LOGICAL REASONING

CALENDARS

CONTENTS

- Types of Years
- Concept of Odd days
- Finding the day of a particular date with reference to another day
- Finding the day of a particular date without any reference
- Repetition of Calendar

TYPES OF YEARS

- **Ordinary Year**

The year which is not a leap year is called an ordinary year. An ordinary year has 365 days.

For example, 2018 is an ordinary year.

- **Leap Year**

Any year having 366 days is called a Leap Year.

e.g. 2000, 2004, 1996 are all leap years.

HOW TO IDENTIFY A LEAP YEAR?

- For **CENTURY YEARS-**

Years which are multiples of 100 like 100,200,300,400,500…1800,1900 etc,

Simply **divide the given year by 400**, if it gets divided then it's a Leap Year else it isn't.

For every other year like 2018, 1992, 1775 etc

Divide the given year by 4. if it gets divided then it's a Leap Year else it isn't.

PRACTICE QUESTION

Find which of the following are Leap Years?

A. 1993

B. 1636

C. 2000

D. 2018

E. 2048

F. 1900

G. 100

H. 50

KEY TO THE PREVIOUS SLIDE

Option B, C and E are Leap Years while all the remaining years are Non-Leap Years.

ODD DAYS

- The number of days left after making complete weeks in a given period of time are called **odd days**.

e.g. In a period of 50 days, the number of odd days will be 1 because 50 days=7 weeks + 1 day.

- The number of odd days will always lie from 0-6.

COUNTING OF ODD DAYS

- 1 ordinary year = 365 days = (52 weeks + 1 day.)

  Therefore, **1 ordinary year has 1 odd day.**

- 1 leap year = 366 days = (52 weeks + 2 days)

  Therefore, **1 leap year has 2 odd days.**

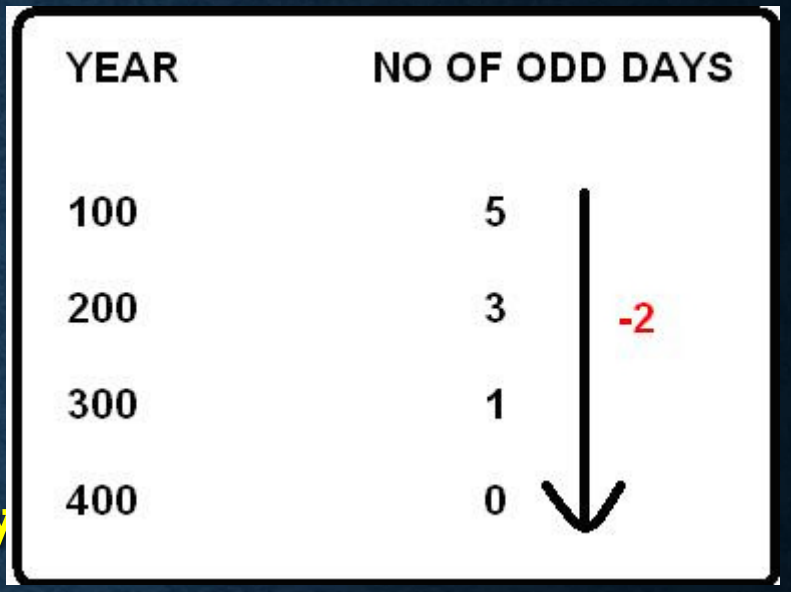
- 100 years = 76 ordinary years + 24 leap years

  = (76 x 1 + 24 x 2) odd days = 124 odd days.

  = (17 weeks + days) 5 odd days.

  Therefore, **Number of odd days in 100 years = 5.**

- Number of **odd days in 200 years** = (5 x 2) = **3 odd days**.
- Number of **odd days in 300 years** = (5 x 3) = **1 odd day**.
- Number of **odd days in 400 years** = (5 x 4 + 1) = **'0' odd day**
- Similarly, each one of 800 years, 1200 years, 1600 years, 2000 years etc. has "0" odd day.



