20-02-2023

★ Calenders:

Leap year = 366 days = Feb 29 days
↳ (Extra 5 hours, 46 minutes are added up to make 29th of Feb.)

For a non century year, a leap year is divisible by 4. But for a century, year is divisible by 400 and not 4.
Eg. 200 is not a leap year.

The only 5 leap years which are also a century up to today are: 400, 800, 1200, 1600, 2000.

★ Divide by 7 & get the Remainder
↓ ↳ odd days.
Week days repeat after 7 days.

Q If today is a Monday, find the week day 59 days later.
→ 59%7 ⇒ 3 odd days.
↳ Monday + 3 ⇒ Thursday.

Note: A non-leap years always adds one extra odd day to our calculation of week days, while a leap year adds two extra odd days.

Note: The first day of a week is to be considered as Monday & not a Sunday.
01/01/0001 AD was a Monday.
This will be our reference for calculations

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Q. Calculate the number of odd days present in 100 years.

100 y

[100 % 4 = 25, but 100th year will not be considered a leap year. Hence 24.]

→ 24 leap years → two odd days × 24 = 48

76 non-leap years → one odd day × 76 = 76

(48 + 76) % 7 = 5 remainder.

ie. 5 odd days.

~~ie. If today is~~

Similarly:

100 years	→	5 odd days
200	→	3
300	→	1
400	→	0

(IMP)

Odd days in every Month:

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

Q. Find the day on 15th Aug 1947.

→

Step 1 : Roll back 1 year, as the year 1947 is not completed yet.

odd days upto 1946 =

1900/400 → 300 rem → ie. one odd day

46/4 ⇒ 11 quotient (for leap years).

(46 + 11) / 7 ⇒ 1 rem → ie. one odd day

Total odd days upto 1946 = 2.

Now calculate odd days for rest of the days. To do so, add odd days according to ~~monts~~ months upto July, because August is not completed yet.

Using prev. calculations table:

odd days upto July = 16. ← (Note: The odd days of Feb will be 0, as 1947 is not a leap year.)

$16\%7 = 2$ odd days

Now for the remaining 15 days:

$15\%7 = 1$ odd day.

Total odd days upto 15 Aug 1947 = $2+2+1=5$.

∴ If 01/01/0001 was Monday then 15/08/1947 will be Friday.

Q.88 29 Oct 1981

Q.89. 6th Sept 2000

Q If 20th Feb 2023 is Monday, find the day on 20th Feb 2053.

→

$2053 - 2023 = 30$

leap years = 2024, 2028, 32, 36, 40, 44, 48, 52 = 8 leap years.

$(30+8)\%7 = 3 +$ Monday

= Thursday

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Q. If 20th Feb 2023 is Monday find the day on 20 Feb 1993.

→

2023 - 1993 = 30 years.

Leap years = 1996, 2000, 2004, 2008, 2012, 2016, 2020 = 7

(30+7)%7 = 2 ⇒ Monday - 2 ⇒ Saturday.

Q. Which of the following can never be the last day of a century? SUNDAY MONDAY TUESDAY WEDNESDAY.

→

As calculated previously ~~last~~ odd days of a century are : 5, 3, 1, 0.

Hence last day can only be Friday, Wednesday, Monday & Sunday.

Ans: TUESDAY.

Q. If we had preserved the calander of 2021, Find the next immediate year when we can reuse it.

→ formula for reusing calander question.

	$4x + 1$	→ 6 years
	$4x + 2$	} → 11 years
	$4x + 3$	
leap year →	$4x + 0$	→ 28 years

2021 → $(4x+1)$

Hence 2021 calander can be reused after 6 years. ie. in 2027.

Q. Find the same for 2011 calander.

→ 2011 → $(4x+3)$ → after 11 years.

ie. 2022.

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★ Permutation and Combinations:

If job1 can be done in x number of ways & Job 2 can be done in y number of ways, the possible ways in which we can perform

(i) Job1 OR Job2 is $x+y$

(ii) Job1 AND Job2 is $x \cdot y$

Q. Mayur has 2 white and 3 black shirts. In how many ways can he select a shirt?

→ 2 OR 3 ⇒ $2+3 = \underline{5}$

Q. Rohit has 5 shirts and 3 jeans. In how many can he dress?

→ 5 AND 3 ⇒ $5 \cdot 3 = \underline{15}$

Q. In how many ways can we arrange 5 students in 2 chairs?

→ $\underline{5} \times \underline{4} = 20$

first chair can be occupied by any of 5 students.

similarly, the second chair can be occupied by any of the remaining 4 students.

