

Input-Output

INTRODUCTION

Problems related to input-output are frequently asked questions in various graduate level competitive examinations. They are not very tough stuff but take a good deal of time to be solved or sometimes students do not take attempt to solve them because of time consuming impression of such type of questions. But proper understanding of the subject makes you believe that such problems are not as tough and time consuming as they seem.

CONCEPT OF INPUT-OUTPUT PROBLEMS

In such problems:

- It is imagined that there is some kind of computer/word processing machine.
- An input is given to the computer/word processing machine
- The computer/word processing machine performs repeated operations as per a certain pattern to give different output in different steps.

Let us see the following input given to a word processing machine.

Input: Ram Shyam Mango Apple Ravi Orange

Now, just suppose that the word processing machine starts operation with a pre-fixed pattern in which first two words interchange their places while rest of the words remain at the same places then, we get

1st output:

Shyam Ram Mango Apple Ravi Orange

If machine does not stop and goes on performing further operations in the same manner for rest of the words then,

2nd output:

Shyam Ram Apple Mango Ravi Orange

3rd output:

Shyam Ram Apple Mango Orange Ravi

To get it more clearly just see the following presentation:

Input:

Ram	Shyam	Mango	Apple	Ravi	Orange
↙	↘	↓	↓	↓	↓

1st output:

Shyam	Ram	Mango	Apple	Ravi	Orange
↓	↓	↙	↘	↓	↓

2nd output:

Shyam	Ram	Apple	Mango	Ravi	Orange
↓	↓	↓	↓	↙	↘
Shyam	Ram	Apple	Mango	Orange	Ravi

3rd output:

It is clear from the presentation given above that for the 1st output, 1st two words (Ram and Shyam) interchange their places; for the 2nd output the next two words (Mango and Apple) interchange their places; for the 3rd output the last two words of the given input (Ravi and Orange) interchange their positions.

In fact, the machine will continue to perform further operations till it is stopped. Suppose the machine stops after 6 operations. Then three more outputs will be produced by it.

Now, we can start watching from 3rd output that how machine gives the another three outputs(4th, 5th and 6th). Let us see :,

3rd output:

Shyam	Ram	Apple	Mango	Orange	Ravi
↓	↓	↙	↘	↓	↓

4th output:

Ram	Shyam	Apple	Mango	Orange	Ravi
↓	↓	↙	↘	↓	↓

5th output:

Ram	Shyam	Mango	Apple	Orange	Ravi
↓	↓	↓	↓	↙	↘
Ram	Shyam	Mango	Apple	Ravi	Orange

6th output:

Point to be noted that final output will be that output where the machine stops. Here, the machine stops after producing 6th output. Therefore, here, 6th output will be last or final output.

In the above example, we get clear picture of a problem that is solved by shifting of words as per a fixed pattern. Here 1st two words mutually shift their places in operation first; the next two words mutually shift their places in operation 2nd, last two words mutually shift their places in operation 3rd and further operation goes on in the same manner. Thus, we come to the conclusion that this is the type of problem which can be called as “**Problem of Shifting**”.

Now, let us go ahead with the word processing machine that performs a different type of operation in which machine arranges the words given in the input as per the arrangement order of those words in the dictionary. In another words, the words given in the input, will be arranged in such a way that the words coming 1st in the dictionary will be put 1st in the 1st output pushing the remaining words rightwards without changing their order; the

word coming 2nd in the dictionary will be put at 2nd place in the 2nd output pushing the remaining words rightwards without changing their order; the word coming third will be put at third place in the 3rd output pushing the remaining words to the right without changing their order. We go on in the same manner to get further outputs till the machine stops. Suppose we have the following input.

Input: Left right above height dark sight. We know that the words given in the dictionary are arranged in alphabetical order. In the given input 'above' is the word that will come 1st in the dictionary. Then,

1st Output: above left right height dark sight. After the word 'above' the next word coming in the dictionary is 'dark'. Therefore, 'dark' will be put at 2nd place in the 2nd output pushing the remaining words left, 'right' 'height' & 'sight' towards right. Then,

2nd Output: above dark left right height sight. For the 3rd output the machine will pick up the word that comes after 'above' & 'dark' in the dictionary. Such word is 'height' and thus, machine put this word at the 3rd place in the 3rd output pushing the words 'left' 'right' & 'sight' rightwards. Therefore,

3rd Output: above dark height left right sight. After 3rd output, we see that the machine does not need to perform further operations as all the words written in the 3rd output have been arranged in alphabetical order. Therefore, machine stops here producing 3rd output as the final step.

In fact this example gives a clean picture of arrangement of words in alphabetical orders. But point to be noted that same kind of arrangement can be seen when numbers are given in place of words. In such cases, the numbers given in the input get arranged in increasing or decreasing order through the operations performed by a number processing machine. Thus, we come to the conclusion that this is the type of problem that can be classified as "**Problem of Arrangement**".

Important note

Shifting operation to be performed by a machine goes on endlessly but operation of arrangement ends as soon as the intended result is achieved.

Step I:	Rmsh	st	Mng	Tng
Step II:	ae	eea	ao	ao
Step III:	mesh	exta	ngo	ngo
Step IV:	Rame	see	Man	Tan

And so on.....

Have you noticed here something? Here the machine performs some random operations and the explanations are as follows:

Step I: Vowels from all words of input disappear.

Step II: Consonants from all words of input disappear.

Step III: 1st two letters from all words of input disappear.

Step IV: Last two letters from all words of input disappear.

After discussing this kind of input-output problem we can conclude:

- For every step machine follows a different rule.
- This is not a problem of shifting or arrangement or mathematics.

Then, what kind of problem is it? In fact, this is the input-output problem that can be put under the category of: **Miscellaneous**.

Note.

The above discussed problem is words/letters based. But this kind of miscellaneous problem can be digits/numbers based also.

Now, we have four types of problems:

- Problems of shifting
- Problems of arrangement
- Problems of mathematical operation
- Miscellaneous.

Now, this is the time to discuss all the four types of input-output problems separately and in more explanatory way.

Step III: copy pencil ruber book pen stop.

Step IV: book pencil ruber copy pen stop.

Step V: copy pencil ruber book pen stop.

Suppose that after the step V the machine stops and thus, step V is the final output. Now, the question can be asked in the following format:

Q.1 What will be the 3rd step of the following input?

Input : One six ten four nine two

Q.2 If the 4th step of an input is:

"alone, tone known shown phone tone". Find out the step V

Q.3 Suppose step III of an input is :

Name Shame Game Fame Dam Ram ". Find the input.

As we know that this is the Problem of Shifting and as per the rule it is clear that 1st and 4th words mutually interchange their place in every step as follows:

from input to step I: book and copy mutually change their places.

from step I to step II: copy and book mutually change their places.

from step II to step III: book and copy mutually change their places.

from step III to step IV: copy and book mutually change their places.

from step IV to step V: book and copy mutually change their places.

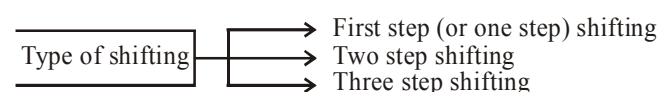
Now, we can do the solution:

Solution 1 : (As per the rule 'one' and 'four' mutually change their places).

Input:	one	six	ten	four	nine	two.
Step I:	four	six	ten	one	nine	two.
Step II:	one	six	ten	four	nine	two.
Step III:	four	six	ten	one	nine	two.

PROBLEM OF SHIFTING

We know that in such type of problem a word/number processing machine generate output through shifting. Shifting does mean an operation in which words or numbers of a given input give outputs in different steps through shifting their place to different place as per a fixed pattern.



(a) First Step Shifting:

In such type of shifting, only a single operation goes on repeatedly. For example, just see the following.

Input: Ravi works Hari talks
Step I: works Ravi Hari talks
Step II: Ravi works Hari talks
Step III: works Ravi Hari talks.

Have you noticed what happens here? Here, the same operation takes place again and again. It does mean that in every output only two words (Ravi & works) takes participation in shifting. In step I Ravi and works mutually interchange their place; in step II Works and Ravi mutually interchange their place; in step III again Ravi and works mutually interchange their place and the same operation will go on repeatedly, if we go ahead for further steps like step IV, step V, step VI, etc.

After having a concept of first step shifting let us solve a problem when the word processing machine gives outputs as follows:

Input: book pencil ruber copy pen stop
Step I: copy pencil ruber book pen stop
Step II: book pencil ruber copy pen stop

Solution 2

Step IV: alone tone known shown phonezone

Here as per the given pattern 'alone' and 'shown' mutually change their place in every step.

Thus,

Step V: shown tone known alone phone zone

Solution 3 Given that

Step III: Name Shame Game Fame Dam Ram

As per the given pattern 'Name' & 'Fame' mutually interchange their places then,

Step II: Fame Shame Game Name Dam Ram

Step I: Name Shame Game Fame Dam Ram

Input: Fame Shame Game Name Dam Ram

The examples so far discussed in first step shifting are very simple as only two words participate in every operations. But the problems related to first step shifting may be more complex when more than two words participate in each operation. Therefore, to identify such type of shifting the students must remember particular rule that is given below :

Identification rule:

0 to 1 = 1 to 2 = 2 to 3 = 3 to 4 =

where,

0 = Input

1 = Step I

2 = Step II

3 = Step III

4 = Step IV

and so on

Further. 0 to 1 = changes from input to step I.

