

3.9

CHAPTER

Miscellaneous Puzzles

Puzzles

A puzzle is a problem given that tests the ingenuity of the solver. In a basic puzzle, It solver should intended to piece together objects (puzzles pieces) in a logical way in order to come up with the desired shape, picture or solution.

Solutions to puzzles may require recognizing patterns and creating a particular order. People with a high ireasoning aptitude may be better at solving these puzzles.

Types of Puzzles

The large number of puzzles that have been created can be divided into various categories for example logical puzzle using chess board.

Other categories include

- Puzzle or Numbers
- Mathematical
- Mathematical problem such as the missing square puzzle
- Picture puzzle
- Connect the dots
- Logical puzzle like Sudoku.
- Spot the difference etc.

Lets have a glimpse of different types of puzzles

Numbers

Ex.1 In a ten digit number first digit represents number of one present in the number. Second digit represents number of two present in the number. Similarly, third digit represents number of three present in the number and so on till ninth digit, which represents number of nine present in the number. Last digit represents number of zero present in the number. Find that number.

Sol.: Let the ten digit number be

a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	a_9	a_0
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The smallest possible ten digit number is 1,00,00,00,000

We will go on modifying this number, since last digit represent number of zeros it should be 9.

Ist step : 1,00,00,00,009.

Since we have only 8 zeros last digit should be 8.

IInd step : 1,00,00,00,008

Since number of "8" present in the above case is one the next modification will be.

IIIrd step : 1,00,00,00,108.

Here number of zeros are only seven so

IVth step : 1,00,00,00,107.

Here, since the number of "7" present is one so next modification will be

Vth step : 1,00,00,01,007.

Here, since number of "1" present is two so the next modification will be

VIth step : 2,00,00,01,007

Number of "2" present is be one so next modification will be

VIIth step : 2,10,00,01,007

Here, since number of zeros present is six so next modification will be

VIIIth step : 2,10,00,01,006.

Here, since number of "6" present is 1 so next modification will be

IXth step : 2,10,00,10,006.

This number 2,10,00,10,006 satisfy all the condition so this is the desired number.

Triangles

Ex.2 Find out the total number of triangles in the given figure.



Fig. (1)

Sol. First of all we will count single triangle.
Number of single triangle = 12

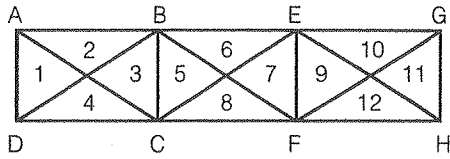


Fig. (2)

Now, we will count triangle made by joining two triangles for example in the below given fig. (3) we have 4 triangles made by joining two single triangles.

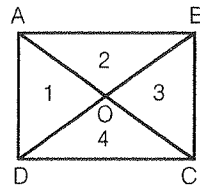


Fig. (3)

$$\begin{aligned}\Delta ADB &= \Delta 1 + \Delta 2 \\ \Delta ADC &= \Delta 1 + \Delta 2 \\ \Delta BDC &= \Delta 3 + \Delta 4 \\ \Delta ABC &= \Delta 2 + \Delta 3\end{aligned}$$

So in the given fig. (2) we will have 12 such "double triangles."

Now, we will count number of triangles made by joining four triangles.

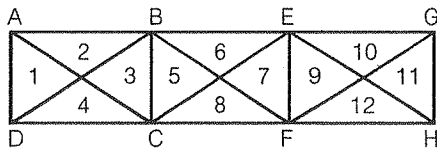


Fig. (4)

$$\begin{aligned}\Delta ACE &= \Delta 2 + \Delta 3 + \Delta 5 + \Delta 6 \\ \Delta DBF &= \Delta 4 + \Delta 3 + \Delta 5 + \Delta 8 \\ \Delta CEH &= \Delta 8 + \Delta 7 + \Delta 9 + \Delta 12 \\ \Delta BFG &= \Delta 6 + \Delta 7 + \Delta 9 + \Delta 10\end{aligned}$$

So we have

12 "Single triangle"
12 "Double triangle" and
4 "Four triangle"
 $\Rightarrow$ 28 triangles Ans.