Q. 5 students and 3 chairs : $5 \times 4 \times 3 = \underline{60}$

N distinct objects can be arranged among themselves in N! ways.

↓

5 students 5 chairs : $5 \times 4 \times 3 \times 2 \times 1 = 5! = \underline{120}$

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Q. How many arrangements of the word WATER are possible if

(i) Vowels are always togeather.
(ii) Vowels are never togeather.
(iii) Consonents are always togeather.
(iv) Consonents are never togeather.
(v) No two consonents are togeather.

⇒

(i) $- - - \square\square \Rightarrow 4! \times 2! \Rightarrow \underline{\underline{48}}$

(ii) For vowels never togeather :

= total possibilities - always togeather cases

$= 120 - 48 = \underline{\underline{72}}$

(iii) $- - \square\square\square \Rightarrow 3! \times 3! \Rightarrow \underline{\underline{36}}$

(iv) $120 - 36 = \underline{\underline{84}}$

(v) $\square - \square - \square \Rightarrow 3! \times 2! = \underline{\underline{12}}$.

Q. How many arrangements of the word GOOGLE are possible.

→ $\dfrac{6!}{2! \times 2!} = \underline{\underline{180}}$

Q. How many 4 digit numbers can you make using the digits 6, 7 and 8 if repetition is allowed.

→

$\underline{3} \times \underline{3} \times \underline{3} \times \underline{3} \Rightarrow 3^4$

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Note: If repetition is allowed, n distinct objects can be arranged in R-places in n^R ways.

Q90 In how many ways can 5 students select a DAC center for each one of them from the available 7 centers, if no two centers can select the same candidate.

IMP Q91 In how many ways can we distribute 6 prices among 4 students so that no price can be shared.

Q92 In how many ways can Siddhart send greeting cards to 4 of his girlfriends through 8 friends if no girl can get more than 1 card.

Q93 In how many ways can we arrange 5 students into 5 chairs in a circle.

Note: n people can be arranged in a circle in $(n-1)!$ ways because the 1st person has only one choice, as choosing any chair will be treated as same.

★ Permutation / Arrangements: Order is important

n distinct objects can be arranged in r positions in ^nP_r ways.

$$^nP_r = \frac{n!}{(n-r)!} ; \quad n \geq r.$$

GYAAN: I Give The Utmost Respect, But I Demand Mine, I Will Earn It.

Q In how many ways can we arrange 3 students into 5 chairs.

→ $^nP_3 \Rightarrow {}^5P_3$ or $5 \times 4 \times 3$.

★ Selection : Here order is un-important.

R-objects can be selected from n-objects in ^nC_r ways.

$$^nC_r = \frac{n!}{(n-r)!\,r!} \quad ; \quad {}^nC_r = {}^nC_{n-r}.$$

Cheat Sheet:

OR	AND	Order important	Order un-important
$+$	$\times$	^nP_r	^nC_r

Q. In how many ways can we form a committee of 5 students from a group of 4 boys and 5 girls, if the committee compriced of

(i) Exactly 2 boys
(ii) Exactly 4 girls
(iii) No boy
(iv) Atleast 3 girls.

⇒

(i) $^4C_2 \cdot {}^5C_3$ or $\boxed{4 \times 3} \times 5 \times 4 \times 3$ → Exactly part is excluded

(ii) $^5C_4 \cdot {}^4C_1$ or $5 \; 4 \; 3 \; 2 \; 4$ IGNORE

(iii) $^5C_5$

(iv) $({}^5C_3 \cdot {}^4C_2) + ({}^5C_4 \cdot {}^4C_1) + {}^5C_5$

Q. How many straight lines can be drawn through 10 non-colinear points?

→

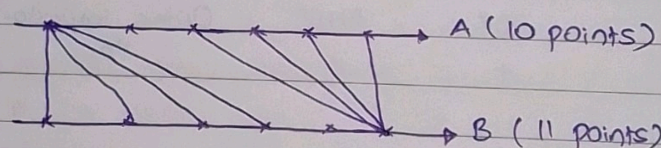
Here order is not important, as lines can be bi-directional.

Ans: ${}^{10}C_2$

In case of Rays, 10 non-colinear points will have ${}^{10}P_2$ rays.

