5 Mathematical Operations and Input–Output

Introduction

Problems based on mathematical operations are asked to test the analytical abilities of the candidates. It shows how good one is at observing things and then implying it to solve the questions.

Properties of Basic Mathematical Operations

Some mathematical operations have properties that make them easier to work with and can actually save your time property namely, commutative, associative, distributive, and identity.

Commutative Property

For addition

$a + b = b + a$

- $2 + 7 = 7 + 2$
- $-5 + 3 = 3 + (-5)$
- $1 + 3 + 5 = 5 + 3 + 1$

For multiplication

$a \times b = b \times a$

- $4 \times 2 = 2 \times 4$
- $(6) \times (-1) = (-1) \times (6)$
- $n \times (-7) = (-7) \times n$

Associative Property

For addition

$(a + b) + c = a + (b + c)$

- $(5 + 2) + 1 = 5 + (2 + 1)$
- $(-1 + 5) + 1 = -1 + (5 + 1)$

For multiplication

$(a \times b)\ c = a\ (b \times c)$

- $(2 \times 3) \times 4 = 2 \times (3 \times 4)$
- $(-1 \times 2) \times (-3) = -1 \times (2 \times -3)$

Identity Property

For addition

- $15 + 0 = 15$ or $0 + 15 = 15$
- $(-1) + 0 = -1$ or $0 + (-1) = -1$

For multiplication

- $7 \times 1 = 7$ or $1 \times 7 = 7$
- $-5 \times 1 = -5$ or $1 \times -5 = -5$

Distributive Property

For addition

$a\ (b + c) = ab + ac$

- $3(4 + 5) = 3(4) + 3(5)$
  $3(9) = 12 + 15$
  $27 = 27$ (True)
- $-2\ [(-1) + 5] = (-2)\ (-1) + (-2)\ (5)$
  $-2\ (4) = 2 + (-10)$
  $-8 = -8$ (True)

Refer to the summary of basic number properties given as discussed earlier.

	Basic Number Properties	
I.	**Commutative property**	
	For addition	$a + b = b + a$
	For multiplication	$a \times b = b \times a$
II.	**Associative property**	
	For addition	$(a + b) + c = a + (b + c)$
	For multiplication	$(a \times b) \times c = a \times (b \times c)$
III.	**Identity property**	
	For addition	$a + 0 = a$ or $0 + a = a$
	For multiplication	$a \times 1 = a$ or $1 \times a = a$
IV.	**Distributive property**	$a \times (b + c) = (a \times b) + (a \times c)$

Associative Property for Division

Does the property (a ÷ b) ÷ c = a ÷ (b ÷ c) hold?

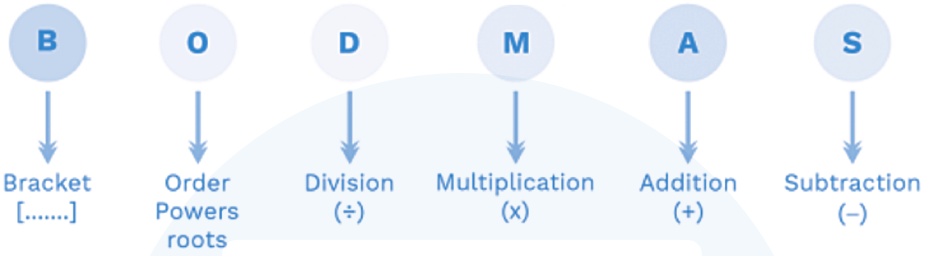
- (20 ÷ 5) ÷ 2 = 20 ÷ (5 ÷ 2)
  (4) ÷ 2 = 20 ÷ (2.5)
  2 ≠ 8 (False)

So, the associative property is not a property for division.

Note: For every type of mathematical operation question, everyone must know only one rule, i.e., BODMAS.

BODMAS

It stands for Brackets, Orders, Division, Multiplication, Addition, and Subtraction. It means one must solve any equation in the BODMAS order. First, open the brackets, then solve the power or roots, then perform division followed by multiplication, addition, and subtraction.



Types of questions asked

The following types of questions can be framed from the topic of mathematical operations:

- Symbol substitution
- Balancing the equation
- Interchange of signs and numbers
- Trick-based mathematical operations

Symbol substitution

Example 1:

If '×' means '–', '÷' means '+', '+' means '×', then 13 × 6 ÷ 3 + 8 is equal to?

(A) 33
(B) 32
(C) 30
(D) 31

Solution: (D)

Change of symbols according to the question,

= 13 – 6 + 3 × 8 = 13 – 6 + 24 = 31

Balancing the equation

Example 2:

Which of the options is correct?

24 8 4 8 = 18

(A) +, ÷, and –
(B) ÷, –, and +
(C) –, –, and –
(D) ÷, +, and –

Solution: (A)

From option (A),

24 + 8 ÷ 4 – 8 = 18

24 + 2 – 8 = 18

24 – 6 = 18

18 = 18 (True)

Interchange of sign and numbers

Example 3:

If we interchange a pair of signs in the following equation, it will hold true.

10 – 2 + 9 × 2 ÷ 4 = 19

Which two signs should be interchanged?

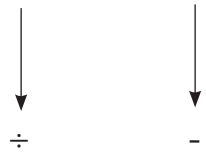
(A) ÷, +
(B) ×, –
(C) ×, ÷
(D) ÷, –

Solution: (D)

Let's check the options one by one

In the given expression, if we interchange '÷' and '–', the equation will hold true as shown below.

10 – 2 + 9 × 2 ÷ 4 = 19



10 ÷ 2 + 9 × 2 – 4 = 19

5 + 18 – 4 = 19

19 = 19 (True)

Hence, option (D) is correct.

Trick-based mathematical operations

Directions for Questions 1 and 2: Answer the questions from the information given below.

If '×' means '÷', '^' means '+' '≥' means '×' and '$' means '–', then find the value of

1. 16 × 4 ^ 8 ≥ 6
(A) 32
(B) 40
(C) 42
(D) 52

Solution: (D)

16 ÷ 4 + 8 × 6
= 4 + 48
= 52

2. 90 ≥ 6 ^ 4 $ 8
(A) 500
(B) 316
(C) 536
(D) 546

Solution: (C)

90 × 6 + 4 – 8
= 544 – 8 = 536

Input–Output

Machine input-output is basically a topic where a set of words, numbers, or their combinations is given in a particular sequence in various steps. One needs to identify the pattern in which the initially given input is processed in various steps and then apply the same pattern to the input given in the question and answer accordingly. (There may be numerous patterns that may be followed while processing a given input.)

As in the question of series (asked in various MBA Entrance exams), the series is made on certain logic and by analysing that logic, we will get to know the next element/value in that series. So, in the case of machine input-output, one has to analyse the given Input and the logic behind its subsequent steps.

Keynote

It is important to know/learn the alphabetical place value of letters and its reverse in determining the logic of the subsequent steps of the Input.

There are seven types of questions asked in the examination from input–output.

Types of Machine Input–Output

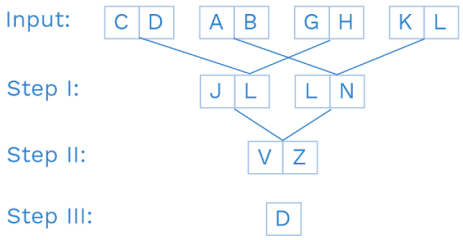
Arrangement of Words/Letters

Arrangement of letters can be done in various ways as given further.

Alphabetical place value of letters

The alphabetical place value followed by some other operations will determine the subsequent steps and the final output.

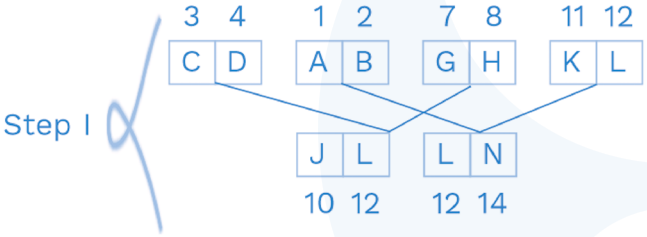
Example 4:



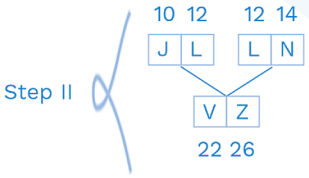
Solution:

Considering the place value of letters, one will be able to determine the subsequent step, following some other operation along with it.