1 to 2 = changes in going from step I to step II.

2 to 3 = changes in going from step II to step III.

3 to 4 = changes in going from step III to step IV and so on.

If we go through the examples discussed so far under this category, we find that they follow this rule. Let us discuss another example that is more complex than those discussed so far. Just see

Input: Flight Sight Night White Fight Right.
Step I: Right Sight White Night Fight Flight.
Step II: Flight Sight Night White Fight Right.
Step III: Right Sight White Night Fight Flight.
Step IV: Flight Sight Night White Fight Right.
Step V: Right Sight White Night Fight Flight.

What we see here? Here we, see that in every operation 'Flight and Right' interchange their places and 'Night and White' interchange their places. Thus, the change in every further step is as same as the change take place in the previous step.

It does mean 0 to 1 = 1 to 2 = 2 to 3 = 3 to 4 = 4 to 5.

Note:

It is important to note that in first step shifting all even steps are equal and all odd steps are equal. Apart from this, all even steps are equal to input. In another words, "Input = Step II = Step IV = Step VI....and so on and "Step I = Step III = Step V....and so on.

(b) Two Step Shifting:

In such type of shifting two operations take place.

Let us see the following example:

Input: Ram Walks Hari Talks.
Step I: Walks Ram Hari Talks.
Step II: Walks Ram Talks Hari.
Step III: Ram Walks Talks Hari.
Step IV: Ram Walks Hari Talks.

Here, while going from input to step I only two words (Ram and Walks) interchange their places learning the remaining two words (Hari and Talks) at the same position they have occupied in the input and while going from step 1 to step II only the last two words (Hari and Talks) interchange their places learning the remaining two words (Walks and Ram) at the same position they have occupied in the step I. These two operations are being performed alternately in further steps. This does mean that the change in going from input to step I is different from the change in going from step I to step II. But the change from input to step I is the same as the change from step II to step III while the change from step I to step II is same as the change from step III to step IV.

After having the concept of two step shifting, let us solve a problem when a word processing machine gives outputs as follows:

Input: come what may say day gone
Step I: gone what may say day come
Step II: gone day may say what come
Step III: come day may say what gone
Step IV: come what may say day gone
Step V: gone what may say day come

Suppose that after the step V the machine stops and thus step V is the last and final input given by the machine. Now, the question can be asked in the following format.

Q.1 What will be the 3rd step of the following input?

Input: No Go Show Toe Know So

Q.2 If step IV of an input is as follows:

Step IV: Line Shine Nine Mine Wine Dine

What step will be the following arrangement?

Arrangement: Dine Shine Nine Mine Wine Line

Q.3 If the machine goes up to step VII which is as follows:

Step VII: Cow Now Dog Rat Lion Tiger

Find out the III step.

As we know that this is a problem of two step shifting, and as per the rule it is clear that in 1st step first and last word (come and gone) interchange their places learning the other words at the same positions they have occupied in the input. In the step II the other two words (what and day) interchange their places learning the remaining words at the same positions they have occupied in the step I. These two operations are being performed alternately as given below:

From input to step I: come and gone interchange places.

From step I to step II: what and dry interchange places.

From step II to step III: gone and come interchange places.

From step III to step IV: day and what interchange places

From step IV to step V: come and gone interchange places.

Now, we can do the solutions:

Solution 1

Input: No Go Show Toe Know So

Step I: So Go Show Toe Know No

Step II: So Know Show Toe Go No

Step III: No Know Show Toe Go So

Solution 2

As per the pattern the 1st and last word of step IV (come and gone) interchange their places in step I and step V learning the remaining words at the same positions they have occupied in step IV. This makes step I and step V equal. Further the given pattern also makes step IV equal to input. Therefore, applying the same pattern the given step IV ("Line Shine Nine Mine Wine Dine") will be the input and the first word 'Line' and the last word 'Dine' of this input interchange their places to give outputs as Step I = Step V. Thus, the given arrangement ("Dine Shine Nine Mine Wine Line") is step I or step V.

Solution 3

Here, the machine follows the pattern given below:

Input = Step IV

Step I = Step V

Step II = Step VI

Step III = Step VII

Step IV = Step VIII

Step V = Step IX

and so on....

Therefore, following this rule given step VII ("Cow Now Dog Rat Lion Tiger") will be equal to step III and this

step III: Cow Now Dog Rat Lion Tiger" is your answer.

The examples discussed so far, related to two-step shifting, are simple ones. But more complex problems related to this type of shifting may appear before you. Therefore, to identify such type of problems a particular rule is given below:

Identification rule:

(a) 0 to 1 = 2 to 3 = 4 to 5and

(b) 1 to 2 = 3 to 4 = 5 to 6.....

where

0 = Input

1 = Step I

2 = Step II

3 = Step III

4 = Step IV

5 = Step V

and so on.

Further, 0 to 1 = changes in going from input to step I.

1 to 2 = changes in going from step I to step II.

2 to 3 = changes in going from step II to step III.

3 to 4 = changes in going from step III to step IV.

4 to 5 = changes in going from step IV to step V.

5 to 6 = changes in going from step V to step VI.

and so on.

If we go through the examples discussed so far under this category we find that they follow this rule. Let us see another example that is more complex than those discussed so far. Just see the following:

Input: catch an fire police team and sea

Step I: sea an police fire team and catch

Step II: an police catch team fire sea and

Step III: and police team catch fire sea an

Step IV: police team an fire catch and sea.

PROBLEMS OF ARRANGEMENT

In the earlier part of this chapter (input-output chapter), we have already discussed what kind of problems are called problems of arrangement. Let us discuss it further:

WHAT ARE THE POSSIBLE WAYS OF ARRANGEMENTS?

1. Word Arrangement from Left Side:

Let us see the following example:

Input: mango tango orange banana pear

Step I: banana mango tango orange pear

Step II: banana mango orange tango pear

Step III: banana mango orange pear tango

Here, we start arrangement from the word that comes 1st in the dictionary; then comes the word coming 2nd in the dictionary; then comes the word coming 3rd in the dictionary and so on. In this case, the arrangement start from left side. This is the reason in step I banana comes 1st as it comes 1st in the dictionary. In the 2nd step orange

comes at 3rd place because after the arrangement of step I the next word coming in the dictionary is mango but it get arranged automatically and hence there is no need to arrange it in step II. This is the reason after arranging banana in step I, we directly come to the word orange (coming 3rd in the dictionary) in step II. In the 3rd step we arrange the word 'pear' (coming 4th in the dictionary) and the word tango get arranged automatically.

Let us see the another format given below:

Input: mango tango orange banana pear
Step I: tango mango orange banana pear
Step II: tango pear mango orange banana
Step III: tango pear orange mango banana

What have you noticed here? In fact, here the arrangement has been done in reverse order. In other words, the last word coming in the dictionary comes 1st from left in the step I. In step II, the 2nd last word coming in the dictionary comes 2nd from left and the arrangement goes on further in the same manner.

2. Word Arrangement from Right:

Just see the following example :

Input: Name Fame Game Shame Jam
Step I: Name Game Shame Jam Fame
Step II: Name Shame Game Fame
Step III: Shame Name Jam Game Fame

In this case, the arrangement starts from right side. The word coming 1st in the dictionary comes at the 1st position from right. At the 2nd position from right comes the word coming 2nd in the dictionary and the process goes on till the arrangement gets completed. In the above given example, 'Fame' is the 1st word coming in the dictionary and hence it comes at the 1st position from right in the step I. In the step II the 2nd word coming in the dictionary (Game) comes at the 2nd position from right. Point to be noted that the word coming third in the dictionary will come at the 3rd position from right and this word is 'Jam'. But 'Jam' automatically get arranged as per the given pattern when we arrange the word 'Game' in II step. This is the reason why we don't arrange 'Jam' in the third step and jump directly to arrange the word. 'Name' that comes 4th in the dictionary. 'Name' occupies 4th position from right and the word 'Shame' automatically get arranged in the 3rd step. Hence, the word 'Shame' does not need to get arranged.

Let us see another format given below:

Input: Name Fame Game Shame Jam
Step I: Name Fame Game Jam Shame
Step II: Fame Game Jam Name Shame

What you have noticed here? In this case, the arrangement does start from right side but here the last word coming in the dictionary comes 1st from right and in this case, 'Shame' is the such word which comes last in the step I pushing rest of the word leftward. In step II the word coming 2nd last in the dictionary occupies the 2nd position from right pushing the words 'Fame', 'Game' and 'Jam' to the left. The rest of the words (Fame, Game and Jam) automatically get arranged in the step II. Here, there is no need to go for further steps.

