Chapter 1: Large Numbers Around Us

1. **'X' is a 6-digit number formed using exactly three different digits. One of the digits appears once, another appears twice, and the third appears three times. When 2 lakhs are added to 'X', the resulting number 'Y' is still a 6-digit number. What is the highest possible value of 'Y'?**

   a) 977889 b) 999999 c) 999988 d) 999887

---

2. **What is the product of all the numbers on a telephone dial-pad?**

   a) 12345 b) 32451 c) 362880 d) None of these

---

3. **Sam forms two different 6-digit numbers, X and Y, using digits from 0 to 9 (without repetition within a number). Exactly two digits are common between X and Y.**
   - **The digit 9 appears in the same position in both numbers**
   - **Y ends with 0, has only one even digit, and its digits are arranged in descending order**
   - **6 is present in X, and the number of even digits on its left is equal to the number of even digits on its right**

   If X is the largest possible number, what is the difference between X and Y?

   a) 9310 b) 9210 c) 8420 d) 8310

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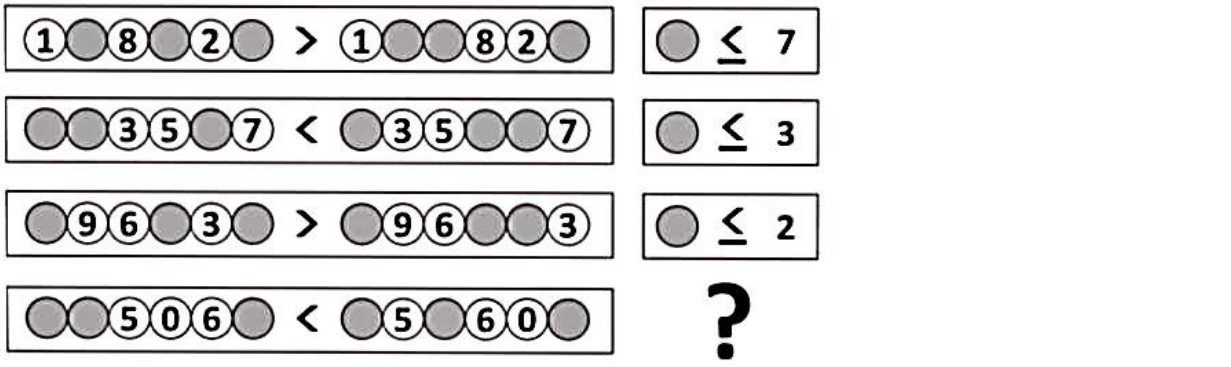
4. **If each of the rows follows the same theme, what will come in place of "?"**



a) ○ ≤ 6 b) ○ ≤ 4 c) ○ ≤ 5 d) ○ ≤ 9

---

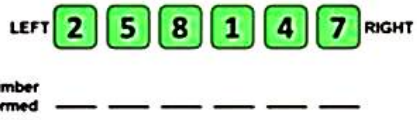
5. **What will come in place of "?"**

Crore - re	→	00000
Million - ion	→	000
Thousand - d	→	00
Billion - llion	→	0000
Lakh - kh	→	?

a) 0 b) 00 c) 000 d) 0000

6. **Six number tokens are given. Rearrange them to form a 6-digit number such that:**
   - **The difference between the first and last digits is as small as possible**
   - **The hundreds digit is double the thousands digit**
   - **No consecutive digits appear next to each other**
   - **All given tokens must be used exactly once**

   How many different 6-digit numbers between 2 lakhs and 8 lakhs can be formed under these conditions?



a) 1 b) 2 c) 3 d) More than 3

---

7. **Two five-digits numbers are formed using different digits from 0 to 9. Both numbers have some digits missing, as shown below:**
   Number 1: _ 1 _ 9 _
   Number 2: _ 4 _ 6 _
   No two consecutive digits of the number series are present in the same number.
   What is the maximum possible difference of the numbers formed?

   a) 47525 b) 52663 c) 52429 d) 46733

---

8. **A, B, C, D, and E each have a different number card among one hundred, one thousand, ten thousand, one lakh, and ten lakhs.**
   - **C has an even number of zeros in his number**
   - **A's number has 2 zeros less than C's number**
   - **D's number has 4 zeros more than A's number**
   - **The number of zeros in B is more than that of A but less than C**

   Which number card does E have?

