
- c) 2016
- d) 1994

Ans: b

Q18. *The calendar of year 1982 is same as which year?*

- A. 1988
- B. 1990
- C. 1992
- D. 1993

Ans: D

Q19. *How many times the 29th day of the month does occur in 400 consecutive years? (Cognizant-2013)*

- A. 4500
- B. 4498
- C. 4497
- D. 4495

Ans: C

Q20. *John was born on Feb 29th of 2012 which happened to be a Wednesday. If he lives to be 101 years old, how many birthdays would he celebrate on a Wednesday?*

- A. 3
- B. 4
- C. 5
- D. 1

Ans: B

Q21. *History Professor Nagarajan was talking to the students about a century which has started with a Monday. What day India would be witnessing on the last day of the century, the Professor was posing a question. Incidentally he posed a question that the last day of the century cannot be:*

(a)Monday

(b) Tuesday

(c)Wednesday

(d) Friday

Can you answer the Professor 's question?

Answer : b) Tuesday