3. Word Arrangement from the Left-Right Alternate:

Let us see the format given below:

Input: Sachin is a great cricket player
Step I: a Sachin is great cricket player
Step II: a is great cricket player Sachin
Step III: a cricket is great player Sachin
Step IV: a cricket great is player Sachin

Here, the arrangement is made by putting the first word at 1st place, then alphabetically last word at last place, then alphabetically second word at second place from left and the further arrangements goes on in the same manner. In the other words, are positioned from the left and from the right alternately. In the step I the word coming 1st in the dictionary is 'a' and it takes 1st position from left. In the step II, the last word coming alphabetically is Sachin and it takes last position (1st from right). In step III, the word coming 2nd in dictionary is 'cricket' that comes at 2nd position from left. In step IV, the word coming 3rd last in the dictionary takes the 3rd position from right. After the step IV, all the words get arranged in alphabetical order. Point to be noted that after step IV, there is no need to arrange the word 'great' as it get arranged automatically in step IV.

Let us see the another format given below:

Input: Sachin is a great cricket player
Step I: is a great cricket player Sachin
Step II: a is great cricket player Sachin
Step III: a is cricket great player Sachin
Step IV: a cricket is great player Sachin

Have you noticed here something? Here, the arrangement starts from right side. In step I, the last word (Sachin) that comes last alphabetically takes the last (1st from right) position. In step II, the word coming 1st alphabetically (the word is 'a') comes at the 1st position from left. As the 2nd last word (player) alphabetically has already taken 2nd position from right, the 3rd last word (great) alphabetically will occupy the third position from right in step III. In the 4th step, the word (cricket) coming 2nd alphabetically comes at the 2nd position from left and the word (is) coming 3rd alphabetically get arranged automatically occupying the 3rd position from left.

4. Arrangement in Increasing or Decreasing Order:

Just have a look at the arrangement format given below:

Input: 25 17 18 58 100 35
Step I: 17 25 18 58 100 35
Step II: 17 18 25 58 100 35
Step III: 17 18 25 35 58 100

This arrangement gives a clear idea of arrangement of numbers in increasing order. In step I, the smallest number (17) comes at the 1st position from left pushing the remaining to the right. In step II, the 2nd smallest number (18) comes at 2nd position from left pushing the remaining number to the right. In step III, the 4th smallest number (35) takes 4th position from left and the other two numbers 58 and 100 get arranged automatically.

The same arrangement take place in the following format also:

Input:	25	17	18	58	100	35
Step I:	25	17	18	58	35	100
Step II:	25	17	18	35	58	100
Step III:	17	18	25	35	58	100

This format gives the clear picture of arrangement in which the arrangement start from right side. In step I, the largest number comes at the 1st position from right; in 2nd step the 2nd largest number comes at the 2nd position from right; in the step III, there is no need to arrange the 3rd largest number (35) as it get arranged automatically in step II. Hence in 3rd step 4th largest number (25) comes at the 4th position from right and the other two number (17 and 18) do not to get arranged in further steps as they automatically get arranged in step III.

Now, let us see decreasing order arrangement:

Input:	25	17	18	58	100	35
Step I:	100	25	17	18	58	35
Step II:	100	58	25	17	18	35
Step III:	100	58	35	25	17	18
Step IV:	100	58	35	25	18	17

The same arrangement can take place from right side (or in the reverse order) as follow:

Input:	25	17	18	58	100	35
Step I:	25	18	58	100	35	17
Step II:	25	58	100	35	18	17
Step III:	58	100	35	25	18	17
Step IV:	100	58	35	25	18	17

5. Number Arrangement from Left-Right Alternate:

Like words left-right alternate arrangement, number arrangement also takes place. The process of this arrangement is exactly the same as the arrangement takes place in case of words. just see the following cases:

Input:	100	125	26	10	15	35
Step I:	10	100	125	26	15	35
Step II:	10	100	26	15	35	125
Step III:	10	15	100	26	35	125
Step IV:	10	15	26	35	100	125

Here, the smallest number (10) takes 1st position from left in step I. In step II the largest number takes the last (1st from right) position. Again in step III the 2nd smallest number (15) comes at the 2nd position from left. In the step IV, the 2nd largest number (100) comes at the 2nd position from right and the remaining number (26 and 35) get arranged automatically.

Case II :

Input:	100	125	26	10	15	35
Step I:	100	26	10	15	35	125
Step II:	10	100	26	15	35	125
Step III:	10	26	15	35	100	125
Step IV:	10	15	26	35	100	125

In case II, the arrangements take place in the same way as the arrangements take place in case I. But the difference here is that case I is a left-right arrangement and case II is the right-left arrangement. In case II, the arrangement starts with the largest number (125) coming at the 1st position from right and this is step I. In step II, the smallest number (10) comes at the 1st position from left. In step III the 2nd largest number (100) comes at the 2nd position from right. In step III, the third largest number (35) automatically comes at the 3rd position from right. In 4th step, the 2nd smallest number (15) comes at the 2nd position from left and 26 get arranged automatically coming at 3rd position from left.

Note: Left-right (or right-left) arrangement of numbers also take place in the same manner when numbers are arranged in decreasing order.

6. Arrangement of Words and Numbers Simultaneously:

Just see the following outputs produced by a word and number machine.

Case I

Input:	50	32	Vandana	Perna	Aradhna	100
Step I:	32	50	Vandana	Perna	Aradhna	100
Step II:	32	Aradhna	50	Vandana	Perna	100
Step III:	32	Aradhna	50	Perna	Vandana	100
Step IV:	32	Aradhna	50	Perna	100	Vandana

In such case, numbers and words get arranged alternately. In step I, the smallest number (32) comes at the 1st position from left pushing the remaining members of input towards right. In the step II, the word coming 1st alphabetically (that is the word 'Aradhna') takes the 2nd position from left pushing the remaining member rightward. Point to be noted that the 2nd smallest number automatically comes at the third position from left while arranging the word 'Aradhna' and hence, there is no need to arrange the 2nd smallest number '50'. This is the reason that in step III, the word (Perna) coming 2nd alphabetically comes at the 4th position from left pushing the other members to the right. In step IV, the largest number (100) occupies the 5th position from left and the word (Vandana) coming last alphabetically comes at last position automatically finishing the complete arrangement.

Let us see some other cases of this type:

Case II:

Input:	50	32	Vandana	Perna	Aradhna	100
Step I:	100	50	32	Vandana	Perna	Aradhna
Step II:	100	Vandana	50	32	Perna	Aradhna
Step III:	100	Vandana	50	Perna	32	Aradhan

In this case, largest number and the word coming last alphabetically get arranged alternately. Then the 2nd longest number and the word coming 2nd last alphabetically get arranged alternately and the process goes on till the arrangements of all the numbers and words get completed. In this case arrangement completes in step III.

Case III:

Input: 50 32 Vandana Prerna Aradhna 100
Step I: Aradhna 50 32 Vandana Prerna 100
Step II: Aradhna 32 50 Vandana Prerna 100
Step III: Aradhna 32 Prerna 50 Vandana 100

In this case, arrangement starts with the word coming 1st alphabetically and such word is 'Aradhna' that comes at the 1st position from left in step I. In step II, the smallest number (32) comes at the 2nd position from left. Then, in step III, the word coming 2nd alphabetically comes at the 3rd position from left and all the other members get arranged automatically.

Case IV:

Input: 50 32 Vandana Prerna Aradhna 100
Step I: Vandana 50 32 Prerna Aradhna 100
Step II: Vandana 100 50 32 Prerna Aradhna
Step III: Vandana 100 Prerna 50 32 Aradhna
Step IV: Vandana 100 Prerna 50 Aradhna 32

In this case, word coming last alphabetically comes 1st from left in step I and such word is 'Vandana'. In step II, the largest number (100) comes at the 2nd position from left. In step III, the word coming 2nd last alphabetically occupies the 3rd position from left, and such word is 'Prerna'. As the 2nd largest number (50) automatically get arranged as per the pattern going on and hence this is not needed to arranged in step IV. This is the reason that in step VI, the word coming 1st alphabetically comes at the 5th position from left and such word is 'Aradhna'. The smallest number (32) get arranged automatically coming at the last position from left in step IV. Thus, it is clear that in this case the word coming 1st alphabetically and the greatest number get arranged alternately in 1st two steps; then 2nd last word alphabetically and 2nd largest number get arranged alternately finishing the whole arrangement in step IV.

Case V:

Input: 50 32 Vandana Prerna Aradhna 100
Step I: 32 50 Vandana Prerna Aradhna 100
Step II: 32 Vandana 50 Prerna Aradhna 100
Step III: 32 Vandana 50 Prerna 100 Aradhna

In this case, the smallest number comes at the 1st position from left in step I and such number is 32. In step II, the word (Vandana) coming last alphabetically occupies the 2nd place from left. In the 2nd step the 2nd smallest number (50) takes the 3rd position from left automatically and also the word coming 2nd last alphabetically takes the 4th position from left automatically. Hence, there is no need to arrange '50' and 'Prerna'. In the III step the largest number (100) occupies the 5th position from left completing the whole arrangement.

Case VI:

Input: 50 32 Vandana Prerna Aradhna 100
Step I: 100 50 32 Vandana Prerna Aradhna
Step II: 100 Aradhna 50 32 Vandana Prerna
Step III: 100 Aradhna 50 Prerna 32 Vandana

In this case, the logic is that the greatest number (100) comes at the 1st position from left in step I. In step II the word coming 1st

alphabetically takes the 2nd position from left and the 2nd largest number (50) gets arranged automatically. Hence, in step III, we directly arrange the word coming 2nd last alphabetically (that word is 'Prerna') occupies the 4th position from left and the other two members (32 and 'Vandana') get arranged automatically finishing the whole arrangement.