Ex.3 Find number of triangles present in given Fig. (5).

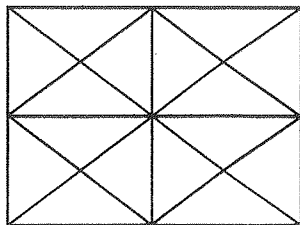


Fig. (5)

Sol. Number of "Single triangles" present in the Fig. (6) are 16.

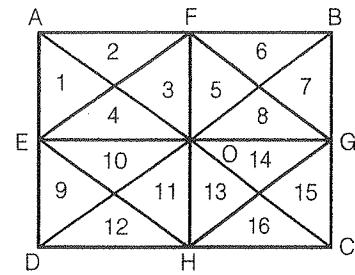


Fig. (6)

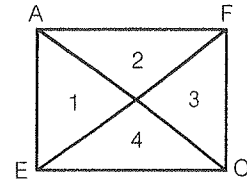


Fig. (7)

Now, we will find number of double triangles in Fig. (7) which is equal to 4 i.e.

$$\begin{aligned}\Delta AFE &= \Delta 1 + \Delta 2 \\ \Delta AFO &= \Delta 2 + \Delta 3 \\ \Delta FOC &= \Delta 3 + \Delta 4 \\ \Delta AEO &= \Delta 1 + \Delta 4\end{aligned}$$

So total "double triangle" in fig. (6) are 16.

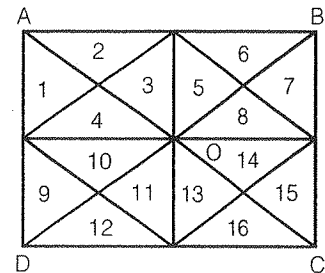


Fig. (8)

Number of "Four triangle" will be 4.

$$\begin{aligned}\Delta AOD &= \Delta 1 + \Delta 4 + \Delta 10 + \Delta 9 \\ \Delta AOB &= \Delta 2 + \Delta 3 + \Delta 5 + \Delta 6 \\ \Delta BOC &= \Delta 7 + \Delta 8 + \Delta 14 + \Delta 15 \\ \Delta DOC &= \Delta 12 + \Delta 11 + \Delta 13 + \Delta 16\end{aligned}$$

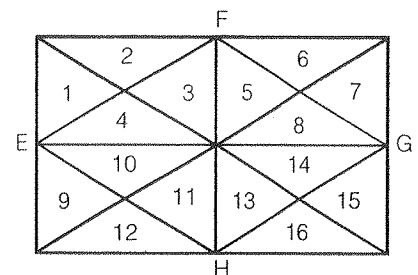


Fig. (9)

Number of "Four triangle" will be 4

$$\Delta EFH = \Delta 3 + \Delta 4 + \Delta 10 + \Delta 11$$

$$\Delta EFG = \Delta 4 + \Delta 3 + \Delta 5 + \Delta 8$$

$$\Delta FGH = \Delta 5 + \Delta 8 + \Delta 14 + \Delta 13$$

$$\Delta EHG = \Delta 10 + \Delta 11 + \Delta 13 + \Delta 14$$

In fig. (9) Number of "Eight Triangles" will be 4

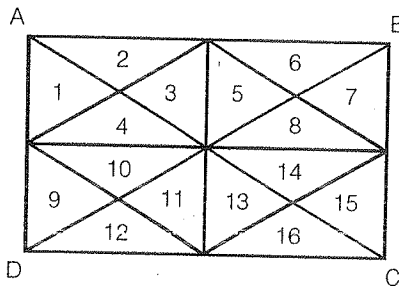


Fig. (10)

$$\Delta ABC = \Delta 2 + \Delta 3 + \Delta 5 + \Delta 6 + \Delta 7 + \Delta 8 + \Delta 14 + \Delta 15$$

$$\Delta BCD = \Delta 7 + \Delta 8 + \Delta 14 + \Delta 15 + \Delta 16 + \Delta 13 + \Delta 11 + \Delta 12$$

$$\Delta ADC = \Delta 1 + \Delta 4 + \Delta 9 + \Delta 10 + \Delta 11 + \Delta 12 + \Delta 13 + \Delta 16$$