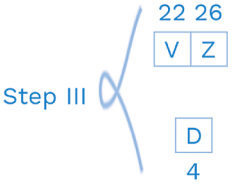
Putting the alphabetical place value and adding cell 1 block 1 with cell 1 block 3, and adding cell 2 block 1 with cell 2 block 3 will determine the first block of step I. Similarly, the second block of step I can be determined.



Again, putting the alphabetical place value and adding cell 1 block 1 with cell 1 block 2, and adding cell 2 block 1 with cell 2 block 2 will help in determining the block in step II.



Now, step III can be reached by the difference in the alphabetical place value of cells in the block of step II.



Ascending or descending order as per dictionary

Words are arranged as they appear in the dictionary which may be from left to right or right to left or both of them simultaneously.

Example 5:

Input: crow cow calf call date dying during

Possible operations

i) On considering the order in which the words would appear in the dictionary in ascending order (taking left to right movement into consideration).

Input: crow cow calf call date dying during

Step I: **calf** crow cow call date dying during

Step II: calf **call** crow cow date dying during

Step III: calf call **cow** crow date dying during

Step IV: calf call cow crow date **during** dying

ii) On considering the order in which the words would appear in the dictionary in descending order (considering the right to left movement).

Input: crow cow calf call date dying during

Step I: crow cow calf call date during **dying**

Step II: cow calf call **crow** date during dying

Step III: calf call **cow** crow date during dying

iii) On considering the order in which the words would appear in the dictionary in ascending to descending order (taking both left to right and right to left movement into consideration simultaneously).

Input: crow cow calf call date dying during

Step I: **calf** crow cow call date during **dying**

Step II: calf **call** cow **crow** date during dying

Number of letters in the given word

Sometimes an Input may be asked where only the number of letters is considered while determining the subsequent steps.

Example 6:

Input: telling team smart superb tea to tomorrow

Step I: **to** telling team smart superb tea tomorrow

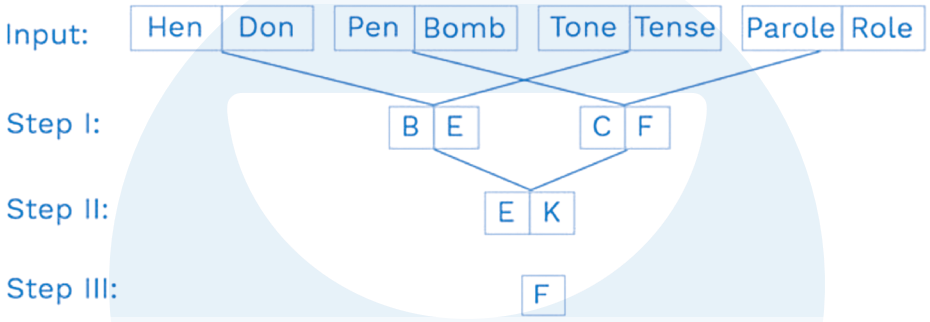
Step II: to **tea** telling team smart superb tomorrow

Step III: to tea **team** telling smart superb tomorrow

Step IV: to tea team **smart** telling superb tomorrow

Step V: to tea team smart **superb** telling tomorrow

Example 7:



Solution:

Input: Hen | Don | Pen | Bomb | Tone | Tense | Parole | Role

Step I of the given input is determined by the number of vowels and consonants (without repetition) in the first and third blocks where the number of vowels takes the first cell and the number of consonants takes the second cell.

Determining the number of vowels in the first block and the third block:

'e', 'o', 'o', 'e', 'e', 'e'

Number of vowels without repetition: 'e', 'o', – 2 (place value of 'B')

Determining the number of consonants in the first block and the third block:

'h', 'n', 'd', 'n', 't', 'n', 't', 'n', 's'

Number of consonants without repetition: 'h', 'n', 'd', 't', 's' – 5 [place value of 'E']

Solution:

For the above Input, consider the number of letters in the given word for determining our subsequent steps from left to right.

Number of vowels or consonants in the given word

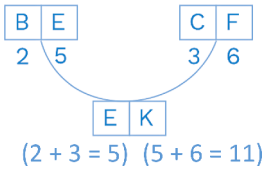
The number of vowels or consonants (with or without repetition) determines the first step of the input and the subsequent steps are determined by the alphabetical place value of the letter or by some mathematical operation as illustrated below.

Hence, in Step I, first block will be: B | E

On consideration, the number of vowels and consonants in the second block and fourth block in Input will help in determining the second block of step I.

Hence, second block will be: C | F

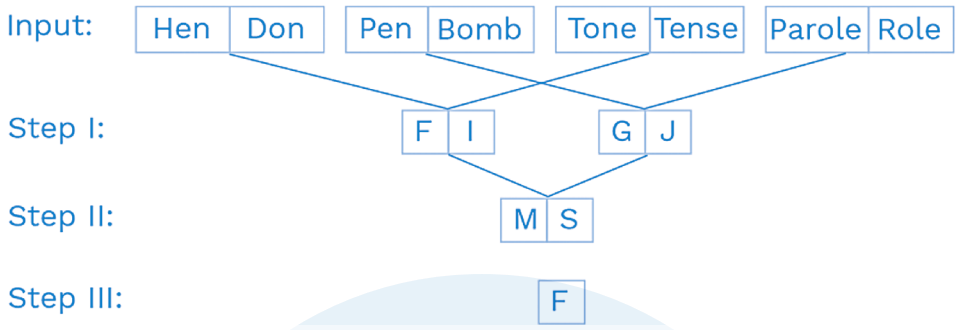
Now, step II of the given input is determined by adding the alphabetical place value of cell 1 in the first and second block of step I and also by adding the alphabetical place value of cell 2 in the first and second block of step I.



Again, step III is arrived at by determining the difference between the alphabetical place value of cell 1 and cell 2 in Step II.

E | K
5 11
F
(11 - 5 = 6)

Example 8:



Step I of the given Input is determined by the number of vowels and consonants (with repetition) in the first and third blocks where the number of vowels takes the first cell and the number of consonants takes the second cell.

Determining the number of vowels in the first block and third block:

'e', 'o', 'o', 'e', 'e', 'e' – 6 (place value of 'F')

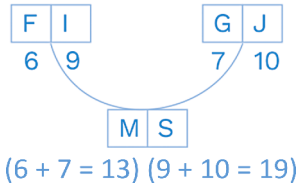
Determining the number of consonants in the first block and third block:

'h', 'n', 'd', 'n', 't', 'n', 't', 'n', 's' – 9 (place value of 'I')

Hence, in Step I, first block will be: F | I

Similarly, second block will be: G | J

Now, step II of the given input is determined by adding the alphabetical place value of cell 1 in the first and second block of step I and also by adding the alphabetical place value of cell 2 in the first and second block of step I.



Again, step III is arrived at by determining the difference between the alphabetical place value of cell 1 and cell 2 in step II.

M | S
13 19
F
(19 - 13 = 6)

Arrangement of Numbers

Arrangement of numbers can be done in various ways namely,

Ascending/descending order

Numbers can be arranged in ascending or descending order from left to right or right to left or sometimes as illustrated below.

Example 9:

Input: 117 84 307 36 211 59 96 186

Possible operations

i) Considering the order in which the numbers would appear when arranged in ascending order.

Input:	**117**	**84**	**307**	**36**	**211**	**59**	**96**	**186**
Step I:	**36**	117	84	307	211	59	96	186
Step II:	36	**59**	117	84	307	211	96	186
Step III:	36	59	**84**	117	307	211	96	186
Step IV:	36	59	84	**96**	117	307	211	186
Step V:	36	59	84	96	117	**186**	307	211
Step VI:	36	59	84	96	117	186	**211**	307

ii) Considering the order in which the numbers would appear when arranged in descending order.