PRACTICE QUESTIONS

1. Find the number of odd days in 345 days.

A) 2

B) 3

C) 4

D) 5

SOLUTION

To find the no. of odd days here, divide the days by 7 and the remainder is the odd days.

$$\text{Rem}\left(345 \div 7\right) = 2 \text{ odd days.}$$

2. Find the number of odd days in a decade?

A) 3

B) 4

C) 5

D) 6

SOLUTION

Here we need to assume that here a decade = 10 years with 2 leap years

10 years → 8 ordinary years + 2 leap years

→ $8 \times 1 + 2 \times 2 = 12$ odd days

$= 5$ odd days.

3. Find the number of odd days for 10 years starting from 2003.

A. 3

B. 4

C. 5

D. 6

SOLUTION

- Here, the period of 10 years starting from 2003 will have 3 leap years in it. They are 2004, 2008 and 2012 respectively.

So, in this period of 10 years, we'll have 7 ordinary years and 3 leap years.

Number of odd days = 7x1 + 3x2 = 13 odd days-------> **6 odd days.**

4. Today is Wednesday. After 61 days, it will be:

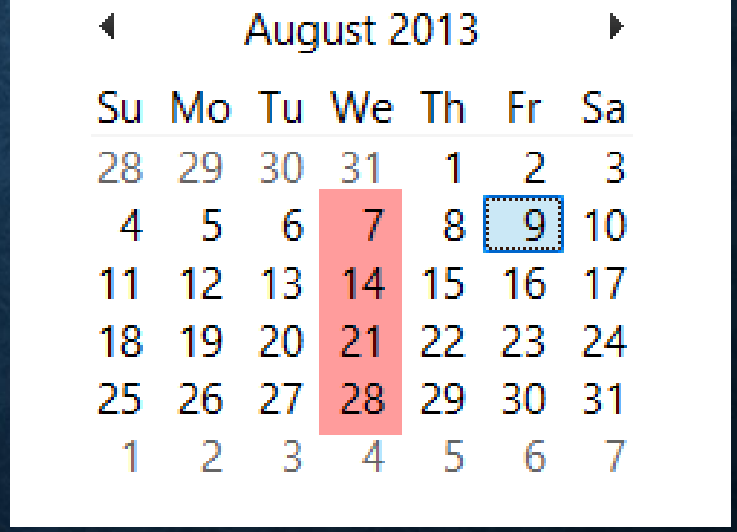
A) Wednesday

B) Monday

C) Tuesday

D) Thursday

Day repeats itself after every 7 days



SOLUTION

- 61 days = 8 weeks + **5 days**

Therefore, number of odd days in 61 days is 5.

So 5 days after Wednesday will be Monday.

NOMENCLATURE USED FOR ODD DAYS

1st January 0001 A.D was Monday

Days	Number of odd days
Sunday	0
Monday	1
Tuesday	2
Wednesday	3
Thursday	4
Friday	5
Saturday	6

ODD DAYS IN DIFFERENT MONTHS

MONTHS	ODD DAYS
JANUARY	3
FEBRUARY	0/1 (ORDINARY/LEAP
MARCH	3
APRIL	2
MAY	3
JUNE	2
JULY	3
AUGUST	3
SEPTEMBER	2
OCTOBER	3
NOVEMBER	2
DECEMBER	3

CALENDAR PROBLEMS CAN BE CLASSIFIED INTO TWO BROAD CATEGORIES –

1. Questions that ask you to find the day of the week for the given date when some other date or day is specified.

2. Questions that ask you to find the day of the week for the given date when no other date or day is specified.

FINDING DAY WITH REFERENCE DAY/DATE

- Find the net number of odd days for the period between the reference date and the given date. The day of the week on the particular date is equal to the number of net odd days ahead of the given reference day.

EXAMPLE

- Today is 21st October. The day of the week is Sunday. This is a leap year. What will be the day of the week on this day after three years?

SOLUTION

- Since this is a leap year, so none of the next 3 years is a leap year.

  Hence the number of **odd days = 3**.

So, the day of the week will be 3 days beyond Sunday i.e. it will be Wednesday.