Q. How many triangles can be drawn between 2 parallel lines A and B if line A contains 10 points and line B contains 11 points.

→



Ans: ${}^{10}C_2 \times {}^{11}C_1 + {}^{10}C_1 + {}^{11}C_2$

Q. In how many ways can we arrange 4 girls and 3 boys in a row so that no two boys sit togeather.

→

$\underset{\text{girls}}{4!} \times \underset{\text{boys.}}{{}^{5}P_3}$

$\_G_1\_ G_2 \_ G_3 \_ G_4 \_$

Q. In how many ways can we arrange 4 identical green balls & 3 identical blue balls in a line so that no two blue balls are togeather.

→

$\underset{\text{greens}}{1!} \times {}^{5}C_3 \rightarrow$ placing blues.

$\_ G \_ G \_ G \_ G \_$

Q

Find the number of squares and rectangles in the above given grid.

→ no. of columns and rows.

squares = $(4 \times 6) + (3 \times 5) + (2 \times 4) + (1 \times 3)$.

keep reducing the count until one of them reaches 1.

rectangles = ${}^{5}C_{2} \times {}^{7}C_{2}$

Here 5 & 7 are line count of the grid.

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Q. How many 5 digit numbers can we make using the digits 1, 2, 3, 4 & 5 (repetition not allowed) such that the num is divisible by 4.

→

--- 12 $\qquad 3! \times 4 = \underline{24}$

--- 24

--- 32

--- 52

Q. How many 5 digit numbers can be made using 1, 2, 3, 4 & 5 (no repetition) that are divisible by ~~5~~. 3.

→ $5! = \underline{120}$.

↳ because in every case the sum of digits will be same (15).

Q Find the sum of all ~~these~~ 120 numbers produced from the previous question.

→

$$5\overline{)120} = \underline{\underline{24}} = 4!$$

4!
_ _ _ _ 1
_ _ _ _ 2
_ _ _ _ 3
_ _ _ _ 4
_ _ _ _ 5

$$24 \times (1+2+3+4+5) = 360$$

360 | 360 | 360 | 360 | 360.

ie 3999960 → Ans

$$\begin{array}{r} 36 \\ + 360 \\ \hline 396 \end{array}$$

★ Probability = $\dfrac{\text{no. of favourable outcome}}{\text{total no of outcomes.}}$

★ Coins: For n coins there are 2^n outcomes.

Q. Six coins are tossed, find the probability of getting
(i) Exactly 3 heads
(ii) no heads
(iii) at least 5 heads
(iv) at most 2 heads.

For coins use ${}^nC_r$.

⇒

(i) ${}^6C_3 / 24$

(ii) ${}^6C_0 / 24$

(iii) $({}^6C_5 + {}^6C_6) / 24$

(iv) $({}^6C_0 + {}^6C_1 + {}^6C_2) / 24$

* Cards:

A deck of card contains 52 cards,
12 face cards (K, Q, & J) x4

Q. 2 cards are drawn from a pack of 52 cards. What is the probability of getting
(i) 2 Red cards
(ii) 1 face card and 1 non-face card
(iii) 1 spade and 1 heart.
(iv) 2 Kings.

⇒

(i) $^{26}C_2 / ^{52}C_2$ (ii) $^{12}C_1 + ^{40}C_1 / ^{52}C_2$

(iii) $^{13}C_1 + ^{13}C_1 / ^{52}C_2$ (iv) $^{4}C_2 / ^{52}C_2$

* Dice : n dice will 6^n outcomes.

Q. Given that two dice are rolled find the probability of getting the sum as (i) 7 (ii) 10. (iii) A perfect square
⇒ (iv) A prime number.

* For 2 dice:

Sum	No. of possible outcomes.		
2	- 1	9	- 4
3	- 2	10	- 3
4	- 3	11	- 2
5	- 4	12	- 1
6	- 5		
7	- 6		
8	- 5		

For 3 dice:

Sum	Combinations		
3	- 1	11	- 36
4	- 3	12	- 28
5	- 6	13	- 21
6	- 10	14	- 15
7	- 15	15	- 10
8	- 21	16	- 6
9	- 28	17	- 3
10	- 36	18	- 1

Ans: (i) 6/36 (ii) 3/36

(iii) 7/36 (iv) 15/36

★ Q. Bag 1 contains 6 Red and 4 Blue balls. While bag 2 contains 7 red and 3 blue balls. A ball is taken from bag 1 and put into bag 2. Now a ball is selected from bag 2. What is the probability that this ball is Red?