Input:	**117**	**84**	**307**	**36**	**211**	**59**	**96**	**186**
Step I:	**307**	117	84	36	211	59	96	186
Step II:	307	**211**	117	84	36	59	96	186
Step III:	307	211	**186**	117	84	36	59	96
Step IV:	307	211	186	117	**96**	84	36	59
Step V:	307	211	186	117	96	84	**59**	36

iii) Considering the order in which the numbers are arranged in an ascending order but considering two movements at a time.

Input:	**117**	**84**	**307**	**36**	**211**	**59**	**96**	**186**
Step I:	**36**	117	84	211	59	96	186	**307**
Step II:	36	**59**	117	84	96	186	**211**	307
Step III:	36	59	**84**	96	**117**	186	211	307

Even number/odd number/prime number

Arrangements in subsequent steps can be made by arranging even/odd/prime numbers in some order as illustrated below.

Example 10:

Input:	**82**	**43**	**47**	**61**	**42**	**21**	**15**	**62**	**77**
Step I:	**42**	82	43	47	61	21	15	62	77
Step II:	42	**15**	82	43	47	61	21	62	77
Step III:	42	15	**43**	82	47	61	21	62	77
Step IV:	42	15	43	**62**	82	47	61	21	77
Step V:	42	15	43	62	**21**	82	47	61	77
Step VI:	42	15	43	62	21	**47**	82	61	77
Step VII:	42	15	43	62	21	47	82	**77**	61

Solution:

It can be observed from above that the first smallest even number, then the smallest odd number, and then the smallest prime number are arranged in subsequent steps from left to right, thus following the same pattern thereafter.

Example 11:

Input:	**82**	**41**	**53**	**31**	**48**	**64**	**24**	**59**
Step I:	**24**	82	41	53	48	64	59	**31**
Step II:	**48**	24	82	53	64	59	31	**41**
Step III:	**64**	48	24	82	59	31	41	**53**
Step IV:	**82**	64	48	24	31	41	53	**59**

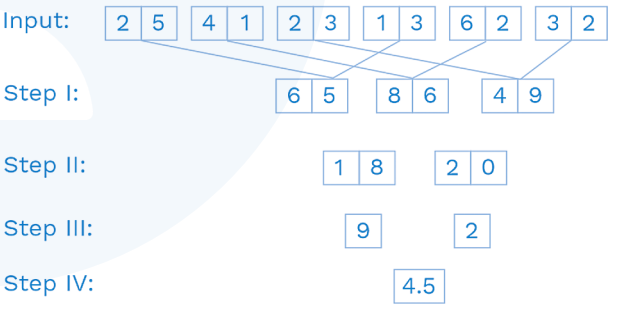
Solution:

It can be observed from above that the even numbers are arranged from left to right whereas odd numbers are arranged from right to left (both in ascending order, i.e., the smallest of the number is arranged first and it moves inward in every subsequent step.

Mathematical operations across the cell/block

The subsequent steps of the input can be obtained by applying mathematical operations, i.e., addition, subtraction, multiplication, or division of the number across the cell/block. Let us understand this with an example.

Example 12:



Solution:

Step I: The first cell of the first block is multiplied by the second cell of the fourth block, and the second cell of the first block is multiplied by the first cell of the fourth block to obtain the first block of Step I.

$2 \times 3 = 6$
$5 \times 1 = 5$
$\boxed{6}\boxed{5}$

Similarly, the second block and third block of Step I are obtained.

Step II: All the first cells of step I are added together to get the first block of step II, and all the second cells of step I are added together to get the second block of step II.

$6 + 8 + 4 = \boxed{1}\boxed{8}$
$5 + 6 + 9 = \boxed{2}\boxed{0}$

Step III: The sum of digits of the first block in step II will give the first block of step III, and the sum of digits of the second block in step II will give the second block of step III.

$1 + 8 = \boxed{9}$
$2 + 0 = \boxed{2}$

Step IV: The first block of step III is divided by the second block of step III.

$\frac{9}{2} = \boxed{4.5}$

Sum of digits of the number

The subsequent steps can be obtained by adding digits of the number in subsequent steps and arranging them in ascending/descending order from left to right or right to left.

Example 13:

Input:	**44**	**38**	**24**	**55**	**16**	**14**	**85**
Step I:	8	2	6	1	7	5	4
Step II:	60	0	32	−3	45	21	12
Step III:	6	0	5	−3	9	3	3
Step IV:	7	4	14	13	34	39	52
Step V:	15	12	22	21	42	47	60
Step VI:	6	3	4	3	6	2	6

Solution:

Step I: The digit sum of the two-digit number is done.

$44 \rightarrow 4 + 4 = 8$

$38 \rightarrow 3 + 8 = 11 = 1 + 1 = 2$

Step II: The number is obtained by first squaring the number and then subtracting 4 from it.

$8^2 = 64 - 4 = 60$

$1^2 = 1 - 4 = -3$

Step III: The sum of digits of the numbers in step II is calculated.

$60 = 6 + 0 = 6$

$32 = 3 + 2 = 5$

Step IV: The squares of consecutive natural numbers starting from 1 are added to the number from left to right.

$6 + 1^2 = 7$

$0 + 2^2 = 4$

$-3 + 4^2 = 13$

Step V: 8 is added to all the numbers obtained in step IV.

$7 + 8 = 15$

$13 + 8 = 21$

Step VI: The sum of digits of the numbers in step V is calculated.

$1 + 5 = 6$

$4 + 2 = 6$

Example 14:

Input:	**245**	**316**	**436**	**519**	**868**	**710**	**689**
Step I:	710	316	436	519	868	245	689
Step II:	710	316	245	519	868	436	689
Step III:	710	316	245	436	868	519	689
Step IV:	710	316	245	436	519	868	689

Solution:

First, the sum of digits of the input is calculated.

Sum of digits of the input:

$\underset{(2+4+5=11)}{245}$ $\underset{(3+1+6=10)}{316}$ $\underset{(4+3+6=13)}{436}$

$\underset{(5+1+9=15)}{519}$ $\underset{(8+6+8=22)}{868}$

710 (7 + 1 + 0 = 8) 689 (6 + 8 + 9 = 23)

The number with the lowest sum of digits interchanges with the first number. The number with the second-lowest sum of digits interchanges with the second number until the numbers are arranged in ascending order based on their sum of digits.

Step I:	**710**	316	436	519	868	**245**	689
Step II:	710	316	**245**	519	868	**436**	689
Step III:	710	316	245	**436**	868	**519**	689
Step IV:	710	316	245	436	**519**	**868**	689

Keynote

If the first number has already the lowest sum of digits, then the number with second lowest sum of digits interchanges with the second number.

Example 16:

Input:	**83**	**145**	**172**	**422**	**248**	**36**	**121**	**99**	**92**	**540**
Step I:	540	83	145	172	422	248	36	121	99	92
Step II:	540	121	83	145	172	422	248	36	99	92
Step III:	540	121	172	83	145	422	248	36	99	92
Step IV:	540	121	172	422	83	145	248	36	99	92
Step V:	540	121	172	422	36	83	145	248	99	92
Step VI:	540	121	172	422	36	92	83	145	248	99
Step VII:	540	121	172	422	36	92	145	83	248	99

Solution:

Input:	**83**	**145**	**172**	**422**	**248**	**36**	**121**
	99	**92**	**540**				
	(24)	(20)	(14)	(16)	(64)	(18)	(2)
	(81)	(18)	(0)				

As stated above, each number is assigned a separate number value which is the product of the digits of each number.

Interchange of digits of the number

The digits of the numbers are arranged in subsequent steps unless the given Input is arranged in an ascending or descending order.

Example 15:

Input:	**29**	**34**	**63**	**74**	**97**	**59**	**12**
Step I:	92	43	36	47	79	95	21
Step II:	121	49	81	121	256	196	09
Step III:	121	94	18	121	652	691	90

Solution:

Step I: The digits of the numbers are interchanged.

Step II: the square of the sum of digits of the numbers is calculated.

Step III: The first and the last digit of the numbers are interchanged.