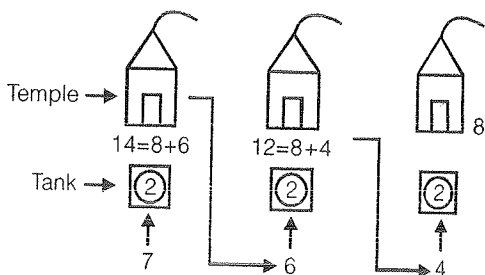
$$\Delta ADB = \Delta 1 + \Delta 2 + \Delta 3 + \Delta 4 + \Delta 5 + \Delta 6 + \Delta 9 + \Delta 10$$

So, total number of triangles will be $16 + 16 + 4 + 4 + 4 = 44$ Ans.

Temple and Tank

Ex.4 There are three temples near Tanjaur. In front of all temples there are one tank each. Kavitha, a lady deity went to a temple with certain number of flower. She washed flowers in tanks in front of first temple and it became doubled. She devoted 8 flowers in that temple and moved to second temple. She again washed remaining flowers and again became doubled. She devoted 8 flowers in the second temple. She again washed remaining flowers in third tank and it become double in front of the last temple and devoted 8 flowers. Then she was left with no flowers. How many flowers Kavitha initially had?

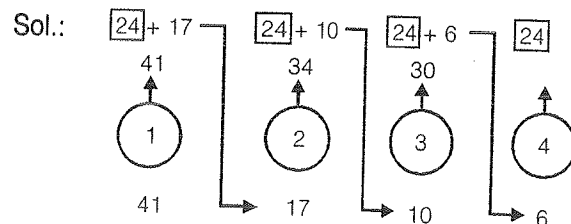
Sol.



- (1) We will start solving it from back side. After devoting 8 flowers in third temple Kavitha had no flowers. It means before washing in third tank she had 4 flowers.
- (2) It also shows that she had 12 flower before devoting 8 flower in second temple.
- (3) From this information we come to know that she had 6 flowers before washing it in second tank.
- (4) It means she had $(8 + 6) = 14$ flowers before devoting to first temple.
- (5) Now we can easily get the number of flower she initially had before washing in first tank.
- (6) From the above Fig. we can easily find solution in a simple and lucid manner.

Cat and Mouse

Ex.5 There are four holes numbered 1, 2, 3 and 4. The unique properties of these holes is that number of mouse become double, triple and four times after entering into hole number 2, 3 and 4 respectively. While it remains same if they enter in first hole. One cat is running in search of few mouse. To save themselves from cat, mouse entered in first hole and came out. 24 of them become diet of cat. They respectively entered into second, third and fourth hole and come with double, triple and four times in number. After their exit from each hole i.e. second third and fourth, 24 mouse become diet of cat each time. At the end there is no mouse left. Find the initial number of mouse before entering into first hole.



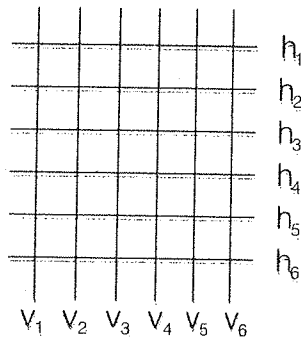
- From the fig it is clear that before entering into fourth hole there were 6 mouse.
- 30 mouse came out of fourth hole, because 24 become diet of cat and 6 remained.
- before entering into third hole there were 10 mouse.
- 34 i.e. $24 + 10$ mouse came out of second hole, 24 become diet of cat and 10 remained.
- 17 mouse entered into second hole.

- 41 mouse came out of first hole.
- There were 41 mouse before entering into first hole.

Rectangles

Ex.6 Six parallel horizontal lines are intersecting perpendicularly to six vertical parallel lines. Find number of rectangles formed after such intersection.

Sol.:



Here V_1 to V_6 represent six parallel vertical lines and h_1 to h_6 represent six parallel horizontal lines.

To form a rectangle we need to select any two horizontal parallel lines which intersect any two vertical parallel lines.