7. Arrangement Based on the Number of Letters in Words:

Just have a look at the following patterns:

Case I :

Input: let pattern love fried be mature
Step I: be let pattern love fried mature
Step II: be let love pattern fried mature
Step III: be let love fried pattern mature
Step IV: be let love fried mature pattern

Here, the words get arranged as per increasing number of letters. In other words, the word having least number of letters comes 1st from left in step I and such word is 'be'. The word 'let' is bigger than 'be' and smaller than other words letterwise and hence, it takes 2nd position from left but it gets arranged automatically when the word 'be' is arranged in step I. In 2nd step, the word 'love' comes at the 3rd position from left as it is bigger than word 'let' letterwise. In step III, the letterwise bigger word (fried) than love comes at the fourth position from left. Similarly, mature comes at the 5th position from left and pattern comes at the last position automatically while arranging the word 'mature'.

Case II :

Input: let pattern love fried be mature
Step I: pattern let love fried be mature
Step II: pattern mature let love fried be
Step III: pattern mature fried let love be
Step IV: pattern mature fried love let be

In this case, the words get arranged in decreasing order in terms of letters. In other words, the word having the largest number of letters comes 1st from left; then comes the word having 2nd largest number of letters; then comes the word having 3rd largest number of letters and the process goes on till the word having the least number of letters occupies the last position from left.

Case III:

Input: let pattern gate a set be hope
Step I: a let pattern gate set be hope
Step II: a be let pattern gate set hope
Step III: a be let set pattern gate hope
Step IV: a be let set gate pattern hope
Step V: a be let set gate hope pattern

Have you noticed something here? Here, the words get arranged in increasing order of letters. But when it comes to the case of two or more words having equal number of letters the priority is given alphabetically. It does mean that the word coming 1st as per the alphabet will be put before the word coming 2nd. Similarly, the word coming 2nd alphabetically will be put before the word coming third. This is the reason why 'let' has been put before 'set' and 'gate' has been put before 'hope'.

Case IV:

Input: let pattern gate a set be hope
Step I: pattern let gate a set be hope
Step II: pattern hope let gate a set be
Step III: pattern hope gate let a set be
Step IV: pattern hope gate set let a be
Step V: pattern hope gate set let be a

In this case, the words get arranged in decreasing order of letters. But when it comes to the case of two or more words having equal number of letters the priority is given to the word that comes later alphabetically. It does mean that the word coming 1st alphabetically will be put after the word coming 2nd and the word coming 2nd will be put after the word coming 3rd. This is the reason why 'hope' has been put before 'gate' and 'set' has been put before 'let'.

Important Note: The case of arrangement discussed so far are the cases of push. In all the cases a new word jumps from its place in every step, occupies its new and due place and gives the remaining words and push either towards left or right as per the requirement of the pattern. But in some cases of arrangement interchange does take place and that format is given below:

8. Arrangement with Interchange:

Let us see the following format of arrangement :

Input: the most beautiful girl is Vandana
Step I: beautiful most the girl is Vandana
Step II: beautiful girl the most is Vandana
Step III: beautiful girl is most the Vandana

In this case, the word (beautiful) coming 1st in alphabetical order comes at the 1st position from left interchanging its place with the word 'the' and this is step I. In step II, the word (girl) coming 2nd in alphabetical order occupies the 2nd position from left interchanging with the word 'most'. In step III, the word coming 3rd (is) comes at the third position from left interchanging with the word 'the' and finishing the complete arrangement in alphabetical order.

This kind of arrangement can also be made in reverse order as follows:

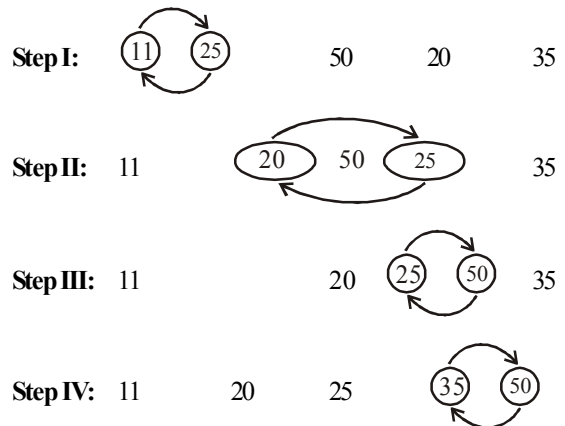
Input : the most beautiful girl is Vandana
Step I: Vandana most beautiful girl is the
Step II: Vandana the beautiful girl is most
Step III: Vandana the most girl is beautiful
Step IV: Vandana the most is girl beautiful

Here, the words take 4 steps to get arranged. In step I, the word (Vandana) coming last alphabetically comes at the 1st position from left interchanging its place with the word 'the'. In step II, the word (the) coming 2nd last alphabetically takes 2nd place from left interchanging its place with the word 'most'. In step III, the word (most) coming last alphabetically interchange its place with the word 'beautiful' and comes at the 3rd position from left. In step IV, the word (is) coming fourth last alphabetically comes at the 4th position interchanging its place with the word 'girl' and finishing the complete arrangement.

This type of cases can also be seen in number arrangements and in the arrangements of numbers and words simultaneously. The examples of these type of arrangements are given below:

EXAMPLE 1. (Increasing order number arrangement)

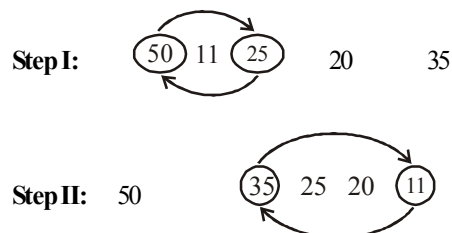
Input: 25 11 50 20 35
Step I: 11 25 50 20 35
Step II: 11 20 50 25 35
Step III: 11 20 25 50 35
Step IV: 11 20 25 35 50

Presentation :

The presentation gives you the clear idea of how interchange takes place in every step.

EXAMPLE 2. (Decreasing order number arrangement)

Input: 25 11 50 20 35
Step I: 50 11 25 20 35
Step II: 50 35 25 20 11

Presentation:**Points to be Remember**

1. First of all, observe the given input line of words or numbers and the last step of rearrangement, so that candidate may get an idea about the changes effected in various steps of rearrangement.
2. In order to know what changes have been made in each step, observe two consecutive steps carefully.
3. Now, correlate the input, the last step and anyone of the middle steps. This will enable you to identify the rule of arrangement.
4. In shifting problems, it is possible to determine the previous/earlier steps including input. We can proceed/move backward or in reverse direction in shifting problems.
5. In shifting problems for convenience, we assign numeric value to given words.

EXERCISE

Directions (Qs. 1-5): Study the following information to answer the given questions:

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

Input: wind packet 19 7 back 12 task 34

Step I: 34 wind packet 19 7 back 12 task

Step II: 34 back wind packet 19 7 12 task

Step III: 34 back 19 wind packet 7 12 task

Step IV: 34 back 19 packet wind 7 12 task

Step V: 34 back 19 packet 12 wind 7 task

Step VI: 34 back 19 packet 12 task wind 7

Step VII: 34 back 19 packet 12 task 7 wind and Step VII is the last step.

As per the rules followed in the above steps, find out in the given questions the appropriate step for the given input.

- Input:** 9 13 about tariff 24 call 29 even.
Which of the following will be step IV?
(a) 29 about 24 9 13 tariff call even
(b) 29 about 24 call 9 13 tariff even
(c) 29 about 24 call 13 9 tariff even
(d) 29 about 24 call 13 even 9 tariff
(e) Cannot be determined
- If Step II of an input is "37 desk 34 garden 5 father victory 17", which of the following steps will be the last step?
(a) Step III (b) Step V
(c) Step IV (d) Step VI
(e) None of these
- If Step I of an input is
59 bead tenure father 38 11 ultimate 24
Which of the following will be Step III?
(a) 59 bead 38 tenure 11 father ultimate 24
(b) 59 bead 38 11 tenure father ultimate 24
(c) 59 bead 38 tenure father 11 ultimate 24
(d) 59 bead 38 father tenure 11 ultimate 24
(e) None of these
- If the last step of an input is 41 cost 32 over 28 project 17 violet which of the following must be the input?
(a) project 32 cost over 17 41 violet 28
(b) project 32 cost over 41 violet 17 28
(c) project cost 32 over 41 17 violet 28
(d) Cannot be determined
(e) None of these
- Which of the following will be the Step III of the following input?
Input: 24 12 entry sand butter 51 32 carry
(a) 51 butter 32 24 12 entry sand carry
(b) 51 butter 32 carry 24 12 entry sand
(c) 51 butter 32 carry 24 entry 12 sand
(d) 51 24 12 entry sand butter 32 carry
(e) None of these

Directions (Qs. 6-10): Study the following information carefully and answer the given questions:

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

Input: 93 come home over 32 47 now 26

Step I: over 93 come home 32 47 now 26

Step II: over 26 93 come home 32 47 now

Step III: over 26 now 93 come home 32 47

Step IV: over 26 now 32 93 come home 47

Step V: over 26 now 32 home 93 come 47

Step VI: over 26 now 32 home 47 93 come

Step VII: over 26 now 32 home 47 come 93 and Step VII is the last step.