Product of digits of the number

The digits of the numbers of the Input are multiplied and then the product of digits is arranged from left to right or right to left in an ascending/descending order.

In subsequent steps, the number which has been assigned the smallest value is placed at the first position in Step I, and the remaining numbers shift one position rightward. In case, the first number has already been the smallest assigned value, then the number which has been assigned the next value will become second and the rest will shift one position rightward and so on.

Also, if two or more numbers have been assigned equal values (i.e., the product of digits), then priority is given to a number that is smaller among the two in the given Input.

Squaring/cubing of the numbers

There may be an input whose subsequent steps follow different operations at various steps as illustrated below.

Example 17:

Input:	**12**	**17**	**14**	**23**	**22**	**19**	**25**	**29**
Step I:	6	16	10	10	8	20	14	22
Step II:	27	512	125	125	64	1000	343	1331
Step III:	15	20	17	26	25	22	28	32
Step IV:	19	29	23	41	39	33	45	53
Step V:	8	7	1	3	6	0	1	2

Solution:

Step I: The digits of every two-digit number have been added and then multiplied by 2.

$12 \rightarrow (1 + 2) \times 2 = 6$

$22 \rightarrow (2 + 2) \times 2 = 8$

Step II: The digits of every number of the input have been added and then cubed.

$12 \rightarrow (1 + 2)^3 = 27$

$14 \rightarrow (1 + 4)^3 = 125$

Step III: All numbers of the input are added with 3.

$12 \rightarrow (12 + 3) = 15$

$25 \rightarrow (25 + 3) = 28$

Step IV: Each number of the input is multiplied by 2 and then 5 is subtracted from it.

$17 \rightarrow (17 \times 2) - 5 = 29$

$23 \rightarrow (23 \times 2) - 5 = 41$

Step V: The difference of the digits of the number in step IV is calculated and then the numbers are placed from left to right.

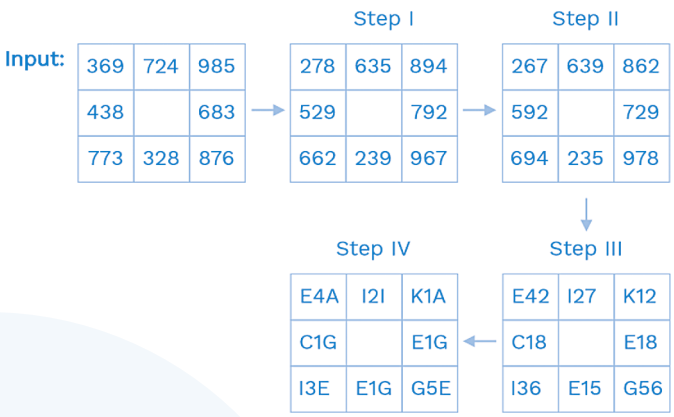
$19 \rightarrow (9 - 1) = 8$

$41 \rightarrow (4 - 1) = 3$

Matrix-based questions

There may be numbers arranged in the (3×3) matrix and following some operation in the subsequent steps as illustrated below.

Example 18:



Solution:

Step I: Odd digits of a number are decreased by 1 and even digits of a number are increased by 1.

Step II: The first digit of each number in the cell remains the same and the last two digits are interchanged in a criss-cross like 278 is opposite to 967 and 78 and 67 are interchanged.

Step III: The last two digits of the number in each cell are multiplied. Also, if the first digit is even, then we add 3, and if the first digit is odd, then we subtract 2 and write its alphabetical letter.

Step IV: The first two digits of the cell remain the same. Also, if the last digit is even, then we subtract 1, and if the last digit is odd, then we add 2 and write its alphabetical letter.

Arrangement of Both Letters and Numbers

Arrangement of both letters and numbers altogether can be done in various ways i.e., letters arranged in ascending or descending order as per order in the dictionary/number of letters in the word/number of vowels and consonants in the word/alphabetical place

value of letters and numbers arranged in ascending or descending order/even or odd number increased or decreased by some value/prime numbers taking some particular letter place/sum or product of the digits in the particular cells of the block or in the block itself/addition or multiplication or subtraction or division of the number in the cell or subsequent cells or across the block/squaring or cubing of the digits or numbers in the cells or block. Let us understand this with some examples.

Example 19:

Input: parenting 16 36 and raising 44 child 21 is demand 35

Step I: **and** parenting 16 36 44 child 21 is demand 35 **raising**

Step II: and **44** parenting 36 child 21 is demand 35 **16** raising

Step III: and 44 **child** 36 21 is demand 35 **parenting** 16 raising

Step IV: and 44 child **36** is demand 35 **21** parenting 16 raising

Step V: and 44 child 36 **demand** 35 **is** 21 parenting 16 raising

Solution:

It can be seen that in the last step all words are arranged in an alphabetic order and numbers are arranged in descending order.

Step I: 'and' and 'raising' are arranged at left and right extreme places, respectively.

Step II: The largest number '44' and the smallest number '16' are arranged on the left and right sides, respectively. In the subsequent steps, the above steps are followed alternately.

Example 20:

Input: watch guide help sky 18 54 26 37 away press 76 42 85 decide

Step I: **away** watch guide help sky 54 26 37 press 76 42 85 decide **18**

Step II: away **decide** watch guide help sky 54 37 press 76 42 85 **26** 18

Step III: away decide **guide** watch help sky 54 press 76 42 85 **37** 26 18

Step IV: away decide guide **help** watch sky 54 press 76 85 **42** 37 26 18

Step V: away decide guide help **press** watch sky 76 85 **54** 42 37 26 18

Step VI: away decide guide help press **sky** watch 85 **76** 54 42 37 26 18

Solution:

In the last step, the words are arranged in an increasing alphabetical order and the numbers are arranged in a decreasing order.

In each step, one word and one number are rearranged. You can see that the word which comes first as per order in the dictionary is arranged in the extreme left position and the smallest number is arranged at the extreme right position.

In the next step, the word which comes second as per order in the dictionary is placed in the second position from the left end and the second-lowest number is placed in the second position from the right end.

In the subsequent steps, the above step is processed simultaneously.

Practice Exercise

Level of Difficulty – 1

1. The symbols hold specific meaning below:
P # Q means P is greater than Q.
P @ Q means P is equal to Q.
P $ Q means P is either greater or equal to Q.
P % Q means P is smaller than Q.
P & Q means P is either smaller or equal to Q.
Identify the appropriate option based on the given statements.
Statement:
I. M # N
II. D @ N
III. E $ D
Conclusion:
I. M # E
II. N & E
(A) Only conclusion I follows.
(B) Only conclusion II follows.
(C) Both conclusions follow.
(D) Neither conclusion I nor II follows.

2. If '+' means '–', '*' means '÷' and '÷' means '×', then what would be the value of the given equation?
16 * 4 ÷ 2 + 2
(A) 4
(B) 6
(C) 8
(D) 10

3. If '@' means '×', '# means '÷', '*' means '+' and '$' means '–', then what would be the value of the given equation?
5 @ 2 $ 4 # 2 * 8
(A) 11
(B) 13
(C) 14
(D) 16

4. If '@' stands for 'minus', '#' stands for 'plus', '$' stands for 'multiplied by' and '%' stands for 'divided by', then find the value of 27 @ 54 % 9 # 7?
(A) 26
(B) 28
(C) 29
(D) None of these

5. If '÷' means '+', '–'means '÷', '×' means '–' and '+' means '×', then $\frac{(48\times8)-8\times2}{4+18\times8+9\div1}=?$
(A) 1
(B) 0
(C) 3
(D) None of these

Directions for Questions 6 to 10: Read the given information and answer the questions that follow.

When a word and number arrangement machine is given an input line of words and numbers, it arranges them following a particular rule. The following is an illustration of input and rearrangement. (All the numbers are two-digit numbers).