Thus

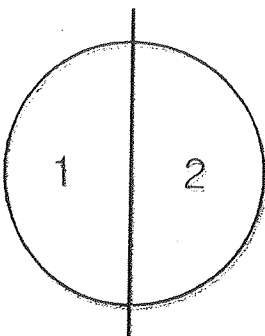
$${}^6C_2 \times {}^6C_2 = 15 \times 15 = 225$$

225 rectangle will be formed.

Birthday Cake

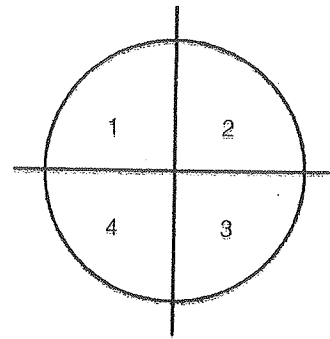
Ex.7 In a Birthday party there is a cake, which is to be cut into different pieces. How many maximum pieces are possible if five vertical cuts are made given that no horizontal cut is allowed.

Sol.



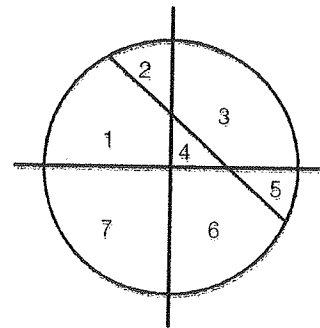
[Fig. First cut]

$$\text{Total pieces} = 1 + 1 = 2$$



[Fig. Second cut]

$$\text{Total pieces} = 1 + 1 + 2 = 4$$



[Fig. Third cut]

$$\text{Total pieces} = 1 + 1 + 2 + 3 = 7$$

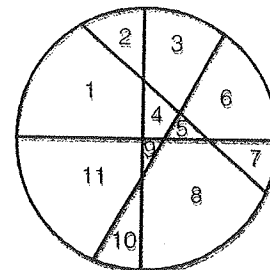


Fig. Fourth cut

$$\text{Total pieces} = 1 + 1 + 2 + 3 + 4 = 11$$

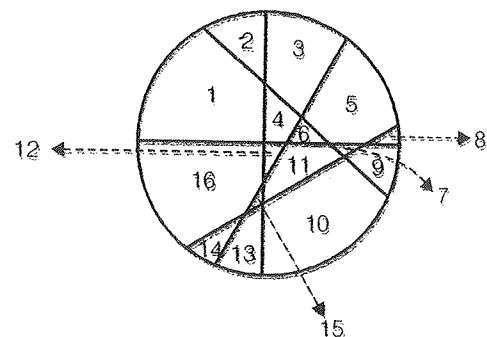


Fig. Fifth cut

$$\begin{aligned} \text{Total pieces will be} \\ = 1 + 1 + 2 + 3 + 4 + 5 = 16 \text{ Ans.} \end{aligned}$$

Similarly, for n cuts we get

$$1 + 1 + 2 + 3 + 4 \dots n \text{ pieces.}$$

$$\Rightarrow 1 + \sum n \text{ pieces.}$$

$$\Rightarrow 1 + \frac{n(n+1)}{2} \text{ pieces is the generalize short-cut.}$$

Intersecting Lines

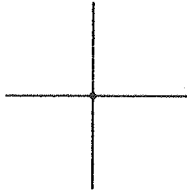
Ex. 8 Five lines are intersecting each other. Find maximum how many intersecting points are possible.

Sol.

1. Single line

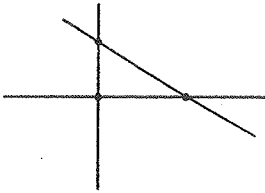
no intersecting points

2. Two lines



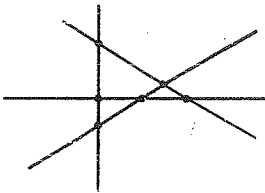
One intersecting point $\Rightarrow 0 + 1 = 1$

3. Three lines



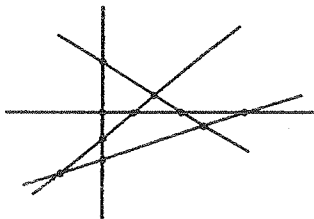
Three intersecting points $\Rightarrow 0 + 1 + 2 = 3$