As per the rules followed in the above steps, find out in each of the following questions the appropriate step.

- Step II of an input is:
sky 20 90 37 begin again 11 home
Which of the following is definitely the input?
(a) 20 90 37 begin again 11 home sky
(b) sky 90 37 20 begin again 11 home
(c) 90 20 37 begin sky again 11 home
(d) Cannot be determined
(e) None of these
- Step III of an input is:
take 17 mind game 29 73 18 loud
How many more steps are required to complete the sequence?
(a) Two (b) Three
(c) Four (d) Five
(e) None of these
- Input:** by now 51 32 for 91 20 me
Which of the following steps will be the last?
(a) III (b) IV
(c) V (d) VI
(e) None of these
- Input:** fight for all 39 62 25 today 19
Which of the following will be step IV?
(a) today 25 for 39 fight all 62 19
(b) today 19 for 25 fight all 39 62
(c) today 19 for 25 fight 39 all 62
(d) Cannot be determined
(e) None of these
- Input:** queen mary 79 62 17 20 green west
Which of the following steps will be the last but one ?
(a) VI (b) VII
(c) V (d) VIII
(e) None of these

Directions (Qs. 11-17) : Study the following information to answer the given questions. A number arrangement machine when given an input of numbers, rearranges them following a particular rule in each step. The following is an illustration of input and steps of rearrangement.

Input	25	280	345	36	93	147	550
Step I	550	280	345	36	93	147	25
Step II	550	345	280	36	93	147	25
Step III	550	345	280	147	93	36	25

This is the final arrangement and Step III is the last step for this input.

11. If '842 485 68 358 236 123 93' is the second step of an input, which of the following steps will be '842 485 358 236 123 68 93'?
 (a) Fourth (b) Fifth
 (c) Sixth (d) Can't be determined
 (e) None of these
12. How many steps will be required to get the final output from the following input?
Input : 78 293 585 740 64 132 26
 (a) 4 (b) 5
 (c) 3 (d) 6
 (e) None of these
13. What will be the third step for the following input?
Input : 113 18 48 225 462 175 288
 (a) 462 288 48 225 113 175 18
 (b) 462 288 225 175 113 48 18
 (c) 462 225 288 48 113 175 18
 (d) 462 288 225 48 113 175 18
 (e) None of these
14. If following is the first step for an input, what will be the fourth step?
Step I : 498 175 292 96 79 387 158
 (a) 498 387 292 175 158 79 96
 (b) 498 387 292 175 96 158 79
 (c) 498 387 292 175 158 96 79
 (d) 498 387 292 175 79 158 96
 (e) None of these
15. Following is the step II for an input. What will be the first step for the input?
Step II : 595 438 28 142 38 65 289
 (a) 595 28 438 142 38 65 289
 (b) 595 438 142 28 38 65 289
 (c) 595 28 142 438 38 65 289
 (d) Can't be determined
 (e) None of these
16. What will be the second step for the following input?
Input : 158 294 22 89 142 385 463
 (a) 463 385 294 22 89 142 158
 (b) 463 385 89 22 142 294 158
 (c) 463 385 22 89 142 158 294
 (d) 463 385 22 142 89 158 294
 (e) None of these
17. Which of the following is the last step for the following input?
Input : 145 227 900 49 116 243 356
 (a) 900 356 243 227 49 145 116
 (b) 900 356 243 227 145 116 49
 (c) 900 356 227 243 145 116 49
 (d) 900 356 243 227 116 145 49
 (e) None of these

Directions (Qs. 18-22) : Study the following information carefully and answer the given questions:

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

Input : sky forward 17 over 95 23 come 40

Step I : come sky forward 17 over 95 23 40

Step II : come 95 sky forward 17 over 23 40

Step III : come 95 forward sky 17 over 23 40

Step IV : come 95 forward 40 sky 17 over 23

Step V : come 95 forward 40 over sky 17 23

Step VI : come 95 forward 40 over 23 sky 17

Step VI is the last step of the rearrangement of the above input.

As per the rules followed in the above steps, answer the following questions.

18. **Input :** machine hire for 19 against 85 21 46
 Which of the following will be step II?
 (a) against 85 hire machine for 19 21 46
 (b) against 85 machine 19 hire for 21 46
 (c) against 85 machine hire for 19 21 46
 (d) Cannot be determined
 (e) None of these
19. **Input :** box at 20 53 62 gift now 32
 Which of the following is step IV?
 (a) at 62 box 53 gift 32 20 now
 (b) at 62 box 53 gift 32 now 20
 (c) at 62 box 53 gift 20 now 32
 (d) Cannot be determined
 (e) None of these
20. **Input :** on at 33 27 42 sky mat 51
 Which of the following steps will be the last?
 (a) VI (b) VII
 (c) V (d) VIII
 (e) None of these
21. Step III of an input is:
 bring 63 desk 11 29 together fight 30
 Which of the following steps will be the last but one?
 (a) VI (b) VII
 (c) VIII (d) V
 (e) None of these
22. Step II of an input is:
 earn 72 31 46 higher goal 20 more
 Which of the following is definitely the input?
 (a) 46 72 31 earn higher goal 20 more
 (b) 20 31 72 46 higher goal earn more
 (c) higher 20 31 72 46 goal earn more
 (d) Cannot be determined
 (e) None of these

Directions (Qs. 23-27) : Read the following information carefully and answer the questions given below:

A word and number arrangement machine when given an input line of words and numbers rearranges them following a particular rule and generates stepwise outputs till the arrangement is complete following that rule.

Following is an illustration of input and steps of rearrangement till the last step.

Input : tree cut 92 51 food 17 garden 32

Step I: cut tree 92 51 food 17 garden 32

Step II: cut food tree 92 51 17 garden 32

Step III: cut food 92 tree 51 17 garden 32

Step IV: cut food 92 51 tree 17 garden 32

Step V: cut food 92 51 garden tree 17 32

Step VI: cut food 92 51 garden tree 32 17

And Step VI is the last step of the input.

As per the rules followed in the above steps, find out the answer to each of the questions given below:

23. Step IV of an input is:

earn more 82 63 12 31 quite new

Which of the following will definitely be **Step II** of the output?

- (a) earn more 12 63 82 31 quite new
- (b) earn more new 82 63 12 31 quite
- (c) earn more quite new 82 12 63 31
- (d) Cannot be determined
- (e) None of these

24. **Input:** bring home 42 73 15 goal 32 type

Which of the following steps will be the last?

- (a) V
- (b) VI
- (c) IV
- (d) VII
- (e) None of these

25. **Input:** bench 47 63 advance 13 29 again between

Which of the following is the step III of the output?

- (a) advance again 63 47 bench 13 29 between
- (b) advance again 63 47 bench between 13 29
- (c) advance again 63 47 bench between 29 13
- (d) Cannot be determined
- (e) None of these

26. Step II of an input is:

desk eagle 12 28 41 69 foreign land

How many more steps will be required to complete the rearrangement?

- (a) 4
- (b) 6
- (c) 5
- (d) 3
- (e) None of these

27. Step III of an input is:

again dark 83 sour 19 21 prey 39

Which of the following steps will be the last but one?

- (a) V
- (b) VI
- (c) VIII
- (d) VII
- (e) None of these

Directions (Qs. 28 - 32) : Study the following information carefully to answer the questions given below. In a toy exhibition, a machine processes a given input by the following rule. Participants are shown one by one till it reaches its last step. Following is an illustration of the working of this machine.

Input : sui me ato fe zen u no

Step I : fe sui me no ato zen u

Step II : no fe sui u me ato zen

Step III : u no fe zen sui me ato

Step IV : zen u no ato fe sui me

Step V : ato zen u me no fe sui and so on.

Now attempt the questions given below.

28. Which of the following steps would read as 'not you only say wise yet are' for the input 'say not you are only wise yet'?

- (a) III
- (b) V
- (c) VI
- (d) VII
- (e) None of these

29. If the Step V of an input is 'so cd rom lay is nor it', which of the following would be its Step II?

- (a) is nor it rom lay so cd
- (b) nor it lay is so cd rom
- (c) lay so cd it rom is nor
- (d) Data inadequate
- (e) None of these

30. If the Step III of an input is 'lo men chi from yet as know', which of the following would be its input?

- (a) Data inadequate
- (b) from lo men know chi yet as
- (c) men chi yet lo as know from
- (d) chi as know men know from lo
- (e) None of these

31. Which of the following correctly describes the 'machine logic' in generating various steps based on the given input?

- (a) Each step is generated on random basis.
- (b) Words/letters are finally arranged in dictionary order.
- (c) The seventh letter interchanges with the fourth every time.
- (d) Data inadequate
- (e) None of these

32. What will be the step IV for the following input?

Input : may sen to cry if not hell

- (a) cry may sen to if not hell
- (b) if not hell to cry may sen
- (c) sen to if may not hell cry
- (d) not hell cry if may sen to
- (e) None of these

Directions (Qs. 33-37): A word arrangement machine, when given a particular input, rearranges it following a particular rule. The following is the illustration of the input and the steps of arrangement:

Input: 95 is 11 my are

Step I: is 95 11 my are

Step II: is 11 95 my are

Step III: is 11 my 95 are

Step III is the last step for this input.