Input: 40 made butter 23 37 cookies salt extra 52 86 92 fell now 19

Step I: butter 19 40 made 23 37 cookies salt extra 52 86 92 fell now

Step II: cookies 23 butter 19 40 made 37 salt extra 52 86 92 fell now

Step III: extra 37 cookies 23 butter 19 40 made salt 52 86 92 fell now

Step IV: fell 40 extra 37 cookies 23 butter 19 made salt 52 86 92 now

Step V: made 52 fell 40 extra 37 cookies 23 butter 19 salt 86 92 now

Step VI: now 86 made 52 fell 40 extra 37 cookies 23 butter 19 salt 92

Step VII: salt 92 now 86 made 52 fell 40 extra 37 cookies 23 butter 19

Step VII is the last step of the above arrangement as the intended arrangement is obtained. As per the rules followed in the

given steps, find out the appropriate steps for the given Input.

Input: 32 proud girl beautiful 48 55 97 rich family 61 72 17 nice life

6. How many steps will be required to complete the given input?
(A) Five
(B) Six
(C) Seven
(D) Eight

7. Which of the following is the third element from the left end of step VI?
(A) beautiful
(B) life
(C) 61
(D) nice

8. Which of the following is step III of the given Input?
(A) proud 72 girl 48 family 32 beautiful 17 55 97 rich 61 nice life
(B) life 55 girl 48 family 32 beautiful 17 proud 97 rich 61 72 nice
(C) girl 48 family 32 beautiful 17 proud 55 97 rich 61 72 nice life
(D) family 32 beautiful 17 proud girl 48 55 97 rich 61 72 nice life

9. What is the position of 'nice' from the left end in the final step?
(A) Fifth
(B) Sixth
(C) Seventh
(D) Eighth

10. Which element is third to the right of 'family' in Step V?
(A) beautiful
(B) 17
(C) proud
(D) 97

Directions for Questions 11 to 15: Consider the following operations:

$a(x, y)$ = mod of $[(x^2 + y^3) - (x^3 + y^2)]$ (e.g., mod of $[-5] = |-5| = 5$)

$b(x, y) = [(x^3 - y^2) + (y^3 - x^2)]$

$c(x, y)$ = LCM of $[a(x, y), b(x, y)]$

$d(x, y)$ = HCF of $[a(x, y), b(x, y)]$

11. Find the value of a (4, 7).
(A) 238
(B) 246
(C) 252
(D) 258

12. Find the value of b (3, 6).
(A) 106
(B) 137
(C) 169
(D) 198

13. Find the value of d (4, 5).
(A) 4
(B) 5
(C) 6
(D) 8

14. Find the value of c (1, 2) – d (2, 1).
(A) 6
(B) 4
(C) 2
(D) 0

15. Find the value of a (5, 3) + b (3, 5).
(A) 182
(B) 124
(C) 200
(D) –42

Level of Difficulty – 2

Directions for Questions 1 to 5: Read the following information carefully and answer the questions given below.

A meeting is to be held from 1 p.m. to 6 p.m. in five shifts each of one hour's duration. The delegates have been allotted different shifts with a code to attend the meeting. Code for shift 1 p.m. to 2 p.m. is 'Chang Bone Exi Dug Gai Fack'. For 2 p.m. to 3 p.m., it is 'Bone Dug Fack Chang Exi Gai'. From 3 p.m. to 4 p.m., it is 'Dug Chang Gai Bone Fack Exi'. From 4 p.m. to 5 p.m., it is 'Fack Gai Dug Exi Bone Chang'. And for the last shift, i.e., 5 p.m. to 6 p.m., it is 'Gai Exi Chang Fack Dug Bone'.

1. If the meeting is to be held from 6 p.m. to 7 p.m., then what will be the code? (Assume the same logic to continue).
(A) Exi Fack Bone Gai Chang Dug
(B) Fack Exi Gai Bone Chang Dug
(C) Exi Bone Chang Fack Gai Dug
(D) Fack Gai Dug Exi Bone Chang

2. If the code from 1 p.m. to 2 p.m. is 'Yi Zen Bec Chi Kai Hoi', then what would be the code from 5 p.m. to 6 p.m.?
(A) Zen Chi Hoi Kai Yi Bec
(B) Chi Hoi Yi Kai Bec Zen
(C) Kai Bec Yi Hoi Chi Zen
(D) Bec Hoi Zen Kai Yi Chi

3. If the code from 1 p.m. to 2 p.m. is 'Yi Zen Bec Chi Kai Hoi', then what would be the code for the shift from 3 p.m. to 4 p.m.?
(A) Chi Hoi Yi Kai Bec Zen
(B) Bec Hoi Zen Yi Kai Chi
(C) Chi Yi Kai Zen Hoi Bec
(D) Bec Zen Yi Kai Hoi Chi

4. If the code of 3 p.m. to 4 p.m. is 'min epi qui shi bic hoi', then what will be the code from 1 p.m. to 2 p.m.?
(A) bic hoi shi epi qui min
(B) shi min qui epi bic hoi
(C) epi shi hoi min qui bic
(D) min qui shi hoi bic epi

5. If the code from 3 p.m. to 4 p.m. is 'min epi qui shi bic hoi', then what will be the code from 5 p.m. to 6 p.m.?
(A) shi min qui epi bic hoi
(B) qui hoi epi bic min shi
(C) min qui hoi bic shi epi
(D) bic shi epi hoi min qui

6. If □ = 17, △ = 8, ▭ = 5, ○ = 10 and ◇ = 3, then △ + ▭ − ○ = ?
(A) □
(B) △
(C) ◇
(D) ○

7. Given interchanges:
Signs + and × and numbers 3 and 4, then which of the following equation is correct?
(A) 4 × 3 + 12 = 24
(B) 4 × 3 + 12 = 40
(C) 4 × 3 + 12 = 51
(D) 4 × 3 + 12 = 32

8. If M denotes '÷', N denotes '×', R denotes '+' and S denotes '–', then which of the following statements is true?
(A) 32 R 8 M 16 S 4 = $-\frac{2}{3}$
(B) 6 N 18 S 26 M 13 R 7 = $\frac{173}{13}$
(C) 11 N 34 M 17 S 8 M 3 = $\frac{38}{3}$
(D) 9 R 9 M 9 S 9 N 9 = –71

9. Which one of the four interchanges in signs and numbers would make the given equation correct: 3 + 5 – 2 = 4?
(A) + and –, 2 and 5
(B) + and –, 2 and 3
(C) + and –, 3 and 5
(D) None of these

10. If A + B = 2C and C + D = 2A, then
(A) A + C = B + D
(B) A + C = 2D
(C) A + D = B + C
(D) A + C = 2B

Directions for Questions 11 to 15: Consider the following operations:

a @ b = a × 3b
a ! b = 2a ÷ b
a ^ b = 3a + b
a # b = 2a – 3b

11. Which of the following is a perfect cube?
(A) [(9 ^ 7) @ 4] # 29
(B) [(9 @ 7) # 4] ^ 29
(C) [(9 # 7) ^ 4] @ 29
(D) [(9 ^ 7) # 4] @ 29

12. Which of the following is a multiple of 13?
(A) [(15 ^ 6) @ 9] ! 2
(B) [(15 @ 6) ^ 9] ! 2
(C) [(15 # 6) ! 9] @ 2
(D) [(15 ! 6) # 9] ^ 2

13. The value of cube root of (30 ^ 35) – square root of (14 # 4) is:
(A) 6
(B) 5
(C) 1
(D) –1

14. The value of [{(3 ^ 5) ! (5 # 3)} @ (1 ! 2)] is:
(A) 12
(B) 24
(C) 36
(D) 84

15. What should be the nature of the value of b for all the four operations to be defined in the domain of real numbers?
(A) b should be a rational number.
(B) b should be a positive real number.
(C) b should belong to the domain –5 ≤ b.
(D) b should be a non-zero real number.

Level of Difficulty – 3

Directions for Questions 1 to 5: Read the following information carefully and answer the questions given below.

A famous museum issues entry passes to all its visitors for security reasons. Visitors are allowed in batches after every hour. In a day there are six batches. A code is printed on the entry pass which keeps on changing for every batch.

Following is an illustration of passcodes issued for each batch.

Batch I: houses neat and clean liked are all by

Batch II: by houses neat all are and clean liked

Batch III: liked by houses clean and neat all are, and so on.