4. Four lines



Six intersecting points $\Rightarrow 0 + 1 + 2 + 3 = 6$

5. Five Lines



Ten intersecting points

$$\Rightarrow 0 + 1 + 2 + 3 + 4 = 10$$

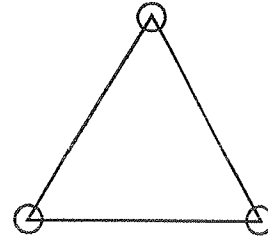
Similar for n intersecting lines, maximum intersecting points will be

$$0 + 1 + 2 + 3 + \dots (n - 1) = \Sigma (n - 1)$$

Coins

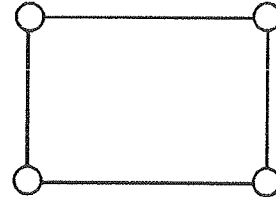
Ex.9 Ten coins are to be placed in five lines in such a manner that each line contains four coins.

Sol. 1. Triangles



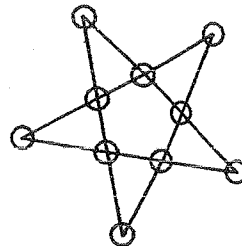
Triangle represents a figure in which three coins are placed in three lines such that each line contains two coins.

2.



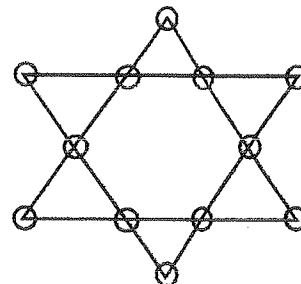
Square or rectangle represents a figure in which four coins are placed in four lines such that each line contains two coins.

3.



A Pentagonal star represents a figure in which ten coins are placed in four lines such that each line contains four coins.

4.

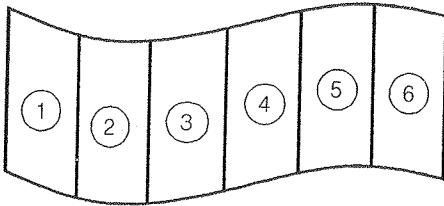


Similarly we can observe in given hexagonal star that twelve coins are present in six lines such that each line contains four coins.

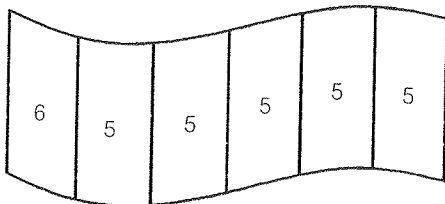
The Flag

Ex.10 Flag of a nation consists of six different vertical strips. How many such flags can be possible if we use six colours to fill the strips such that no two consecutive strips will have same colours?

Sol.



First strip can be filled with any six colours. Next strip can be filled with any five colours except the colour filled in strip one. Successive strips will also be filled in the same manner i.e. 5 ways. Number of possible flags will be



$$6 \times 5 \times 5 \times 5 \times 5 \times 5 = 18750 \text{ Ans.}$$

□□□□□



Practice Exercise: I

Direction (Qs. 1 to 3): Read the following information carefully and answer the question below it.

Rahul brought some sweets on his 21st birthday. He offered one less than the half of total number sweets in the temple near the house. He also gave one sweet each to 3 beggars sitting on the stairs of 'temple'. On the way back to home, he stopped a big group of poor children and gave them half of what was left with him. After reaching home he shared the remaining two pieces of sweets with his younger brother.

1. How many sweets did he originally had?
 - (a) 8
 - (b) 10
 - (c) 12
 - (d) 14

2. How many sweets did he offered in the temple?
 - (a) 3
 - (b) 4
 - (c) 5
 - (d) 6
3. How many sweets did he gave to poor children?
 - (a) 1
 - (b) 2
 - (c) 30
 - (d) 42

Direction (Qs. 4 to 7): Read the following information carefully and answer the question below it.