   a) One thousand b) Ten thousand c) One lakh d) Ten lakh

---

9. **4 friends, Alex, Bob, Calvin and David have a different profession – Doctor, Lawyer, Cricketer, and Engineer and earn a different salary – ₹40,000, ₹50,000, ₹60,000 and ₹70,000 per year. (not necessarily in the same order)**
   - **The cricketer earns the highest**
   - **Alex earns more than Bob, while the doctor earns more than David, who is the engineer**
   - **Bob is the lawyer, and neither Bob nor David has an exact salary of ₹50,000**

   Which of these options shows the correct profession and salary of Calvin?

   a) Cricketer - ₹70,000 b) Doctor - ₹60,000 c) Doctor - ₹50,000 d) Doctor - ₹40,000

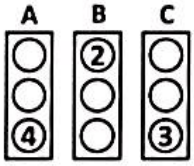
---

10. **The following are the clues to the 6-digit password of Nisha's laptop:**
    35 tens
    31 thousands
    25 ones
    423 hundreds
    14 ten thousands
    What is Nisha's password?

    a) 213625 b) 203675 c) 212375 d) 213675

The Thinking Spot

Columns A, B, and C contain 3 numbers each, such that:
- The number of times each number appears in all 3 columns combined, is equal to its value (e.g., 2 appears twice, 3 appears thrice, etc.)
- Each column contains AT LEAST TWO different numbers
If column A is the only column with THREE different numbers, then which column has the highest sum?



(a) Column A
(b) Column B
(c) Column C
(d) Both columns B and C

Chapter 2: Arithmetic Expressions

1. **Identify the odd one out from the following expressions, after INTERCHANGING their operators.**

   a) 204 + 3 ÷ 29 b) 67 - 2 × 37 c) 48 ÷ 6 × 3 d) 195 × 49 - 2

---

2. **There is a seminar from 11:00 AM to 2:00 PM, where students must spend AT LEAST 1 hour in the seminar. The table displays the number of students entering and exiting the seminar at different times. What is the MAXIMUM possible number of students who spent at least 2 hours in the seminar?**

SR. NO	TIME	IN	OUT
1.	11:00 AM	120	
2.	12:00 PM	40	60
3.	1:00 PM	80	40
4.	2:00 PM		140

   a) 60 b) 80 c) 100 d) 120

---

3. **In the given expression, '8 @ 7 - 15 < 4 × 2 × 5' which operator cannot be used in place of '@', such that the condition remains valid?**

   a) - b) ÷ c) + d) ×

---

4. **A bus has 40 seats, and some seats are already occupied, with one passenger in each seat.**
   - **At the first stop, 5 passengers get off and 8 passengers get in**
   - **At the second stop, 2 passengers get off and 4 passengers get in**
   - **At the third stop, exactly half of the passengers get off**

   After this, half of the bus seats are occupied.
   Which of the following expressions represents the number of passengers on the bus at the beginning?

   a) 5 × 5 + 5 b) 6 × 6 - 4 c) 5 × 5 + 10 d) 6 × 6 - 5

---

5. **The following expression has a whole number 'n'. If a blank can either take '×4' or '–12', what is the least possible value of 'n'?**
   Expression: (n ____ ____) ____ = 96

   a) 9 b) 18 c) 4 d) 72

---

6. **Which operators should be interchanged to get the minimum value of the given expression?**
   8 × 4 + 2 - 1

   a) × and + b) + and - c) - and × d) No change

---

7. **In certain code, 1 is coded as 2, 3 is coded as 10, 5 is coded as 26.**
   In the same way, 4 is coded as A and 6 is coded as B.
   If C is the sum of A and B, which of the following is correct regarding C?

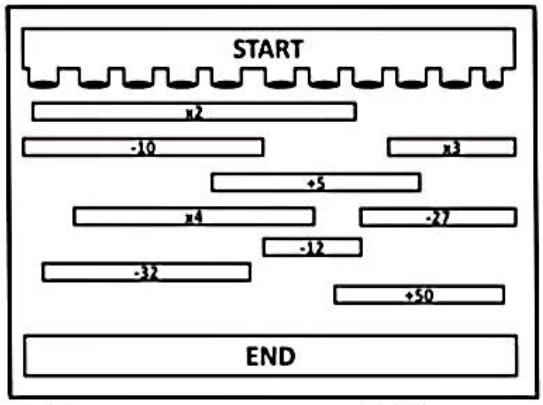
   a) C > 55 b) C < 50 c) C = 50 d) C < 55