1. If the passcode for the third batch is 'you succeed day and hard work to for', then what will be the passcode for the sixth batch?
(A) work hard to for succeed you and day
(B) hard work for and succeed you to day
(C) work hard for to succeed you and day
(D) hard work for to succeed you and day

2. If 'visit in 15 should the we time 40' is the passcode for the fifth batch, then '15 we the should visit 40 time in' will be the passcode for which of the following batches?
(A) II
(B) IV
(C) I
(D) III

3. Naman visited the museum in the fourth batch and was issued a passcode 'to one rush avoid not do very run'. What would have been the passcode for him had he visited the museum in the second batch?
(A) rush do not avoid to run very one
(B) rush not do avoid to run very one
(C) avoid rush not do to run very one
(D) Cannot be determined

4. Kamal went to visit the museum in the second batch. He was issued a passcode 'length the day equal of an night are'. However, he could not visit the museum in the second batch as he was a little late. He then preferred to visit in the fourth batch.
What will be the new passcode issued to him?
(A) an of are night the length equal day
(B) an are of night the length equal day
(C) an of are night the equal day length
(D) of are length equal day the night an

5. If the passcode for the second batch is 'to come hard you did work and success', then what will be the passcode for the sixth batch?
(A) hard work did you to success and come
(B) did work hard you to come and success
(C) hard work did you success and come to
(D) hard work did come success and you to

Directions for Questions 6 and 7

A machine when given an input line of numbers modifies them following a particular rule. An illustration of the input and the following steps is shown below.

Input:	**64**	**125**	**27**	**216**	**1331**
Step I:	4	5	3	6	11
Step II:	17	26	10	37	122
Step III:	34	52	20	74	244
Step IV:	7	7	2	11	10
Step V:	9	9	4	3	2

Here, step V is the output.

Solve the following questions based on the rule followed above.

6. What is the final step of the given input?

	8	**343**	**512**	**729**	**1**
(A)	3	3	6	3	8
(B)	3	3	6	5	6
(C)	3	3	6	4	6
(D)	3	3	6	3	6

7. Which of the following is the second element from the left of the third step of the given input?

8 343 512 729 1

(A) 90
(B) 100
(C) 110
(D) 125

Directions for Questions 8 to 10: These questions are based on the following information.

A number arrangement machine, when given an input line of numbers, rearranges them by following a particular rule in each step. The following is an illustration of an input and its rearrangement:

Input:	**63**	**71**	**34**	**82**	**17**	**98**	**57**	**20**	**46**	**75**
Step I:	97	63	71	34	82	57	20	46	75	18
Step II:	81	97	63	71	34	57	46	75	18	21
Step III:	74	81	97	63	71	57	46	18	21	35
Step IV:	70	74	81	97	63	57	18	21	35	47
Step V:	62	70	74	81	97	18	21	35	47	58

Step V is the last step for the given input.

As per the rules followed in the above steps, find out the appropriate steps for the given input and answer the following questions:

Input for the questions: **69 19 77 28 84 91 36 45 62 53**

8. What is the difference between the numbers that are third from the left end in step III and fourth from the right end in step IV?
(A) 46
(B) 70
(C) 44
(D) 51

9. What is the average of the numbers which are the second number from the right end in step V, the fifth number from the right end in step I, and the second number from the right end in step II?
(A) 42
(B) 38
(C) 34
(D) 45

10. Which number is fourth to the left of the third to the right of the third number from the left end in step V?
(A) 61
(B) 68
(C) 76
(D) 83

11. Select the correct set of symbols which will fit in the given equation?
5 7 0 8 = 27
(A) ×, –, +
(B) ×, +, +
(C) +, ×, –
(D) ×, +, –

12. If '+' means '–', '×' means '÷', '÷' means '×', and '–' means '+', which interchange of signs will make the following equation correct?
40 + 8 × 3 – 3 ÷ 5
(A) + and ÷
(B) – and ÷
(C) × and +
(D) × and ÷

13. In a group of tiger and flamingo the number of legs is 9 more than thrice the number of heads. What is the number of tigers in the group while flamingos are 23?

(A) 64
(B) 32
(C) 28
(D) 34

Directions for Question 14: Identify the code for the given word, following the conditions given below, along with the codes given for the letters in the table.

Letter	Z	H	Q	P	E	F	G	S	T	N	W	O	R	D	X
Code	5	^	@	1	π	4	1	!	#	6	®	2	9	%	8

Conditions:

I. If the first letter is a vowel and the last letter is a consonant, the codes are to be interchanged.
II. If the first letter is consonant and the last letter is a vowel, both are to be coded as the code for the last letter.
III. If both the first and the last letters are vowels, both are to be coded as '%'.

14. QWZEGO

(A) @®5π12
(B) 2®5π12
(C) 2@512%
(D) None of these

15. If 2 + 4 = 9, 5 + 3 = 16, 9 + 11 = 100, then 13 + 15 = ?

(A) 196
(B) 169
(C) 64
(D) 121

Solutions

Level of Difficulty – 1

1. (B)

Let's decode the statement with the help of instruction.

1. M # N indicates M > N
2. D @ N indicates D = N
3. E $ D indicates E ≥ D

Now, join these statements with common terms will get,

M > N = D ≤ E

Conclusion 1:

M # E indicates M > E

It is clearly seen that M is not necessarily greater than E

So, conclusion 1 does not follow

Conclusion 2:

N & E indicates N ≤ E

In the above equation, it is given that D ≤ E and it is known that N = D

So, N ≤ E follows.

So, conclusion 2 does follow.

Hence, option (B) is correct.

2. (B)

First, put symbols according to their correct meaning.

Now, the given equation becomes,

$$16 \div 4 \times 2 - 2 = \frac{16}{4} \times 2 - 2 = 8 - 2 = 6$$

Hence, option (B) is correct.

3. (D)

First, put symbols according to their correct meanings,

Now, the given equation becomes,

$$5 \times 2 - 4 \ \div 2 + 8 = 10 - \frac{4}{2} + 8 = 10 - 2 \ + 8$$

$$= 8 + 8 = 16$$

Hence, option (D) is correct.

4. (B)

Using the correct symbols, the given expression will be:

= 27 – 54 ÷ 9 + 7 = 27 – 6 + 7 = 28

Hence, option (B) is correct.

5. (C)

Using the proper notation on the above equal

$$= \frac{(48-8) \div 8 - 2}{4 \times 18 - 8 \times 9 + 1} = \frac{40 \div 8 - 2}{72 - 72 + 1} = \frac{3}{1}$$

Hence, option (C) is correct.

6. (C)

From Input to step I: The word that comes first in the alphabetical order goes to the first position. The smallest number goes to the second position. The rest of the line shifts rightward.

From step I to step II: The word that comes second in alphabetical order goes to the first position. The second smallest number goes to the second position. The rest of the line shifts rightward.

This goes on until in the last step all the words are arranged in reverse alphabetical order and the numbers are arranged in descending order from left to right.

Input: 32 proud girl beautiful 48 55 97 rich family 61 72 17 nice life

Step I: beautiful 17 32 proud girl 48 55 97 rich family 61 72 nice life

Step II: family 32 beautiful 17 proud girl 48 55 97 rich 61 72 nice life

Step III: girl 48 family 32 beautiful 17 proud 55 97 rich 61 72 nice life

Step IV: life 55 girl 48 family 32 beautiful 17 proud 97 rich 61 72 nice

Step V: nice 61 life 55 girl 48 family 32 beautiful 17 proud 97 rich 72

Step VI: proud 72 nice 61 life 55 girl 48 family 32 beautiful 17 97 rich

Step VII: rich 97 proud 72 nice 61 life 55 girl 48 family 32 beautiful 17

Hence, option (C) is correct.

7. (D)
Step VI: proud 72 nice 61 life 55 girl 48 family 32 beautiful 17 97 rich
Hence the required element = nice
Hence, option (D) is correct.

8. (C)
Step III: girl 48 family 32 beautiful 17 proud 55 97 rich 61 72 nice life
Hence, Option (C) is correct.