⇒

B1: 6R 4B   B2: 7R 3B

$$\frac{4}{10} \times \frac{7}{11} + \frac{6}{10} \times \frac{8}{11}$$

probability for Bag 1, that the selected ball was blue and red respectively.

probability for Bag 2, that the selected ball is Red.

Q.

Q. The probability that 3 students A, B and C can solve a problem is $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved?

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⇒ Using Bernoulli trial,

$$P(\text{solving}) = 1 - P(\text{not-solving}).$$
$$= 1 - \left(\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4}\right)$$
$$= 1 - \frac{1}{4} = \underline{\underline{\frac{3}{4}}}$$

Q A company currently manages 3 managers (A, B and C) and 5 recruitment agents (D, E, F, G and H). New office in US requires the company to relocate 2 of 3 managers and 3 of 5 agents. Find the number of possible combinations given that :

Manager A and C cannot work togeather.
C and E cannot ——— " ———
D and G ——— " ———
D and F ——— " ———

(i) If D goes to new office which of the following is/are true?

(a) C cannot go (b). A cannot go $\left\{ \text{AB / DEH} \right.$

(c) H must also go

Ans: (a) and (c).

(ii) Which of the following is sure to find a place in new office?

(a) B (b) H (c) G (d) E

Ans: (a).

(iii) Which of the following team combination is wrong.

(a) ABDEH (b) ABFGH (c) ABEGH (d) ABDGH

Ans: (d)

Q. Mr and Mrs Sharma and Mr and Mrs Gupta play 3 games of chess on a knock out basis. Further,
(i) Sharmas won less number of games than Guptas
(ii) The womens won one game & men won two
(iii) In only the first game were the two players married to each other.

(Qi) Who did not lost a game?
(a) Mr. Sharma (b) Mrs. Sharma
(c) Mr. Gupta (d) Mrs. Gupta

(Qii) Who played & won first game?

(Qiii) Which was a all men game?
(a) Second (b) Third (c) Second or Third
(d) Both Second and Third.

Ans: Starting game possibilities.

Mr vs Mrs Gupta OR Mr vs Mrs Sharma

Winners ⇒

Mr. G → Mr. G vs Mr. S → winner → Mr. G vs Mrs. S (winner: Mrs. S)

Mrs. G (not-possible) [violates condition (ii)]

Mr. S (not-possible) [it will violate condition (iii)]

Mrs. S (not-possible) [it will violate condition (i) & (ii)]

Ans (Qi) : (b)
Ans (Qii) : Mr. Gupta
Ans (Qiii) : (a)

Q. Aptitude Rohra Sir > APTITUDE MATERIAL > Reasoning 20 Jan.doc
Q 19 to 23.

Age	State	Name
32	MP	Asim
38	Orissa	Minal
34	Karnataka	Pankaj.
26	UP	Kunal
44	Gujarat	~~As~~ Pravin
18	Maha.	Laxman

✓ Pravin oldest
✓ Laxman youngest not Gujarat
✓ Pankaj & Kunal not 18 or 38
✓ Minal, Laxman, Pankaj nither oldest nor in 20s.

Q. 24 - 36.

F	Professor
D	Clerk
A	Surgon
C	Tailor
B	Trader
E	Pilot

D, A: married
C, B: married

A $\xleftrightarrow{\text{couple}}$ D
Surgon Clerk

B $\xleftrightarrow{\text{couple}}$ C
Mother Trader Tailor

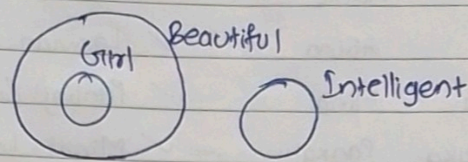
F $\xleftrightarrow{\text{siblings}}$ E
(Prof.) Pilot

* Syllogism: 7 variations.

Steps: Draw a ven diagram using condition (i) & (ii). Now validate condition (iii) using the produced ven diagram.

Note: Partial truth = May or May not be situation = false case.

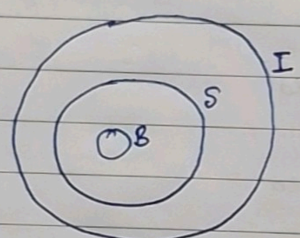
Type 1: (i) All girls are beautiful
(ii) No beautiful is intelligent.
(iii) Therefore no girl is intelligent.