8. **In the following expression, each ball with a mathematical operator is swapped with the ball immediately to its left, to form a new arithmetic expression. What will be the value of NEW EXPRESSION - ORIGINAL EXPRESSION?**

a) 63 b) 73 c) - 63 d) - 73

---

9. **A stone with an initial value of 10 is dropped through one of the holes at the START and moves in a straight path to reach the END. As it passes each numbered bar along the way, its value changes according to the operation shown on that bar. What is the maximum value the stone can have when it reaches the END?**



a) 60 b) 88 c) 53 d) 68

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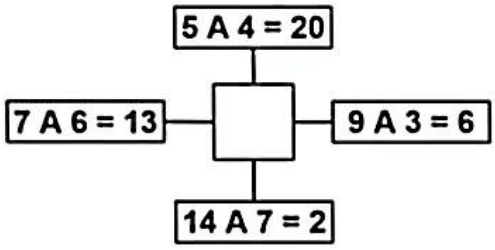
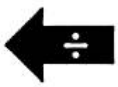
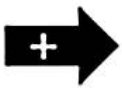
10. **Each arrow has a mathematical operator. When placed in the centre box, its operator replaces the letter A in the equation it points to. Which arrow satisfies an equation based on this rule?**



a) 

b) 

c) 

d) 

The Thinking Spot

Tom, Sam, Mariya, John, and Bob each selected a shape. They placed their shapes in the grid below.

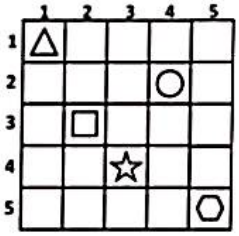
Tom's shape is neither a circle nor a triangle

Sam's shape is in column number 3

Mariya's shape is not in the first three rows

John's shape is neither square nor circle

Which of the following shapes is chosen by Bob?

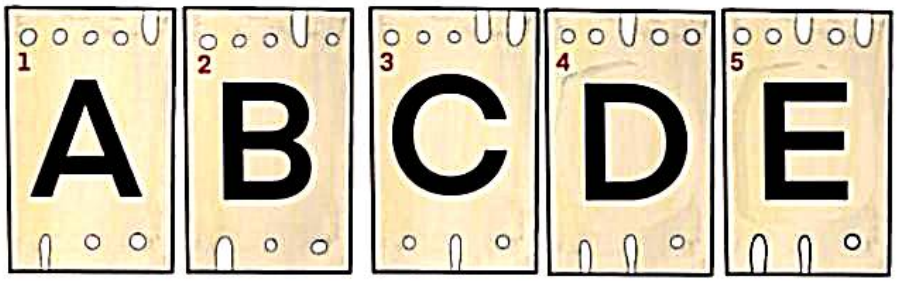


(a) Square (b) Circle (c) Hexagon (d) Triangle

Chapter 3: A Peek Beyond the Point

Activity Time

Activity: Punched Cards



Consider a set of cards with the alphabet written on them, and we shuffle them. The objective is to arrange them in alphabetical order.

One method is to find the card A first, then B and so on. This might take some time.

Now, notice that the cards have been punched on the top. There are an O-shaped and a U-shaped punch, and using these holes, we can sort the cards in an interesting way. Insert a stick in the set of cards starting from the rightmost hole. Once you lift the stick, some will come along with it. Now, bring them in front & repeat this for all sets of holes. Magically, the cards are sorted.

In our day-to-day life, we use the decimal number system, which uses the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The decimal number system is based on bundles of ten (Powers of 10 which is 1,10,100,1000,.....). Similarly, the binary number system is based on bundles of two (Power of 2 which is 1,2,4,8,.....). So, if we compare the two numbering systems for place values, this is what it looks like....

	Decimal (Bundles of Ten)	Binary (Bundles of Two)
Units Place	1	1
First Bundle	10 = 10	2 = 2
Second Bundle	10x10 = 100	2x2 = 4
Third Bundle	10x10x10 = 1000	2x2x2 = 8

The binary number system (popularly known as the language of computers) deals with only two numbers: 0 and 1. We can convert any decimal number to its binary equivalent and vice versa. You can convert any decimal number into a binary representation by writing it with the power of 2.

For example, 23 = 16 + 4 + 2 + 1.

23 in decimal	$10^1 = 10$	$10^0 = 1$
23	2	3

23 in binary	$2^4 = 16$	$2^3 = 8$	$2^2 = 4$	$2^1 = 2$	$2^0 = 1$
$(10111)_2$	1	0	1	1	1

1. What will be the binary representation for the decimal number 14?

a) 1010 b) 1100 c) 1110 d) 1111

The number of digits or bits (binary digits) in a binary number depends on the number. For example, numbers up to 7 can be represented in a 3-bit binary number, numbers from 8 to 15 in a 4-bit binary number, numbers from 16 to 31 similarly need an additional bit, hence a 5-bit binary number, and so on. There are 26 letters in English; hence, 5 sets of holes on each card for sorting.