Now, study the logic given above and answer the questions that follow:

33. **Input:** go 123 save be 39 67 let

Which among the given steps will be the last step for the given input?

- (a) III
- (b) IV
- (c) V
- (d) VI
- (e) None of these

34. **Input:** we 143 lay as 12 may 36

What is step IV for the given input?

- (a) as 12 we lay 36 143 may
- (b) as 12 we 36 143 lay may
- (c) as we 143 lay 12 may 36
- (d) may 36 12 lay 143 we as
- (e) None of these

35. If step III of an input is 'mare 1665 meat 1885 saves 20171 19199', then which of the following will definitely be the input?

- (a) meat saves 20171 1885 mare 1665 19199
 (b) mare 1885 saves meat 1665 19199 20171
 (c) 19199 saves mare meat 1885 1665 20171.
 (d) Can't be determined
 (e) None of these
36. **Input:** like tea 115 1264 eat 151 gate
 For the above input, which step will be the following arrangement?
Arrangement: eat 115 tea 151 like 1264 gate
 (a) VI (b) V
 (c) III (d) II
 (e) None of these
37. If step II of a given input is 'get 116 1250 say 1124 four 148 hire' then which of the following is step VI of the given input?
 (a) get 116 say 148 four 1124 hire 1250
 (b) get 116 say 148 1250 1124 four hire
 (c) get 116 say 148 four 1124 1250 hire
 (d) Data inadequate
 (e) None of these
- Directions (Qs. 38-42) :** Study the following information to answer the given questions.
 A word arrangement machine when given an input line of words, rearranges them following a particular rule in each step. The following is an illustration of the input and the steps of rearrangement.
- Input :** going but for crept te light sir
Step I : crept going but for te light sir
Step II : crept going light but for te sir
Step III : crept going light but for sir te
 (Step III is the last step for this input)
- As per the rules followed in the above steps, find out in the given questions the appropriate step for the given input.
38. **Input:** the in car as he may me
 Which of the following will be the third step for this input?
 (a) car the in as he may me
 (b) car may the as in he me
 (c) car as may he the in me
 (d) car may the in as he me
 (e) None of these
39. If the second step of an input is 'clever remand window sales batch tiger never' which of the following will be its sixth step?
 (a) clever remand window batch sales tiger never
 (b) window remand clever sales batch tiger never
 (c) batch never sales tiger clever remand window
 (d) clever remand window tiger batch sales never
 (e) It cannot have sixth step.
40. If the input is 'true se veto be nuke my like', which of the following will be the IV step?
 (a) like nuke true veto be se my
 (b) be my like se true veto nuke
 (c) be my se like true veto nuke
 (d) veto true nuke like so be my
 (e) Cannot be determined
41. **Input:** 'more fight cats cough sough acts idea'.
 Which of the following steps would be the last step for this input?
 (a) III (b) IV
 (c) V (d) VI
 (e) VII

42. If the V step of an input is 'more pure soft cat not so sir at', what will be the II step?
 (a) at so more pure cat not soft sir
 (b) more pure soft so sir cat at not
 (c) more pure soft cat so sir at not
 (d) more so sir soft pure cat at not
 (e) Cannot be determined

Directions (Qs. 43-49): Study the following information to answer the questions given below :

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

Input	: 48	245	182	26	99	542	378	297
Step I	: 542	48	245	182	26	99	378	297
Step II	: 542	26	48	245	182	99	378	297
Step III	: 542	26	378	48	245	182	99	297
Step IV	: 542	26	378	48	297	245	182	99
Step V	: 542	26	378	48	297	99	245	182

This is the final arrangement and step V is the last step for this input.

43. What will the fourth step for an input whose second step is given below?
Step: 765 42 183 289 542 65 110 350
 (a) 765 42 542 350 183 289 65 110
 (b) 765 42 542 65 110 183 289 350
 (c) 765 42 542 65 183 289 110 350
 (d) Cannot be determined
 (e) None of these
44. What should be the third step of the following input?
Input: 239 123 58 361 495 37
 (a) 495 37 361 123 239 58
 (b) 495 37 58 361 123 239
 (c) 495 37 58 123 361 239
 (d) 495 37 361 239 123 58
 (e) None of these
45. How many steps will be required to get the final output from the following input?
Input: 39 88 162 450 386 72 29
 (a) Two (b) Three
 (c) Four (d) Six
 (e) None of these
46. What should be the last step of the following input?
Input: 158 279 348 28 326 236
 (a) 348 28 326 158 279 236
 (b) 348 28 326 236 158 279
 (c) 348 28 236 158 279 326
 (d) 348 28 158 326 236 279
 (e) None of these
47. If the first step of an input is "785 198 32 426 373 96 49", then which of the following steps will be "785 32 426 49 198 373 96"?
 (a) Third (b) Fourth
 (c) Fifth (d) Second
 (e) None of these
48. Below is given the second step of an input. What will be its fourth step?
Step II: 298 12 128 36 212 185

- (a) 298 12 212 128 36 185
 (b) 298 12 212 36 128 185
 (c) 298 12 36 212 128 185
 (d) Cannot be determined
 (e) None of these
49. Below is given the third step of an input. What will be its second step?
Step III: 387 42 236 185 92 64
 (a) 387 42 185 236 92 64
 (b) 387 42 92 185 236 64
 (c) 387 42 185 92 236 64
 (d) Cannot be determined
 (e) None of these
- Directions (Qs. 50-54):** Study the following information carefully and answer the questions given below it :
 An export processing unit has a computerised machine which generates six codes to distinguish products of each of the seven batches produced in a day. The machine is fed code for the first batch of each day. Based on that, the machine generates 6 codes by rearrangement of words for subsequent batches. Following is an illustration of generation of codes for some batches of a day.
- Day's **first** batch – who nut cream page for table.
 Day's **second** batch – who for cream page nut table.
 Day's **third** batch – who for page cream nut table.
 Day's **fourth** batch – table for page cream nut who.
 Day's **fifth** batch – page table for nut who cream.
 Day's **sixth** batch – page who for nut table cream.
- and so on till seventh batch. Next day based on the same rule, new set of words will be introduced as given above :
50. If the seventh batch of the day is 'from door no leaf glass but', which of the following would be the first three words of the code of the third batch of that day?
 (a) door leaf from ... (b) door leaf but ...
 (c) glass leaf but ... (d) but door no ...
 (e) None of these
51. If the code of sixth batch of the day is 'very say could man on fire', which of the following batch codes would read as 'say could very fire man on'?
 (a) Second (b) Third
 (c) Fourth (d) Fifth
 (e) None of these
52. If the code of fourth batch is 'so when clean get lemon dust', which of the following would be the code for seventh batch?
 (a) get dust lemon when so clean
 (b) clean so when lemon dust get
 (c) when get dust so clean lemon
 (d) clean dust lemon when so get
 (e) None of these
53. If the first batch code of a day is 'five gave it close to mine', which of the following will be the code for fourth batch?
 (a) five to it close gave mine
 (b) mine to close it gave five
 (c) five to close it gave mine
 (d) close five to gave mine it
 (e) None of these
54. If the code of fifth batch of a day is 'same is tea at now then', which of the following would definitely be the first code of that day?

- (a) tea same is now then at
 (b) same now tea at is then
 (c) now at then same tea is
 (d) now tea is same then at
 (e) None of these

Directions (Qs. 55-59): Study the following information carefully and answer the questions given below:

An exhibition is open for public since 9 am till 3 pm and again since 4 pm till 10 pm. In a day there are 12 batches of 1 hour each. The entry ticket bears a pass code made up of seven words, which changes every hour following a particular rule. The pass codes for 4 pm to 10 pm are the same as those for respective hours during 9 am till 3 pm, i.e. the pass code for 4 pm to 5 pm is same as of 9 am to 10 am and so on. Following is an illustration of the code and steps of rearrangement for subsequent clock hours.

Day's Pass code

First batch	9 am to 10 am (4 pm to 5 pm)	dig more and you will find water
Second batch	10 am to 11 am (5 pm to 6 pm)	and dig find you water will more
Third batch	(11 am to 12 noon) (6 pm to 7 pm)	find and will you more water dig.

and so on.

55. If the pass-code for 7 pm to 8 pm batch is 'pen with write pencil nice time day', what will be the pass-code for 11 am to 12 noon?
 (a) day nice with pencil write pen time
 (b) day with nice pencil write pen time
 (c) nice day with pencil write pen time
 (d) nice day pencil with write time pen
 (e) None of these
56. If the pass-code for the batch 4 pm to 5 pm is 'go to office in time every day', what will be the pass code for 2 pm to 3 pm batch?
 (a) day to go in every office time
 (b) to day go in every office time
 (c) to go day in every office time
 (d) to go in day every office time
 (e) None of these
57. If the pass-code for the second batch is 'do not play the near water dirty', what will be the pass code for 2 pm to 3 pm batch?
 (a) dirty near play the not do water
 (b) near dirty not the play do water
 (c) dirty near not the play do water
 (d) near dirty not the play water do
 (e) None of these
58. If the pass-code for third batch is 'at study sleep and night child good', which batch will have the pass-code 'child sleep night and study good at'?
 (a) Second (b) Fourth
 (c) Sixth (d) Fifth
 (e) None of these
59. If the pass-code for 5 pm to 6 pm is 'out in above over field the and', what will be the pass-code for 1 pm to 2 pm?
 (a) field and the over out in above
 (b) the field and over out in above
 (c) field the and over out above in
 (d) the field and over out above in
 (e) None of these

Directions (Qs. 60-64): Study the following information carefully and answer the questions given below :

A word arrangement machine, when given a particular input, rearranges it following a particular rule. The following is the illustration of the input and the steps of arrangement:

Input: top the name good for is there

Step I: is top the name good for there

Step II: is for top the name good there

Step III: is for the top name good there

Step IV: is for the top good name there

(This is the last arrangement and step IV is the last step of this input.)