Ans: False

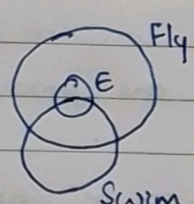
Type 2: (i) All boys are smart.
(ii) All smart are idiot.

Agreed → (iii) All boys are idiots.



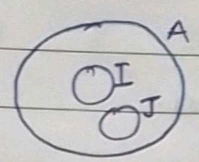
Ans: True.

Type 3: (i) All elephants can fly
(ii) Some elephants can swim
(iii) Some flying objects can swin



Ans: True

Type 4: (i) All Indians are Asians
(ii) All Japanese are Asians
(iii) Some Japanese are Indians



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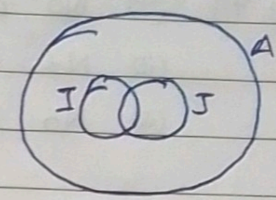
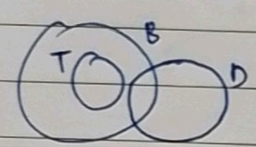


Ans: May or May not be = False.

Type 5 : (i) All tigers are brave.

(ii) Some brave are dangerous.

(iii) Some tigers are dangerous.



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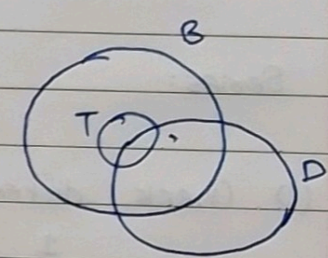
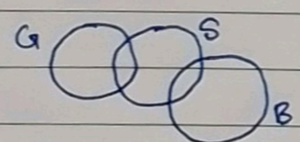


Ans: May or May not be = False.

Type 6 : (i) Some gold is silver

(ii) Some silver is bronze

(iii) Some gold is bronze



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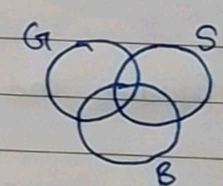
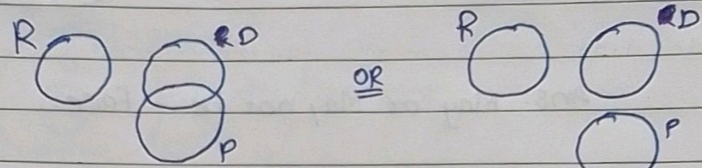


Ans: May or May not be = False

Type 7: (i) No diamond is Ruby
(ii) No Ruby is Pearl
(iii) No Diamond is Pearl.



Ans: May or May not be = False.

★ Series:

(i) Check difference

1, 2, 3, 4, <u>5</u>

(ii) Check difference of difference

2, 10, 30, 68, <u>130</u>, <u>222</u>, <u>350</u>

8, 20, 38, $\boxed{62}$

12, 18, $\boxed{24}$

(iii) Squares and cubes.

100 99 98 94 86 77 <u>50</u>

1^2 1^3 2^2 2^3 3^2 3^3

(iv) Fibonacci series

3 5 8 13 21 34 55 <u>89</u>

2 3 5 8 13 21 34

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(v) Higher level Fibonacci series: Adding last 3.

1 2 3 6 11 20 37

1 1 3 5 9 17

(vi) Geometric progression: $a, ar, ar^2, ar^3, \ldots$

Arithmetic progression: $a, a+d, a+2d, a+3d, \ldots$

Harmonic progression: $1/a, 1/a+d, 1/a+2d, \ldots$

5 7 11 19 35 67 131

(vii) Combination of two or more series:

4 4 4

7 35 11 27 15 19 19 11

8 8 8

(viii) 77 49 36 18 8

7x7 4x9 3x6 1x8

(ix) 1 4 6 8 9 10 12 14 15 16 18

Prime Numbers Skipped

A D F H I J L N O P R

* (x) O T T F F S S E N

one two three four nine

(xi) 1 8 11 18 80 81 numbers starting with vowels.

Most used alphabet in numbering system is e

least used is t.

(xii) 1 4 5 6 7 9 11 100

All above numbers have an absence of letter 't'.

(xiii) Description Series.

1 , 11 , 21 , 1211 , 111221 , 312211 .

One one   two one   One one, one two, two one,