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2. You want to perform a similar punched card activity with Hindi alphabets. How many holes are needed on each card?

a) 5 b) 6 c) 8 d) 10

Punching Pattern on the Card

Every alphabet can correspond to a number, and every number can be represented in the binary system. The following table contains the corresponding conversion from decimal to binary.

Letter	Corresponding Decimal Number	Corresponding Binary Number
A	1	00001
B	2	00010
C	3	00011
D	4	00100
E	5	00101
..	..	..
..	..	..
Y	25	11001
Z	26	11010

These binary numbers indicate to us a unique way to punch. Where there is 0, punch an O-shaped hole, and where there is 1, punch a U-shaped hole. For example: 01010 is the binary equivalent of J, so the holes on card J from left to right will be O U O U O.

---

3. Can you identify which card the binary pattern 10101 belongs to?

a) P b) S c) T d) U

---

4. The alphabet R comes 18th in the order starting from A as 1. What will be the punching pattern on Card R?

a) U0U0U b) UU0U0 c) U00U0 d) 0UU00

Punched cards, utilising binary choices is analogous to their role in powering early computing machines such as IBM sorters and Turing's Bombe. This binary concept has its roots in study of poetry in ancient India, which was well studied by Acharya Pingala's and documented in his work Chandaḥśāstra (~2 BCE).

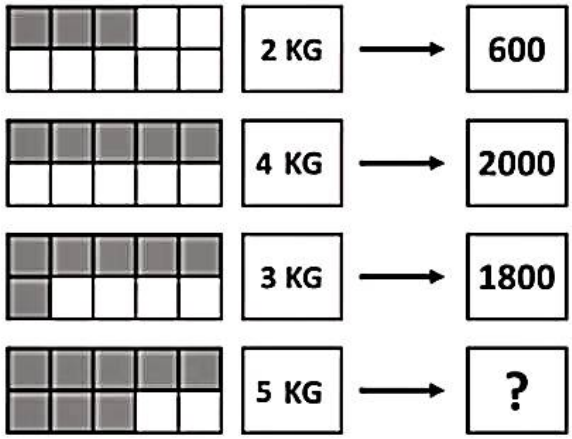
Questions

1. **Two decimal numbers differ by 3.6. In one of the numbers, the decimal point is moved one place to the right. After this change, both numbers become equal. Which was the smaller of the two original numbers before shifting the decimal point?**

   a) 0.4 b) 0.36 c) 3.6 d) 4

---

2. **What will come in place of "?"**



   a) 2000 b) 4000 c) 40000 d) 8000

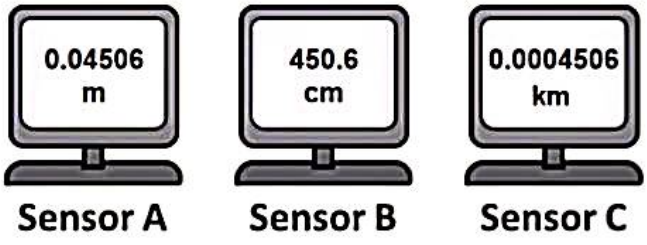
---

3. **Find the next term in the given series below:**
   85.41, 88.71, 89.01, 92.31, 92.61, 95.91, 96.21, __

   a) 96.51 b) 99.21 c) 99.51 d) None of these

---

4. **There are three sensors - A, B, and C. Each sensor displays the measurement of the length of the same item, but in different units: metres, centimetres, or kilometres. Only one sensor shows the correct length. The other two show values that are 10 times greater and 10 times smaller than the actual length (the units remain unchanged). Based on the readings shown, which sensor displays the correct length?**



   a) Sensor A b) Sensor B
   c) Sensor C d) Cannot be determined

5. What will come in place of "?" in the given series?

5	4
4.5	

,

4	4.5
4.25	

,

4.5	4.25
4.375	

,

4.25	4.375
4.3125	

,

4.375	4.3125
4.34375	

, ?

a)

4.3125	4.450
4.38125	

b)

4.3125	4.34375
8.65625	

c)

4.3125	4.34375
4.328125	

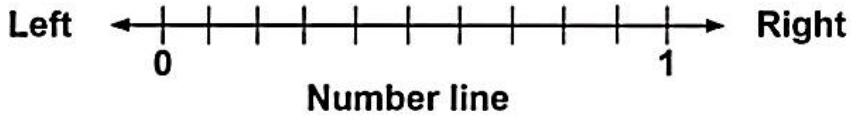
d)

4.3125	4.375
4.32812	

---

6. Four friends A, B, C, and D each select a distinct point on the following number line (from 0 to 1) such that:
   - A's point is 4th to the right of D's point
   - The value of C's point is at least 0.4 and B's point has the highest value among all friends
   - No two friends choose adjacent points

   What is the LEAST possible sum of the points chosen by all of them?