Study the pyramid of the letters given below and answer the questions

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      B
    M T R
  G C S N P
Y Q H K E A I
J F U W X O V Z D
  
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4. Which letter is missing in the pyramid?
 - (a) F
 - (b) I
 - (c) L
 - (d) P
5. If letters were to be studied vertically, which two letters happen to be neighbours that occur together in alphabetical order?
 - (a) WX
 - (b) PR
 - (c) UV
 - (d) ST
6. Two letters in the above pyramid have exactly the same number of letters between them horizontally as they have in the alphabetical order. Which are they?
 - (a) Y and Q
 - (b) V and X
 - (c) N and P
 - (d) E and K
7. If all the horizontal lines were to be studied separately which neighbours in the alphabetical order are the farthest?
 - (a) F and U
 - (b) Q and Y
 - (c) C and S
 - (d) H and Q

Direction (Qs. 8 to 15): Read the following information carefully and answer the question below it.

The Selection Committee of a company laid down the following criteria of selection for the post of Manager-Accounts:

- (i) The candidate must be a post-graduate in Commerce.

- (ii) The candidate must have completed 21 years and should not be more than 35 years as on 31-07-1996.
 - (iii) If the candidate does not satisfy the criterion in (i) above but has completed his CA examination he will be referred to Director – Finance, who can allow the candidate to appear in the interview if otherwise eligible.
 - (iv) If the candidate fulfils all the criteria mentioned in (i) and (ii) above, he/she will be called for group discussion.
 - (v) The candidate must get 50% marks to qualify in the group discussion.
 - (vi) If the candidate qualifies in the group discussion he/she will be called for interview.
 - (vii) The candidate must get 30% marks in the interview (out of 50) to get finally selected.
- Based on the above criteria, decide which of the following course of action should be taken in the case of candidate described in each of the following questions.

Mark answer as:

- (1) If the candidate can be selected;
 - (2) If the candidate is to be referred to Director – Finance;
 - (3) If the candidate can be called for group discussion;
 - (4) If the candidate can be called for interview;
 - (5) If the candidate cannot be selected
3. Mr. Das is M.Com and his date of birth is 30-06-1961
 3. Mrs. Krishnamurthy is a qualified CA and was 25 years old on 31-07-1996
 10. Mr. Kant, a post-graduate with Commerce obtained 70% marks in group discussion and secured 20 marks in Interview. He was 35 years as on 31-07-1996
 1. Mrs. Desai is a post-graduate in Economics and her date of birth is 3-04-1965
 2. Mr. Patel, a post-graduate was permitted by Director Finance. He was born on 30-05-1963. He obtained 12 marks in interview
 3. Mr. Mathur is Ph.D in Commerce and was 34 years old on 1-08-1995. He obtained 14 marks in interview.

14. Mr. Roy is a commerce graduate, has passed his CA examination and was born on 18-04-1974.

15. Mr. Subramaniam whose date of birth is 04-05-1965 is a post graduate with Commerce and has obtained 60% marks in the interview

Direction (Qs. 16 to 20): Read the following information carefully and answer the question below it.

Three small children Sonu, Monu and Tonu went on a picnic with their dog Jhony. They carried with them few chocolates, which none of them incidentally counted on their way. They rested under a tree and slept for a while. After some time Sonu woke up, gave one chocolate from the total to Jony and distributed the remaining into three equal parts, ate his share and slept. After some time, Monu woke up, gave one chocolate to Jony and distributed that remaining into three equal parts, ate his share and slept. After some time Tonu woke up and repeated the same. A little later all of them woke up together, gave one chocolate from the total to Jhony and divided the remaining chocolates among them and each one ate his share. By chance we know that the total number of chocolates were less than 150 in the beginning and they didn't break any chocolate.

16. How many chocolates were in the beginning?
 - (a) 66
 - (b) 84
 - (c) 118
 - (d) 79
17. What is the difference in the number of chocolates eaten by Monu and Tonu?
 - (a) 6
 - (b) 11
 - (c) 14
 - (d) 18
18. What is the difference in the number of chocolates eaten by Sonu and Tonu?
 - (a) 25
 - (b) 15
 - (c) 20
 - (d) 18
19. Monu and Tonu ate the chocolates in the ratio...
 - (a) 13 : 11
 - (b) 9 : 7
 - (c) 4 : 3
 - (d) 5 : 4
20. How many more chocolates did monu eat, than Jhony?
 - (a) 20
 - (b) 27
 - (c) 32
 - (d) 36

Direction (Qs. 21 to 25): Read the following information carefully and answer the question below it.