60. If following is the second step of an input, what will be the fourth step?

Step II: is to for while they were going day

- (a) is to day for they while were going
- (b) is to day for while they were going
- (c) is to for day while they were going
- (d) Can't be determined
- (e) None of these

61. If following is the third step of an input, what will be its first step?

Step III: no dog was first five forest dense

- (a) no was dog first five forest dense
- (b) no first was dog five forest dense

(c) no dog first was forest five dense

(d) can't be determined

(e) None of these

62. Which of the following is the third step for the following input?

Input: lack of a common safe in the

- (a) a of in the lack common safe
- (b) a of in lack common safe the
- (c) a in of lack common safe the
- (d) a in of the lack common safe
- (e) None of these

63. How many steps will be required to get the final output from the following input?

Input: where do you go out of way

- (a) One
- (b) Three
- (c) Four
- (d) Eight
- (e) None of these

64. If step I of an input is 'If there was no good man', what step would be 'if no man there was good'?

- (a) Second
- (b) Third
- (c) Fourth
- (d) Can't be determined
- (e) None of these

ANSWER KEY

1	(b)	8	(d)	15	(d)	22	(d)	29	(a)	36	(c)	43	(c)	50	(a)	57	(c)	64	(b)
2	(c)	9	(b)	16	(e)	23	(d)	30	(e)	37	(a)	44	(d)	51	(b)	58	(d)		
3	(d)	10	(e)	17	(b)	24	(a)	31	(e)	38	(b)	45	(e)	52	(d)	59	(e)		
4	(d)	11	(b)	18	(c)	25	(e)	32	(b)	39	(e)	46	(a)	53	(b)	60	(a)		
5	(a)	12	(b)	19	(c)	26	(c)	33	(d)	40	(a)	47	(b)	54	(c)	61	(d)		
6	(d)	13	(d)	20	(d)	27	(a)	34	(e)	41	(d)	48	(b)	55	(e)	62	(c)		
7	(b)	14	(c)	21	(a)	28	(c)	35	(d)	42	(e)	49	(d)	56	(b)	63	(e)		

Hints & Explanations

1-5: Here it is case of arrangement. The logic is: the words get arranged in alphabetical order. Whereas the numbers get arranged in descending order. Numbers occupy odd places in the final steps while words occupy even positions. When any element gets arranged the previous elements occupying that position shifts one place towards right.

1. (b) **Input:** 9 13 about tariff 24 call 29 even
Step I: 29 9 13 about tariff 24 call even
Step II: 29 about 9 13 tariff 24 call even
Step III: 29 about 24 9 13 tariff call even
Step IV: 29 about 24 call 9 13 tariff even
2. (c) **Step II:** 37 desk 34 garden 5 father victory 17
Step III: 37 desk 34 father garden 5 victory 17
Step IV: 37 desk 34 father 17 garden 5 victory Since all the elements of the input are fully arranged in Step IV, this is the last step of the given input.

3. (d) **Step I:** 59 bead tenure father 38 11 ultimate 24
Step II: 59 bead 38 tenure father 11 ultimate 24
Step III: 59 bead 38 father tenure 11 ultimate 24
 4. (d) Since it is a case of arrangement, we can't obtain previous steps with certainty.
 5. (a) **Input:** 24 12 entry sand butter 51 32 carry
Step I: 51 24 12 entry sand butter 32 carry
Step II: 51 butter 24 12 entry sand 32 carry
Step III: 51 butter 32 24 12 entry sand carry
- 6-10:** An intuitive look at the input and the steps makes it clear that it is a case of arrangement. The input is a combination of words and numbers. Words get arranged according to reverse order of alphabetical arrangement whereas numbers get arranged in ascending order.
- In step I, 'over' occupies the first place from the left end and the other elements are pushed one place rightward.

Similarly, in step II, '26' occupies the second place from the left end and the other elements are pushed one place rightward. Thus, alternate arranging of words and numbers finally gives the last step in which the odd places from the left are occupied by words and the even places are occupied by numbers.

6. (d) Since it is a case of arrangement, therefore previous steps or input can't be determined with certainty.
7. (b) **Step III:** take 17 mind game 29 73 18 loud
Step IV: take 17 mind 18 game 29 73 loud
Step V: take 17 mind 18 loud game 29 73
Step VI: take 17 mind 18 loud 29 game 73
 Hence, step VI is the last step. Therefore, three more steps are required to complete the sequence.
8. (d) **Input:** by now 51 32 for 91 20 me
Step I: now by 51 32 for 91 20 me
Step II: now 20 by 51 32 for 91 me
Step III: now 20 me by 51 32 for 91
Step IV: now 20 me 32 by 51 for 91
Step V: now 20 me 32 for by 51 91
Step VI: now 20 me 32 for 51 by 91
 Hence, step VI is the last step for the given input.
9. (b) **Input:** fight for all 39 62 25 today 19
Step I: today fight for all 39 62 25 19
Step II: today 19 fight for all 39 62 25
Step III: today 19 for fight all 39 62 25
Step IV: today 19 for 25 fight all 39 62
10. (e) **Input:** queen mary 79 62 17 20 green west
Step I: west queen mary 79 62 17 20 green
Step II: west 17 queen mary 79 62 20 green
Step III: west 17 queen 20 mary 79 62 green
Step IV: west 17 queen 20 mary 62 79 green
Step V: west 17 queen 20 mary 62 green 79
 Hence, step V is the last step. Therefore, the penultimate step (last but one) is step IV.

11 – 17: Here the rule followed is: numbers are getting arranged in descending order.

The largest of the given numbers interchanges its place with the first number. [In case the largest number is already arranged, the second largest is interchanged with the number next to the largest no., and so on until the numbers are arranged in descending order.

11. (b) **Step II:** 842 485 68 358 236 123 93
Step III: 842 485 358 68 236 123 93
Step IV: 842 485 358 236 68 123 93
Step V: 842 485 358 236 123 68 93
13. (d) **Input:** 113 18 48 225 462 175 288
Step I: 462 18 48 225 113 175 288
Step II: 462 288 48 225 113 175 18
Step III: 462 288 225 48 113 175 18
14. (c) **Step I:** 498 175 292 96 79 387 158
Step II: 498 387 292 96 79 175 158
Step III: 498 387 292 175 79 96 158
Step IV: 498 387 292 175 158 96 79
15. (d) Previous step can't be determined.
16. (e) **Input:** 158 294 22 89 142 385 463
Step I: 463 294 22 89 142 385 158
Step II: 463 385 22 89 142 294 158

17. (b) The series which is in strictly descending order will be the answer.

18-22 : From the last step it can be concluded that words and numbers are arranged alternately. Words are arranged alphabetically whereas numbers are arranged in descending order. When the arrangement of all elements gets completed in a particular step that step is called last step.

18. (c) **Input:** machine hire for 19 against 85 21 46
Step I: against machine hire for 19 85 21 46
Step II: against 85 machine hire for 19 21 46
19. (c) **Input:** box at 20 53 62 gift now 32
Step I: at box 20 53 62 gift now 32
Step II: at 62 box 20 53 gift now 32
Step III: at 62 box 53 20 gift now 32
Step IV: at 62 box 53 gift 20 now 32
20. (c) **Input:** on at 33 27 42 sky mat 51
Step I: at on 33 27 42 sky mat 51
Step II: at 51 on 33 27 42 sky mat
Step III: at 51 mat on 33 27 42 sky
Step IV: at 51 mat 42 on 33 27 sky
Step V: at 51 mat 42 on 33 sky 27
21. (a) **Step III:** bring 63 desk 11 29 together fight 30
Step IV: bring 63 desk 30 11 29 together fight
Step V: bring 63 desk 30 fight 11 29 together
Step VI: bring 63 desk 30 fight 29 11 together
Step VII: bring 63 desk 30 fight 29 together 11
 Step VII is the last step. Hence, step VI is the second last step (penultimate step).
22. (d) Previous steps can't be determined.
- 23-27:** In the given arrangement the first and the second places are occupied by words; the third and the fourth by numbers; the fifth and the sixth by words; and the seventh and the eighth by numbers. Words occupy place in alphabetical order while numbers occupy place in descending order. Whenever a word or a number gets arranged other elements shift one place rightward.
23. (d) Since it is a case of 'Arrangement', previous steps can't be obtained with certainty.
24. (a) **I: Input:** bring home 42 73 15 goal 32 type
Step I: bring goal home 42 73 15 32 type
Step II: bring goal 73 home 42 15 32 type
Step III: bring goal 73 42 home 15 32 type
Step IV: bring goal 73 42 home type 15 32
Step V: bring goal 73 42 home type 32 15
 Since all the elements of Input get arranged in Step V, it is the last step.
25. (e) **Input:** bench 47 63 advance 13 29 again between
Step I: advance bench 47 63 13 29 again between
Step II: advance again bench 47 63 13 29 between
Step III: advance again 63 bench 47 13 29 between
26. (c) **Step II:** desk eagle 12 28 41 69 foreign land
Step III: desk eagle 69 12 28 41 foreign land
Step IV: desk eagle 69 41 12 28 foreign land
Step V: desk eagle 69 41 foreign 12 28 land
Step VI: desk eagle 69 41 foreign land 12 28
Step VII: desk eagle 69 41 foreign land 28 12

27. (a) **Step III:** again dark 83 sour 19 21 prey 39
Step IV: again dark 83 39 sour 19 21 prey
Step V: again dark 83 39 prey sour 19 21
Step VI: again dark 83 39 prey sour 21 19
 Since step VI is the last step (because all elements of step III get arranged in step VI), step V is the required step (penultimate step or last but one.)