Number line

a) 2.0 b) 1.9 c) 1.8 d) 1.4

---

7. Alex has to fill in the blank with a DECIMAL NUMBER formed using every digit among 0, 1, 2, 3, and 4, each exactly once, where:
   - The sum of the digits before the decimal point is equal to the sum of the digits after the decimal point
   - The digits before the decimal point are in descending order and the digits after the decimal point are in ascending order
   - The conditions of "<" are satisfied

   How many different numbers can be placed in the blank?

34.201 < _____ < 412.03

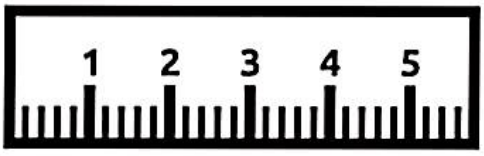
a) 2 b) 3 c) 4 d) More than 4

---

8. Raj measures the lengths of two objects, Object A and Object B, using a ruler marked in centimetres.
   - On Day 1, Object A measures 5.2 cm. Its length decreases by 1 line on Day 2, 2 lines on Day 3, 3 lines on Day 4, and so on, following the same pattern
   - On Day 1, Object B measures 1.2 cm. Its length increases by 1 line on Day 2, 2 lines on Day 3, 3 lines on Day 4, and so on, following the same pattern

   On which day will the difference between the lengths of the two objects be the least?

   Note: *The scale is in centimetres*



a) Day 3 b) Day 4 c) Day 5 d) Day 6

9. **Some numbers are given in the boxes below. In each number, interchange the digits immediately to the left and right of the decimal point. After making this change, how many boxes will contain a number greater than 498.540?**

491.893	497.860	491.855	490.993
A	B	C	D

a) 1 b) 2 c) 3 d) 4

---

10. **Seven decimal numbers, A-G, are given.**
    1. **Arrange the numbers in ascending order to form Arrangement 1**
    2. **Modify the numbers as follows:**
    - **For numbers in odd positions, move the decimal point one place to the right**
    - **For numbers in even positions, move the decimal point one place to the left**
    3. **Arrange the modified numbers again in ascending order to form Arrangement 2**

In Arrangement 2, which pair(s) of numbers have exactly three numbers between them?

0.05, 0.505, 5.05, 5.55, 0.55, 5.005, 0.005

A B C D E F G

a) A and E b) G and D c) C and F d) E and D

The Thinking Spot

The numbers given below are to be placed in the grid in such a way that the sum of two adjacent numbers in the grid should be greater than 9 but less than 17. What will come in place of A and B?

Numbers: 2, 3, 5, 11, 15

14			A	8	B	12	1	

(a) A = 5 and B = 2
(b) A = 3 and B = 5
(c) A = 2 and B = 3
(d) A = 5 and B = 3

Chapter 6: Number Play
Activity Time

Introduction

Solving puzzles always seems complex. But have you wondered how computers solve puzzles? We will see a simplified way to solve some puzzles by following simple instructions and using the binary computer language. This will give us insight into how we can break complex problems into smaller pieces that can be easily solved. By combining smaller problems, computers can solve a larger one.

Activity: Logical puzzle punch cards

In this activity, you will use punched cards to solve logical puzzles. By stacking, aligning, and filtering the cards, we will see how complex reasoning can be built from simple decisions - **True** or **False**, mirroring how binary logic works inside a computer.

The scenario is that you have the following lights in the room: **Yellow Y, Pink P, Red R, Green G,** and **Blue B**. By following the clues given in the **Case Cards**, you have to figure out which lights are **ON** in the given Puzzle. To solve these puzzles, we have a deck of cards representing all possible combinations of these lights being **ON** or **OFF**.

Understanding the cards

To solve these puzzles, we have a deck of cards representing all possible combinations of these lights being **ON** or **OFF**. Each card has five positions for holes on the top, and each position corresponds to a coloured light mentioned above in the given order.