Atul, Bhupinder, Charles and Deepak are four brothers playing a game where the loser doubles the money of each of the other players by giving them from his share at that point of time. They played four games and each brother lost one game in alphabetical order. At the end of the fourth game each brother had Rs. 64.

21. Who started with the lowest amount?
(a) Atul (b) Bhupinder
(c) Charles (d) Deepak
22. What was the amount left with Charles at the end of the second round?
(a) 72 (b) 144
(c) 132 (d) 136
23. How many rupees did Bhupinder start with?
(a) 64 (b) 136
(c) 68 (d) 72
24. At the end of the fourth round, who had the max. profit? (max. winning vis-a-vis opening amount)
(a) Atul (b) Bhupinder
(c) Charles (d) Deepak
25. Who had the minimum deviation from the opening amount?
(a) Atul (b) Bhupinder
(c) Charles (d) Deepak

Direction (Qs. 26 to 28): Read the following information carefully and answer the question below it.

Life was not easy before Aryabhatta. Zero was not invented and also people could not multiply numbers. Thus mathematics had only 9 digits (1 to 9) and after that came 11 and so on. Find the answer to following operations in mathematics used then.

26. What is $7 + 11 + 3 =$?
(a) 20 (b) 21
(c) 22 (d) 23
27. What is $21 + 29 + 1 =$?
(a) 50 (b) 51
(c) 52 (d) 54
28. What is $15 + 5 + 1 + 9 =$?
(a) 30 (b) 31
(c) 32 (d) 33

Direction (Qs. 29 to 33): Read the following information carefully and answer the question below it.

Rahul was at a crossroads in his life. He went to an astrologer to learn what the future held for him. The astrologer explained that Rahul had many choices to make and he could only explain what each choice lead to. On leaving the astrologer, Rahul could take bus routes 213 or 231 to go to his next stop. The first led to a choice between two jobs and the second to a choice between two areas of business.

In all four cases, Rahul would go abroad. Rahul would marry a woman whose name begins with 'P' if he either took a job in production or had a business in readymade garments. Rahul would go to the US if he either had a job in marketing or a business in spare parts manufacture.

29. If Rahul has a wife called Pradnya and a production job, which bus did he take?
(a) 213
(b) 231
(c) (1) or (2)
(d) cannot be determined
30. If Rahul took bus number 231 and married Rohini, what work does he do?
(a) marketing job
(b) production job
(c) garments business
(d) spare parts business
31. If Rahul took bus number 213 and is married to Rehana, which country does he live in?
(a) India (b) UK
(c) US (d) Canada
32. If Rahul has a spare parts business, which of the following could be his wife's name?
(a) Pradnya (b) Prachi
(c) Savita (d) Any of these
33. If Rahul works in Australia, which of the following is possible?
(a) Production job or spare parts business
(b) Production job, married to Poorva
(c) Garments business, married to Shruti
(d) Marketing job or garments business

Solutions

Answer 1 to 3:

Let the number of sweets be x .

Number of sweets left with him after Temple,

$$= x - \left(\frac{x}{2} - 1\right) = \frac{x}{2} + 1$$

Number of sweets left with him after giving to the

$$\text{beggars} = \frac{x}{2} - 2$$

Number of sweets left with him after giving to the

$$\text{poor children} = \frac{x}{4} - 1$$

Number of sweets left with him after giving his

$$\text{brother} = \frac{x}{4} - 2 = 1$$

This gives $x = 12$

1. (c)
2. (c)
3. (b)

Answer 4 to 8 :

4. (c) L is missing in the pyramid
5. (d) PR are not occurring together in alphabetical order. WX and UV are not vertical neighbours in a given pyramid. ST occur together in alphabetical order and also are vertical neighbours in a given pyramid.
6. (b) Y and Q; N and P; E and K are horizontal neighbours in the given pyramid, but name of these pairs does not occur together in alphabetical order. Both in the pyramid and in alphabetical order V and X are separated by exactly one letter.
7. (c) F and U are separated by 14 letters in an alphabetical order, while Q and Y are separated by 7 letters; C and S separated by 15 letters and H and Q are separated by 8 letters. Hence C and S are the farthest away from each other among given pairs.