PRACTICE QUESTION

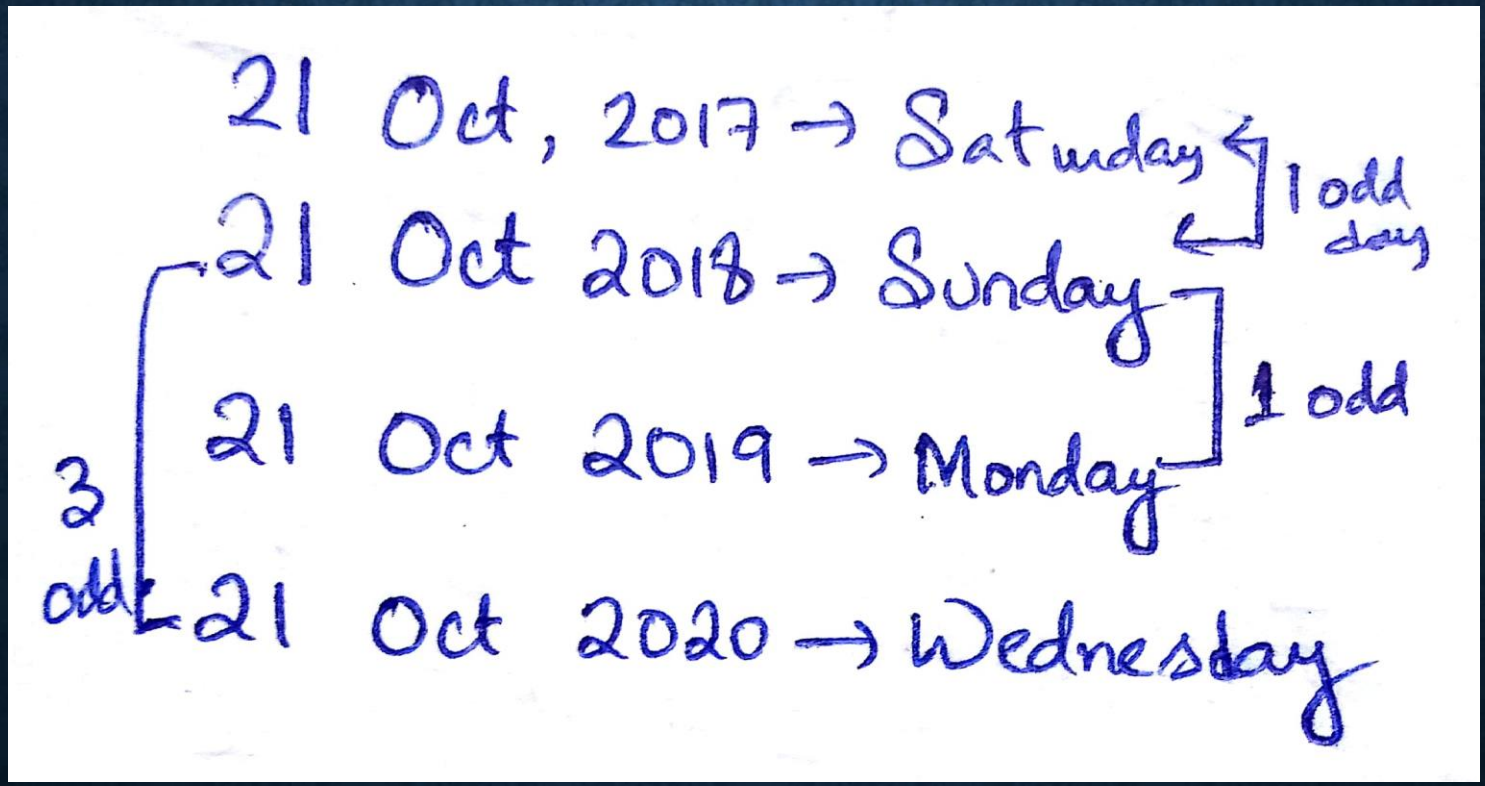
1. If 21st October, 2018 is a Sunday, then what will be the day on:

   A. 21st October, 2019

   B. 21st October, 2020

   C. 21st October, 2017

SOLUTION


21 Oct, 2017 → Saturday
21 Oct 2018 → Sunday
21 Oct 2019 → Monday
21 Oct 2020 → Wednesday
1 odd day
1 odd
3 odd

SHORTCUT TO CALCULATE A DAY WITHOUT A GIVEN REFERENCE DATE

Formula

$$\text{REMAINDER} = \frac{\text{DATE} + \text{MONTH CODE} + \text{CENTURY CODE} + \text{LAST TWO DIGIT OF YEAR} + (\text{LAST TWO DIGIT OF YEAR} \div 4)}{7}$$

Month Code-
(Normal Year)

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

Month Code-
(Leap Year)

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

Year Codes:

Year	Code
1500 – 1599	0
1600 – 1699	6
1700 – 1799	4
1800 - 1899	2

Year	Code
1900 – 1999	0
2000 – 2099	6
2100 – 2199	4
2200 - 2299	2

PRACTICE QUESTION

What was the day of the week on 17th June, 1998?

A. Monday
B. Tuesday
C. Wednesday
D. Thursday

SOLUTION

Here, Year Code= 0, Month Code= 4, **Date = 17.**

Last 2 digits of the given year = 98

Quotient of (98/4) = 24

Adding all the above values, we get **0 + 4 +17 + 98 + 24 = 143.**

Remainder of 143 / 7 = 3.

3 Odd days corresponds to Wednesday.

Thus, 17th June 1998 was a **Wednesday**.

REPETITION OF CALENDARS

Conditions for two different years to have the same calendar:

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

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

SAMPLE QUESTION

Which upcoming year after 2007 will have the same calendar as of 2007?

A. 2012

B. 2014

C. 2016

D. 2018

HINT:- Count the number of odd days year wise from the year 2007 onwards to get the net sum equal to ‘0’ odd day

SOLUTION

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

Here, Sum = 14 odd days----→ 0 odd day

Therefore, 2018 will have the same calendar as of 2007.

SHORTCUT FOR CALENDAR REPETITION

Divide the given year by 4 and according to the remainder-

		ODD DAYS
Remainder → 1	After 6 years	7
→ 2	After 11 years	14
→ 3	After 11 years	14
→ 0	After 28 years	35

LIMITATION- The given year and the upcoming year, both should lie from 1901-2099.

PRACTICE QUESTION

Which upcoming year will have the same calendar as of the following years?

1. 2004
2. 2019
3. 1948
4. 1993
5. 1990

SOLUTION

1. 2004 is completely divisible by 4 so the **remainder out here will be 0**. Therefore, the upcoming year having the same calendar as of 2004 is **2004+28= 2302** .

2. 2019 leaves a **remainder of 3** when divided by 4 so **we'll add 11 here**. Thus the answer will be **2019+11= 2030**.

3. 1948 leaves a **remainder of 0** when divided by 4. Therefore the answer will be **1948+28=1976.**

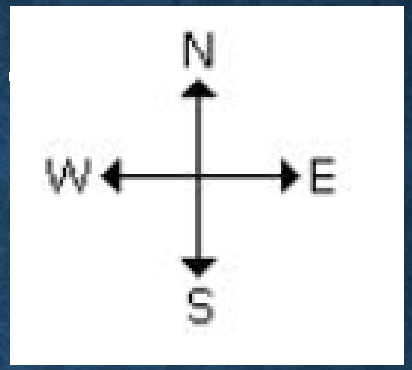
4. 1993 leaves a **remainder of 1** when divided by 4 so **we'll add 6 here** to get the answer. This, the answer will be **1993+6=1999**.