Each position has two possible hole types: **U-shaped** or **O-shaped**. Each card represents one possible combination. If a light is **ON** in a card, then the hole corresponding to it is **U-shaped**. If a light is **OFF** in a card, then the hole corresponding to it is **O-shaped**.

Eg: **Yellow Y** is **OFF**, **Pink P** is **ON**, **Red R** is **ON**, **Green G** is **OFF**, **Blue B** is **OFF** is the card where the holes are **O U U O O**.

Each hole, thus, has 2 possible states. If we have two holes, then we have $2 \times 2 = 4$ possible states. Likewise, if we have 3 holes, we have $2 \times 2 \times 2 = 8$ states. Therefore, if we have 5 holes, we will have $2 \times 2 \times 2 \times 2 \times 2 = 32$ states. That is the number of distinct cards we have.

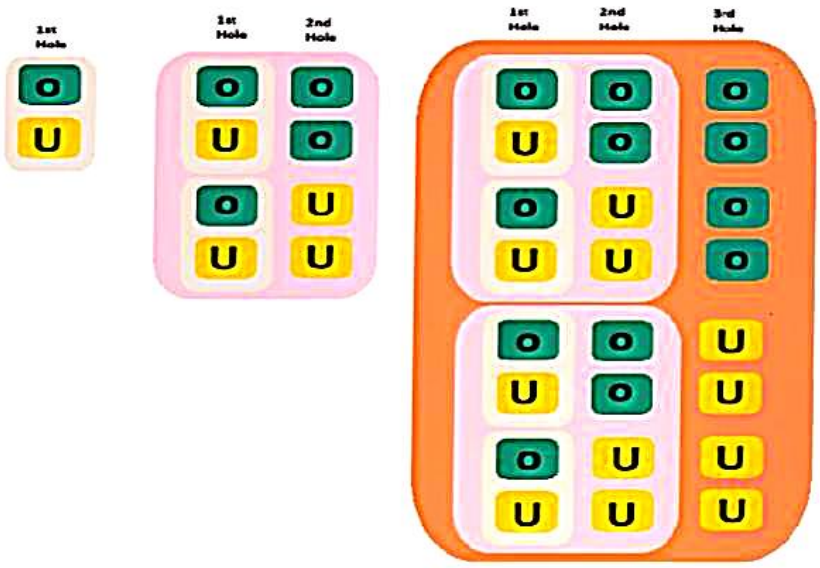


Figure: All the possible three-hole states and how they come from the two-hole states

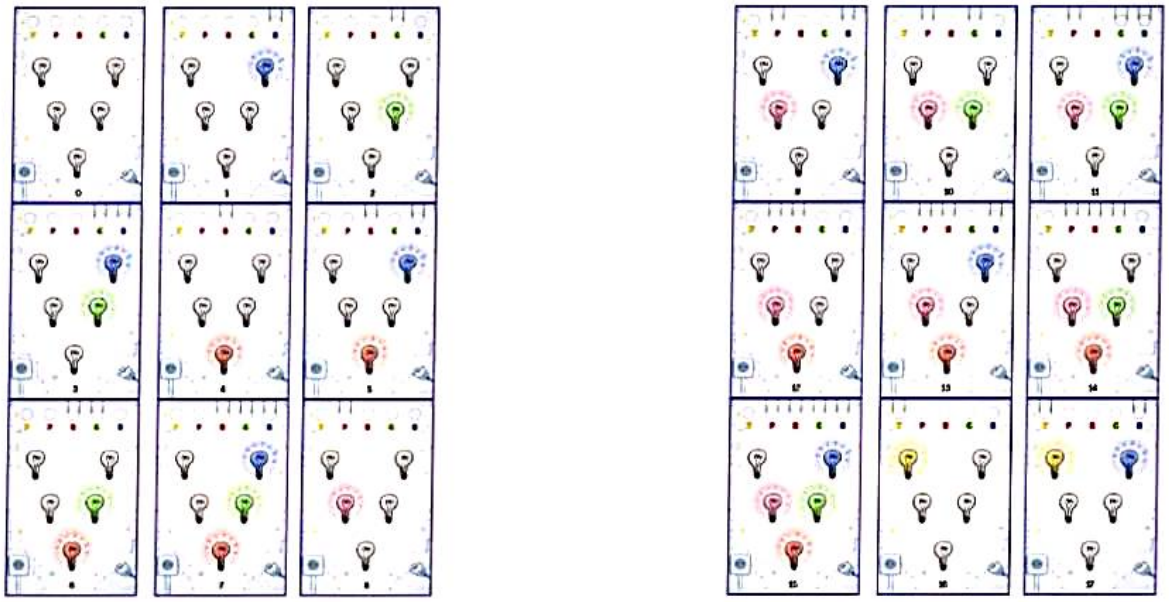


Figure: Some possible cards with 5 binary digits

Procedure

If the puzzle says a light is **ON**, we need to remove all cards where that light is **OFF**. For that, we put the stick into the deck of cards through the hole corresponding to that light and pull out all the cards that get stuck to it. We remove these cards because they got stuck due to **O-shaped** holes that indicate the light is **OFF**.