Answer 8 to 15:

8. (5) Condition (ii) is not satisfied
9. (2) All the conditions of eligibility are satisfied
10. (1) All condition is are satisfied
11. (5) condition (ii) is not satisfied
12. (5) Condition satisfies all the five condition except condition (vii)

13. (5) Condition satisfies all the five condition except condition (vii)
14. (2) According to condition (iii) he should be referred to Director - Finance.
15. (1) He will be selected.

Answer 16 to 20:

Let the number of chocolates in the beginning be x .

So when Sonu woke up,

he left $\frac{2}{3}(x - 1)$ for the others.

When Monu woke up he left,

$$\frac{2}{3} \left[\frac{2}{3}(x - 1) - 1 \right] = \frac{4x - 10}{9}$$

$$\text{while Tonu left} = \frac{8x - 38}{27}$$

Finally they divided $\frac{8x - 38}{27} - 1$ into three equal parts.

$$\text{So, } \frac{8x - 38 - 27}{27} \text{ or } \frac{8x - 65}{27} \text{ was divided into}$$

three equal parts. This means $\frac{8x - 65}{27}$ is

divisible by 3 or $8x - 65$ is a multiple of 81. Let $8x - 65 = 81n$ where n is an integer

So $81n + 65$ should be divisible by 8. It has to be an even number, so $81n$ should be odd number. Trying with 1, 3, 5 we get 7 and 15 as the two initial possible number but $n = 15$ will give us an initial starting number $x = 160$, which is not acceptable. So, $n = 7$ is the accepted value. So in the beginning there were 79 chocolates with the given conditions. We can distribute them accordingly. The table below show number of chocolates eaten by each.

Rounds	Sonu	Monu	Tonu	Jhony
First	26	26	26	1
Second	17	17	17	1
Third	11	11	11	1
Last	7	7	7	1
Total = 79	33 ✓	24 ✓	18 ✓	4 ✓

Where numbers represent chocolates distributed to each during four round. While squared number shown chocolate eaten by an individual during that particular rounds and tick represent total chocolates eaten by particular individual.

16. (d)
17. (a)
18. (b)
19. (c)
20. (a)

Answer 21 to 25:

The four brothers play in such a way that the loser doubles the money of the other players and they lose in an alphabetical order. Thus, working backwards all question can be answered.

	A	B	C	D
Initially	132	68	36	20
Round 1	8	136	72	40
Round 2	16	16	144	80
Round 3	32	32	32	160
Round 4	64	64	64	64

Refer to the table below the respective numbers represent the money after completion of the round mentioned.

21. (d)
22. (b)
23. (c)
24. (d)
25. (b)

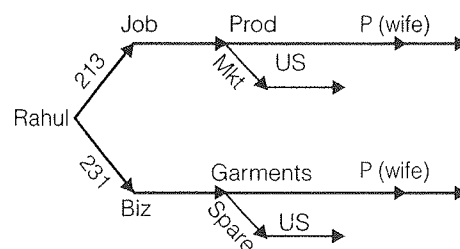
Answer 26 to 28:

Replace 10 by 11, 20 by 22 and so on.

26. (c) $7 + 11 + 3$ is actually $7 + 10 + 3 = 20$ which is 22
27. (c) $21 + 29 + 1$ is actually $19 + 27 + 1 = 47$ which is 52
27. (c) $15 + 5 + 1 + 9$ actually $14 + 5 + 1 + 9 = 29$ which is 32.

Answer 29 to 33:

Draw a tree of possibilities for the predictions. You can read the answer from the tree



29. (a)
30. (d) Bus route 231, and not 'P' wife implies spare parts business.
31. (c) The bus number tell us that Rahul has a job, but if the wife is Rehana, it is a not a production job. Hence marketing job in US.
32. (c)
33. (b) As Rahul works in Australia he can do job in Production or Business in Garments and his wife's name will start P.