5. 1990 leaves a **remainder of 2** when divided by 4. Therefore the upcoming year having the same calendar as of 1990 will be **1990+11=2001.**

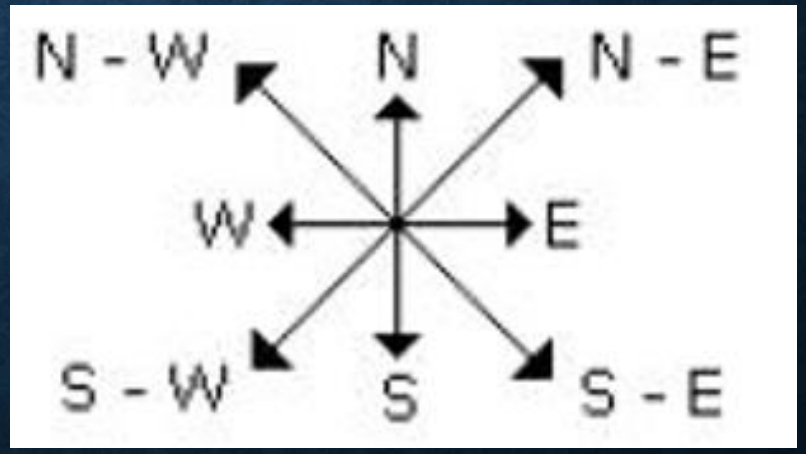
DIRECTION SENSE

- Direction sense is one of the easiest topics in logical reasoning.
- Questions from this topic generally involve an individual travelling certain distances in certain directions.
- The best way to solve these problems is to represent the traces of the path traversed by the person(assuming that you are the person), as found in the information provided by the question.

- There are four main directions –
  North, South, East and **West**.



- There are four cardinal directions – **North-East(N-E), North-West(N-W), South-East (S-E), South-West(S-W).**



Things to be noted:

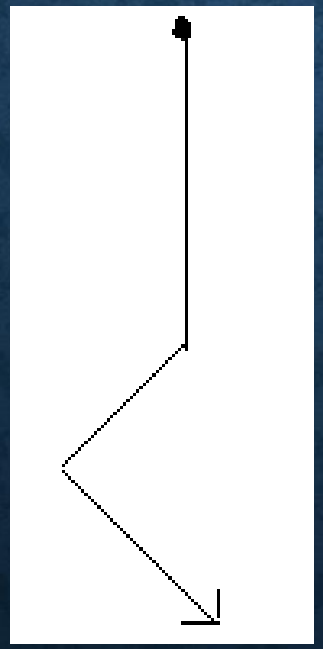
- At the time of sunrise if a man stands facing the east, his shadow will be towards west.
- At the time of sunset the shadow of an object is always in the east.
- If a man stands facing the North, at the time of sunrise his shadow will be towards his left and at the time of sunset it will be towards his right.
- At 12.00 noon, the rays of the sun are vertically downward hence there will be no shadow.
- Always shortest distance should be calculated unless mentioned otherwise.

Examples:

1. Salman walks southwards, then takes a half right turn and then a left turn. In which direction is he walking now?

a) South-East
b) South-West
c) South
d) North

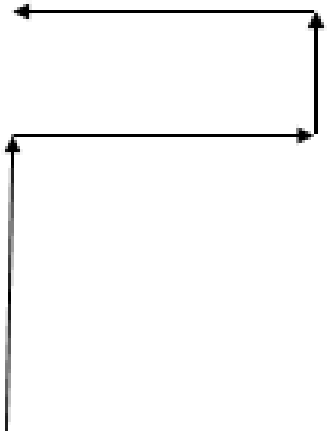
Ans: a)South-East



2. A man walks northwards. After a while he turns to his right and a little further to his left. Finally, after walking a distance of 1km, he turns towards his left again. In which direction is he moving now?

a) South
b) North
c) West
d) East

Ans:c) West



3. A man went 10 kms towards south. Then turned East and covered 10 kms and turned to the right. Again after 10 kms he turned to the left and covered 10kms to reach the destination. How far and in which direction is he to his starting point?

a) $20\sqrt{2}$ km, South- East
b) $20\sqrt{2}$ km, North- East
c) $20\sqrt{2}$ m, South- East
d) 20 km, South East

Ans: a) $20\sqrt{2}$ km, South- East