If we know some light is **OFF** in the puzzle, we remove all the cards that do not come out with the stick; these are the cards with **U-shaped** holes in positions corresponding to the given colour, which indicate that the light is **ON**.

Ensuring the above helps us solve the logical puzzles through punch cards.

Let's get familiar with the cards and the rules.

1. **Can you identify which bulbs are 'OFF' based on the card?**

a) **Blue B** and **Yellow Y** bulbs

b) **Green G** and **Red R** bulbs

c) **Red R** and **Yellow Y** bulbs

d) All bulbs are OFF

Understanding using a case

The operation of the cards is explained by showing how they can be used for solving a problem in two-valued logic.

We can start by taking **Case 1**, which contains the first 8 cards from 0 to 7, and focus only on the **Red R, Green G,** and **Blue B** lights. Three statements are given containing simple assertions and negation statements. The aim is to determine which bulbs are on or off among these.

To solve this problem, let's establish some notation. Only three terms are involved, so we shall be concerned with only the **Red R, Green G,** and **Blue B** holes.

Red bulb '**ON**', 1st position will be **U**	**Red** bulb '**OFF**', 1st position will be **O**
Green bulb '**ON**', 2nd position will be **U**	**Green** bulb '**OFF**', 2nd position will be **O**
Blue bulb '**ON**', 3rd position will be **U**	**Blue** bulb '**OFF**', 3rd position will be **O**

If all lights are **ON**, then **RGB = U U U**
If all lights are **OFF**, then **RGB = O O O**
If **Red** is **OFF, Green** is **ON, Blue** is **OFF**, then **RGB = O U O**
If **Red** and **Green** are **ON,** but **Blue** can be anything, then **RGB = U U X**

---

2. **Can you identify which bulb is OFF based on this pattern: RGB = U U O?**

a) **Red** bulb b) **Green** Bulb c) **Blue** Bulb d) All bulbs are OFF

Case 1: Focusing on RGB cards only (with 8 cards only)

Statements
I. The **Red** light is **ON**
II. The **Blue** light is **OFF**
III. ON light only has **OFF** Neighbour
The problem has three statements.

- *The statement **I**: "The **Red** light is **ON**"*

Insert the stick in the **R** position and lift.
The stick will raise all **RGB = O X X** cards: All cards where **Red** is **OFF**.
<u>**RGB = O X X** cards are discarded.</u>

All remaining cards are assembled into a pack once more (in any order), and we are ready for the second statement.

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3. After performing an action using Statement I, how many cards are left in the pack?

a) 8 b) 4 c) 2 d) 1

- *The second statement, **II**, "The **Blue** light is **OFF**"*

---

4. After performing the action using Statement II, among these, which card will not be discarded?

a) **RGB = X X O** b) **RGB = U O U** c) **RGB = X X U** d) All will be eliminated

Correct answer: a. **RGB = X X O**
Explanation: We discard all the cards where **Blue** light is **ON**, **RGB = X X U,** and keep those cards where **RGB = X X O.**
Competencies: Algorithmic thinking, decomposition, pattern recognition

All remaining cards are assembled into a pack once more (in any order), and we are ready for the third statement.

- *The third statement, **III**, "**ON** light only has **OFF** Neighbour"*

After this action, only one card will be left, and that will be the solution to the logical puzzle.

5. **What is the pattern of the last card (solution)?**

a) **RGB = U U O** b) **RGB = U O U** c) **RGB = O U U** d) **RGB = U O O**

Case 2: Focusing on RGB cards only (with 8 cards only)

Statements

I. The **Red** light is **ON**

II. The Lights are either all **ON** or all **OFF**

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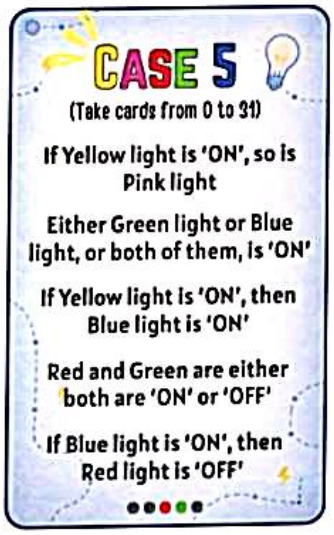
6. **Among these, what would be the pattern of the solution?**

a) **RGB = U O O** b) **RGB = O O O** c) **RGB = U O U** d) **RGB = U U U**

More Puzzles

Below are three progressively harder cases. They introduce additional logic and multi-step filtering to mimic advanced truth-table-based reasoning. Each ends with one solution card.