9. (A)
Step VII: rich 97 proud 72 nice 61 life 55 girl 48 family 32 beautiful 17
So, nice is in the fifth position.
Hence, option (A) is correct.

10. (B)
Step V: nice 61 life 55 girl 48 family 32 beautiful 17 proud 97 rich 72
Third to the right of family is '17'.
Hence, option (B) is correct.

11. (B)
a (4, 7) = mod of $[(4^2 + 7^3) - (4^3 + 7^2)]$ = 246
Hence, option (B) is correct.

12. (D)
b (3, 6) = $[(3^3 - 6^2) + (6^3 - 3^2)]$ = 198
Hence, option (D) is correct.

13. (A)
d (4, 5) = HCF of [a(4, 5), b(4, 5)] = HCF of [(141 – 89), (39 + 109)] = HCF of [52, 148] = 4
Hence, option (A) is correct.

14. (D)
c (1, 2) = LCM of [a(1, 2), b(1, 2)]
a (1, 2) = 4
b (1, 2) = 4
So c (1, 2) = LCM of [4, 4] = 4
d (2, 1) = HCF of [a(2, 1), b(2, 1)] = HCF of [4,4] = 4
Hence (c) (1, 2) – d (2, 1) = 4 – 4 = 0
Hence, option (D) is correct.

15. (C)
a (5, 3) = 82
b (3, 5) = 118
Hence (a) (5, 3) + b (3, 5) = 82 + 118 = 200
Hence, option (C) is correct.

Level of Difficulty – 2

1. (A)

For the sake of convenience, let us represent the words digitally as:

Chang – 1, Bone – 2, Exi – 3, Dug – 4, Gai – 5, Fack – 6

Shift I:	1	2	3	4	5	6
Shift II:	2	4	6	1	3	5
Shift III:	4	1	5	2	6	3
Shift IV:	6	5	4	3	2	1
Shift V:	5	3	1	6	4	2

The rule followed is as illustrated below:

Shift I to Shift II: The second, fourth, and sixth words become the first three and the first, third and fifth becomes the last three.

Shift II to Shift III: The second, fourth, and sixth words become the first three and the first, third and fifth become the last three (same as Shift I to Shift II).

Shift III to Shift IV: The fifth, third, and the first words get arranged as the first three and then the sixth, fourth and second words as the last three.

Shift IV to Shift V: The second, fourth, and sixth words become the first three and the first, third and fifth become the last three (same as Shift I to Shift II).

Continuing the same logic to continue,

From 6p.m. to 7p.m.,

Shift 6: 3 6 2 5 1 4

i.e., Exi Fack Bone Gai Chang Dug

Hence, option (A) is correct.

2. (C)

As explained earlier, let's denote the given code as: Yi = 1, Zen = 2, Bec = 3, Chi = 4, Kai = 5 and Hoi = 6, in

So, Shift 5: Kai Bec Yi Hoi Chi Zen

Hence, option (C) is correct.

3. (C)

As explained earlier, let's denote the Shift 1 code as: Yi = 1, Zen = 2, Bec = 3, Chi = 4, Kai = 5 and Hoi = 6,

Shift 3: 4 1 5 2 6 3, i.e., 'Chi Yi Kai Zen Hoi Bec'

Hence, option (C) is correct.

4. (C)

Again, Denoting the Shift 3 code as: min = 4, epi = 1, qui = 5, shi = 2, bic = 6, hoi = 3,

Shift 1: 1 2 3 4 5 6 code will become epi shi hoi min qui bic

Hence, option (C) is correct.

5. (B)

Shift 3 (3 p.m. to 4 p.m.): 4 1 5 2 6 3

min epi qui shi bic hoi

Shift 5 (5 p.m. to 6 p.m.): 5 3 1 6 4 2

qui hoi epi bic min shi

Hence, option (B) is correct.

6. (C)

According to the above notations/symbols

 = 17

 = 8

 = 5

 = 10

 = 3

Required equation is = +  -  = 8 + 5 – 10 = 3 =

Hence, option (C) is correct.

7. (C)

On interchanging + and × and 3 and 4 in (1),
The equation will be,
$3 + 4 \times 12 = 24$
$3 + 48 = 24$
$51 \neq 24$ (False)
On interchanging + and × and 3 and 4 in (2),
The equation will be,
$3 + 4 \times 12 = 40$
$3 + 48 = 40$
$51 \neq 40$ (False)
On interchanging + and × 3 and 4 in (3).
The equation will be,
$3 + 4 \times 12 = 51$
$3 + 48 = 51$
$51 = 51$ (True)
So, option (C) satisfies the condition. There is no need to check further.
Alternatively,
LHS of all the equations given in the options are the same. Let us solve it as per the given condition.
LHS = $3 + 4 \times 12 = 51$
Hence, option (C) is correct.

8. (D)

Using the proper notations, let's solve all the given options one by one.

i)

$$32 + 8 \div 16 - 4 = -\frac{2}{3}$$

$$32 + \frac{1}{2} - 4 = -\frac{2}{3}$$

$$\frac{64 + 1 - 8}{2} = -\frac{2}{3}$$

$$\frac{57}{2} \neq -\frac{2}{3}$$

ii)

$$6 \times 18 - 26 \div 13 + 7 = \frac{173}{13}$$

$$108 - \frac{26}{13} + 7 = \frac{173}{13}$$

$$113 \neq \frac{173}{13}$$

iii)

$$11 \times 34 \div 17 - 8 \div 3 = \frac{38}{3}$$

$$11 \times \frac{34}{17} - \frac{8}{3} = \frac{38}{3}$$

$$22 - \frac{8}{3} = \frac{38}{3}$$

$$\frac{66-8}{3} = \frac{8}{3}$$
$$\frac{58}{3} \neq \frac{38}{3}$$

iv)

$$9+9\div9-9\times9=-71$$
$$9+\frac{9}{9}-81=-71$$
$$9+1-81=-71$$
$$-71=-71$$

So, option (D) satisfies the condition.

9. (C)

By making the interchanges given in (i)
3 – 2 + 5 = 4 or 6 = 4, which is false
By making the interchanges given in (ii)
2 – 5 + 3 = 4 or 0 = 4, which is false
By making the interchanges given in (iii)
5 – 3 + 2 = 4
4 = 4, which is true
So, option (C) will satisfy the condition.

10. (A)

Given, A + B = 2C ...(i)
C + D = 2A ...(ii)
Now, adding (i) and (ii),
A + B + C + D = 2C + 2A
⇒ B + D = A + C
Hence, option (A) is correct.

11. (A)

[(9 ^ 7) @ 4] # 29
[(9 ^ 7) @ 4] # 29 = (34 @ 4) # 29 = (34 × 12) # 29
= 2(34 × 12) – (3 × 29) = 729 which is a perfect cube.

The other cubes have values of 1127, –435, and 4872, respectively, which are not perfect cubes.
Hence, option (A) is correct.

12. (B)

[(15 @ 6) ^ 9] ! 2
[(15 ^ 6) @ 9] ! 2 = [51 × 3 × 9] ! 2 = 1377
[(15 @ 6) ^ 9] ! 2 = [270 × 3 + 9] ! 2 = 819
[(15 # 6) ! 9] @ 2 = [24/9] @ 2 = 16
[(15 ! 6) # 9] ^ 2 = [10–27] ^ 2 = –49
Only 819 is a multiple of 13.
Hence, option (B) is correct.

13. (C)

cube root of (30 ^ 35) – square root of (14 # 4) = cube root of (90 + 35) – square root of (28 – 12) = 5 – 4 = 1
Hence, option (C) is correct.

14. (D)

[{(3 ^ 5) ! (5 # 3)} @ (1 ! 2)] = {(14 ! 1) @ 1} = (28 @ 1) = 84
Hence, option (D) is correct.

15. (D)

Because with b we perform the arithmetic operations of addition, subtractions, multiplications as well as divisions, hence b should be a non-zero real number
Hence, option (D) is correct.