Questions

1. **Form the largest four-digit odd number by selecting exactly one digit from each row and each column. What is the sum of the digits?**

7	4	5	3
6	9	2	6
5	1	3	2
8	9	7	4

a) 21 b) 22 c) 23 d) 24

---

2. **In the given image, S, T, and N represent distinct single-digit numbers, where T > S. What is the value of N + S?**

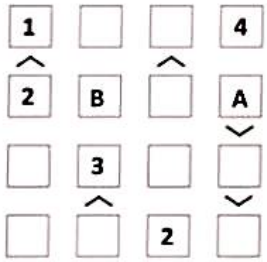
	S	T	6
+	T	S	N
1	7	6	8

a) 13 b) 12 c) 9 d) 11

---

3. **Each square of the given puzzle must be filled with a single-digit natural number such that:**
   - **The sum of all four different digits in each row and each column is 10**
   - **All the inequality signs (< and >) between the boxes must be followed**

   Find the correct values of A and B.



a) A = 3, B = 4 b) A = 2, B = 1 c) A = 1, B = 4 d) A = 3, B = 1

---

4. **How many cells contain a digit equal to the sum of all the other digits in its corresponding row and column combined?**

3			6
1	2	3	
	4		2
5			1

a) 2 b) 3 c) 4 d) 5

5. **Using the digits 1, 2, 3, and 4, form the highest and the smallest three-digit numbers such that each number contains exactly two different digits. What is the sum of the two numbers formed?**

a) 545 b) 555 c) 565 d) 575

---

6. **A 2-digit number is formed using two different digits, and the digits are reversed to create another 2-digit number. The difference between these 2 numbers CANNOT be:**

a) An even number b) An odd number c) A prime number d) An integer

---

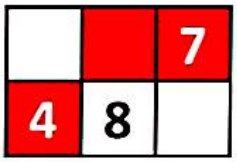
7. **A four-digit number has the same number of even and odd digits. Which of the following could possibly be the sum of the digits of this number?**

a) 11 b) 15 c) 20 d) All of these

---

8. **The given grid is to be filled with distinct single-digit natural numbers such that:**
   - **The sum of each row is the same and is an even number**
   - **The larger number in each column is placed in the red block**

   What is the sum of the numbers in the white blocks?



a) 16 b) 17 c) 15 d) 20

---

9. **A computer generates rectangles where the length and breadth (dimensions) follow a series. If the pattern continues, what will be the area of the next rectangle the computer should draw?**

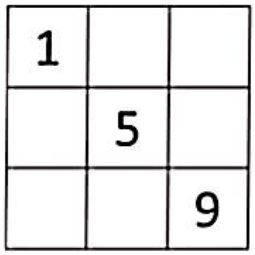
   $2 \times 3, 3 \times 5, 5 \times 8, 8 \times 13, 13 \times 21, ?$

a) 693 sq. units b) 2210 sq. units c) 442 sq. units d) 714 sq. units

---

10. **Given below is a 3 × 3 grid to be filled by numbers from 1 to 9 such that:**
    - **Every pair of adjacent digits in a row should have a difference of three**
    - **Some of the numbers have already been placed**

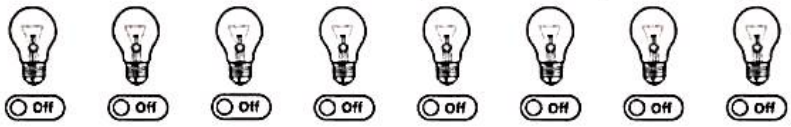
    Based on the given conditions, choose the correct option.



a) A row can have all numbers as even b) A row can have all numbers as odd
c) A row can have 2 even and 1 odd number d) All of these

The Thinking Spot

Given below are bulbs, each with a switch beneath it. When you press a switch, it lights up ONLY the adjacent bulbs and not the bulb above the switch. What is the minimum number of switches you need to press to light up all the bulbs?



(a) 2 (b) 3 (c) 4 (d) 5