Level of Difficulty – 2

1. (C)

Let the reference chart be: houses = 1, neat = 2, and = 3, clean = 4, liked = 5, are = 6, all = 7, by = 8

Batch I	1	2	3	4	5	6	7	8
Batch II	8	1	2	7	6	3	4	5
Batch III	5	8	1	4	3	2	7	6

In every step 3 changes are happening in order simultaneously:

From Batch I,

The 8th position comes 1st – 8 1 2 3 4 5 6 7,

The 8th position comes 4th – 8 1 2 7 3 4 5 6, and

The 8th position comes 5th – 8 1 2 7 6 3 4 5,

to form Batch II.

From Batch II,

The 8th position comes 1st – 5 8 1 2 7 6 3 4,

The 8th position comes 4th – 5 8 1 4 2 7 6 3, and

The 8th position comes 5th – 5 8 1 4 3 2 7 6,

to form Batch III.

Likewise,

Batch IV	6	5	8	7	2	1	4	3
Batch V	3	6	5	4	1	8	7	2
Batch VI	2	3	6	7	8	5	4	1

Hence,

Given, Batch III

you	succeed	day	and	hard	work	to	for
↓	↓	↓	↓	↓	↓	↓	↓
5	8	1	4	3	2	7	6

∴ Batch VI

2	3	6	7	8	5	4	1
↓	↓	↓	↓	↓	↓	↓	↓
work	hard	for	to	succeed	you	and	day

Hence, option (C) is correct.

2. (D)

We have seen in the last question that if

Batch I	1	2	3	4	5	6	7	8,

then

Batch II	8	1	2	7	6	3	4	5
Batch III	5	8	1	4	3	2	7	6
Batch IV	6	5	8	7	2	1	4	3
Batch V	3	6	5	4	1	8	7	2
Batch VI	2	3	6	7	8	5	4	1

Given, Batch V

visit	in	15	should	the	we	time	40
↓	↓	↓	↓	↓	↓	↓	↓
3	6	5	4	1	8	7	2

∴ 15	we	the	should	visit	40	time	in
↓	↓	↓	↓	↓	↓	↓	↓
5	8	1	4	3	2	7	6

Batch III

Hence, option (D) is correct.

3. (A)

We have seen in the last question that if

Batch I	1	2	3	4	5	6	7	8,

Then,

Batch II	8	1	2	7	6	3	4	5
Batch III	5	8	1	4	3	2	7	6
Batch IV	6	5	8	7	2	1	4	3

Given, Batch IV

to	one	rush	avoid	not	do	very	run
↓	↓	↓	↓	↓	↓	↓	↓
6	5	8	7	2	1	4	3

Batch II

8	1	2	7	6	3	4	5
↓	↓	↓	↓	↓	↓	↓	↓
rush	do	not	avoid	to	run	very	one

Hence, option (A) is correct.

4. (D)

As explained earlier,

Given, Batch II

8	1	2	7	6	3	4	5
↓	↓	↓	↓	↓	↓	↓	↓
length	the	day	equal	of	an	night	are

Batch IV

6	5	8	7	2	1	4	3
↓	↓	↓	↓	↓	↓	↓	↓
of	are	length	equal	day	the	night	an

Hence, option (D) is correct.

5. (A)

Using the logic explained earlier,
Batch II 8 1 2 7 6 3 4 5
Hence:
to – 8, come – 1, hard – 2, you – 7, did – 6, work – 3, and – 4, success – 5
Therefore:
Batch VI
2 – hard, 3 – work, 6 – did, 7 – you, 8 – to, 5 – success, 4 – and, 1 – come
Hence, option (A) is correct.

6. (D)

Input:	**64**	**125**	**27**	**216**	**1331**
Step 1:	4	5	3	6	11
Step 2:	17	26	10	37	122
Step 3:	34	52	20	74	244
Step 4:	7	7	2	11	10
Step 5:	9	9	4	3	2

The logic is as explained below:
Step I: Cube root of the input terms are taken
Step II: Take the Square and add 1 in each term of step 1
Step III: Terms in the previous step are multiplied by 2
Step IV: Summation of the digits of each term in the previous step
Step V: Single digits + 2, if the result is a double digit then the summation of digits + 1

Similarly,

Input:	**8**	**343**	**512**	**729**	**1**
Step 1:	2	7	8	9	1
Step 2:	5	50	65	82	2
Step 3:	10	100	130	164	4
Step 4:	1	1	4	911	4
Step 5:	3	3	6	3	6

Hence, option (D) is correct.

7. (B)

As per the rule explained earlier,

Input:	8	343	512	729	1
Step 1:	2	7	8	9	1
Step 2:	5	50	65	82	2
Step 3:	10	100	130	164	4

As we can see from all the steps, the second element from the left of the third step of the given input is '100'.
Hence, option (B) is correct.

8. (B)

From input to step I: The highest number is shifted to the left end and 1 is subtracted from it and the lowest number is shifted to the right end and 1 is added to it.
From step I to step II: The second highest number is shifted to the left end and 1 is subtracted from it and the second-lowest number is shifted to the right end and 1 is added to it.
The above-said process is repeated until we get the desired output.

Input:	**69**	**19**	**77**	**28**	**84**
	91	**36**	**45**	**62**	**53**
Step I:	90	69	77	28	84
	36	45	62	53	20
Step II:	83	90	69	77	36
	45	62	53	20	29
Step III:	76	83	90	69	45
	62	53	20	29	37
Step IV:	68	76	83	90	62
	53	20	29	37	46
Step V:	61	68	76	83	90
	20	29	37	46	54

As we can see that the difference between the numbers which are the third number from the left end in step III and the fourth number from the right end in step IV is 90 — 20 = 70.
Hence, option (B) is correct.

9. (C)
As we can see from all the steps, 46, 20, and 36 would be the required numbers and their average is 34.
Hence, option (C) is correct.

10. (B)
As we can see from step V, the desired number can be observed to be 68.
Hence, option (B) is correct.

11. (D)
Here, put all the sets of symbols one by one in the given equation.
(A) $5 \times 7 - 0 + 8 = 27$
$35 + 8 = 27$
$43 \neq 27$ (False)
(B) $5 \times 7 + 0 + 8 = 27$
$35 + 8 = 27$
$43 \neq 27$ (False)
(C) $5 + 7 \times 0 - 8 = 27$
$5 + 0 - 8 = 27$
$5 - 8 = 27$
$-3 \neq 27$ (False)
(D) $5 \times 7 + 0 - 8 = 27$
$35 - 8 = 27$
$27 = 27$ (True)
Hence, option (D) is correct.

12. (C)
$40 + 8 \times 3 - 3 \div 5$
According to given conditions, by replacing the mathematical operators,
$40 - 8 \div 3 + 3 \times 5 = 17$
If we interchange divide and minus,
$40 \div 8 - 3 + 3 \times 5 = 17$
$5 - 3 + 15 = 17$
$2 + 15 = 17$
$17 = 17$,
So, the equation is correct.
So, option (C), i.e., 'x' and '+' are to be interchanged, as '÷' is represented by 'x' and '–' is by '+'.
Hence, option (C) is correct.

13. (B)
Let's take the number of tigers = x.
Also, the number of flamingos = 23
Hence, the total number of heads = $(x + 23)$
Hence, the total number of legs = $(4x + 46)$
According to the question,
$(4x + 46) - 3(x + 23) = 9$
$4x + 46 - 3x - 69 = 9$
$x - 23 = 9$
$x = 32$
Hence number of tigers = 32.
Hence, option (B) is correct.

14. (B)
Condition I:
First letter — Vowel; Last letter — Consonant
then the codes are to be interchanged.
Condition II:
First letter — Consonant; Last letter — Vowel
then both are to be coded as the last letter.
Condition III:
First letter — Vowel; Last letter — Vowel
then both are to be coded as '%'.
In this question, condition II is followed then the code will be
⇒ 2®5π12
Hence, option (B) is correct.

15. (A)
$$\text{The rule is } a + b = \left(\frac{a+b}{2}\right)^2$$
$$2+4 = \left(\frac{2+4}{2}\right)^2 = 9$$
$$\text{So, } 13+15 = \left(\frac{13+15}{2}\right)^2 = 196$$
Hence, option (A) is correct.