(28-32): Here the rule followed is: In each step the fourth word becomes first word and the last word becomes fourth word and all other words shift one place rightwards except the third, which shifts two place rightwards.

In order to make things easier, let us represent the words digitally from 1 to 7.

Then we have:

Input:	1	2	3	4	5	6	7
Step I:	4	1	2	7	3	5	6
Step II:	7	4	1	6	2	3	5
Step III:	6	7	4	5	1	2	3
Step IV:	5	6	7	3	4	1	2
Step V:	3	5	6	2	7	4	1
Step VI:	2	3	5	1	6	7	4

28. (c) Input: say not you are only wise yet
 1 2 3 4 5 6 7
Arrangement: not you only say wise yet are
Step VI: 2 3 5 1 6 7 4
29. (a) **Step V:** so cd rom lay is nor it
 3 5 6 2 7 4 1
Step II: 7 4 1 6 2 3 5
 is nor it rom lay so cd
30. (e) **Step III:** lo men chi from yet as know
 6 7 4 5 1 2 3
Input: 1 2 3 4 5 6 7
 yet as know chi from lo men

31. (e) The rule is given above.

(33-37): From the last step it can be concluded that words and numbers are arranged alternately. Word with least number of letters shifts to the leftmost position followed by the least number among the given numbers. In case of two words with same number of letters, words are arranged as per their dictionary order. For getting arranged they are interchanged with the word/number whose place it occupies.

33. (d) **Input :** go 123 save be 39 67 let
Step I : be 123 save go 39 67 let
Step II : be 39 save go 123 67 let
Step III : be 39 go save 123 67 let
Step IV : be 39 go 67 123 save let
Step V : be 39 go 67 let save 123
Step VI : be 39 go 67 let 123 save
34. (e) **Input :** we 143 lay as 12 may 36
Step I : as 143 lay we 12 may 36
Step II : as 12 lay we 143 may 36
Step III : as 12 we lay 143 may 36
Step IV : as 12 we 36 143 may lay
35. (d) Previous step can't be determined.
36. (c) **Input :** like tea 115 1264 eat 151 gate
Step I : eat tea 115 1264 like 151 gate

Step II : eat 115 tea 1264 like 151 gate

Step III : eat 115 tea 151 like 1264 gate

37. (a) **Step II :** get 116 1250 say 1124 four 148 hire
Step III : get 116 say 1250 1124 four 148 hire
Step IV : get 116 say 148 1124 four 1250 hire
Step V : get 116 say 148 four 1124 1250 hire
Step VI : get 116 say 148 four 1124 hire 1250

[**Note:** In the sample given for the arrangement, the mode of arrangement is ambiguous. We have taken interchange as our basis but arrangement by shifting is also a possibility. Such ambiguous questions should not be asked.]

38-42: The words are arranged according to the number of letters they have, one at a time. The word with the maximum number of letters is put first. If two words have the same number of letter, we go for alphabetical arrangement.

38. (b) **Input :** the in car as he may me
Step I : car the in as he may me
Step II : car may the in as he me
Step III : car may the as in he me
39. (e) **Step II :** clever remand window sales batch tiger never
Step III : clever remand window batch sales tiger never
Step IV : clever remand window batch never sales tiger
 Now, step IV would be the last step.
40. (a) **Input :** true se veto be nuke my like
Step I : like true se veto be nuke my
Step II : like nuke true se veto be my
Step III : like nuke true veto se be my
Step IV : like nuke true veto be se my
41. (d) **Input :** more fight cats cough sough acts idea
Step I : cough more fight cats sough acts idea
Step II : cough fight more cats sough acts idea
Step III : cough fight sough more cats acts idea
Step IV : cough fight sought acts more cats idea
Step V : cough fight sough acts cats more idea
Step VI : cough fight sough acts cats idea more
42. (e) We can't move backward.

(43-49): From the last step it is clear that there are two alternating series of numbers: One in descending order and the other in ascending order.

When we go through input to step I, we find that the largest no. becomes the first and remaining numbers shift rightward. In the next step the smallest no. becomes the second and the rest shift rightward. These two steps continue alternately untill the two alternate series are formed.

43. (c) **Step II:** 765 42 183 289 542 65 110 350
Step III: 765 42 542 183 289 65 110 350
Step IV: 765 42 542 65 183 289 110 350
44. (d) **Input:** 239 123 58 361 495 37
Step I: 495 239 123 58 361 37
Step II: 495 37 239 123 58 361
Step III: 495 37 361 239 123 58
45. (e) **Input:** 39 88 162 450 386 72 29
Step I: 450 39 88 162 386 72 29
Step II: 450 29 39 88 162 386 72
Step III: 450 29 386 39 88 162 72
Step IV: 450 29 386 39 162 88 72
Step V: 450 29 386 39 162 72 88

46. (a) Last step can be known directly.
47. (b) **Step I:** 785 198 32 426 373 96 49
Step II: 785 32 198 426 373 96 49
Step III: 785 32 426 198 373 96 49
Step IV: 785 32 426 49 198 373 96
48. (b) **Step II:** 298 12 128 36 212 185
Step III: 298 12 212 128 36 185
Step IV: 298 12 212 36 128 185
49. (d) Previous steps can't be determined
- 50-54:** The machine operates as follows:
1st batch to 2nd batch: Second and fifth words interchange places.
2nd to 3rd: The middle two words interchange places.
3rd to 4th: First and last words interchange places.
4th to 5th: The middle words move to the extreme positions on their respective sides while the outer words move inwards.
 Hereafter, the process is repeated, i.e.,
5th to 6th: Same as 1st to 2nd
6th to 7th: Same as 2nd to 3rd
- Let us now make our job easy by going in for digital representation. We assign numbers 1 to 6 to the words in the first batch: who-1, nut-2, cream-3, page-4, for-5, table 6. Thus, our table becomes:
- | | | | | | | |
|-------------------|---|---|---|---|---|---|
| 1st batch: | 1 | 2 | 3 | 4 | 5 | 6 |
| 2nd batch: | 1 | 5 | 3 | 4 | 2 | 6 |
| 3rd batch: | 1 | 5 | 4 | 3 | 2 | 6 |
| 4th batch: | 6 | 5 | 4 | 3 | 2 | 1 |
| 5th batch: | 4 | 6 | 5 | 2 | 1 | 3 |
| 6th batch: | 4 | 1 | 5 | 2 | 6 | 3 |
| 7th batch: | 4 | 1 | 2 | 5 | 6 | 3 |
- We can now answer the questions easily by applying the above table.
50. (a) **7th batch:** from door no leaf glass but
 4 1 2 5 6 3
3rd batch: 1 5 4...
 door leaf from ...
51. (b) **6th batch:** very say could man on fire
 4 1 5 2 6 3
 As per the above code, 'say could very fire man on' would read as 154326, which clearly is the 3rd batch (see table).
52. (d) **4th batch:** so when clean get lemon dust
 6 5 4 3 2 1
7th batch: 4 1 2 5 6 3
 clean dust lemon when so get
53. (b) Note that 4th batch is the reverse order of the first batch.
54. (c) **5th batch:** same is tea at now then
 4 6 5 2 1 3
1st batch: 1 2 3 4 5 6
 now at then same tea is

(55-60): The order of words changes from one batch to the next as follows: the first word becomes the second; the second becomes the last; the third becomes the first; the fourth remains the same; the fifth becomes the sixth; the sixth becomes the third; and the last becomes the fifth.

For convenience, we plot the movement of each word in each step by the numbers assigned to them in the first batch:

dig-1, more-2, and-3, you-4, will-5, find-6 and water-7.

1st batch: 9 am to 10 am (4pm to 5 pm)	1	2	3	4	5	6	7
2nd batch: 10 am to 11 am (5 pm to 6 pm)	3	1	6	4	7	5	2
3rd batch: 11 am to 12 noon (5 pm to 6 pm)	6	3	5	4	2	7	1
4th batch: 12 noon to 1 pm (7 pm to 8 pm)	5	6	7	4	1	2	3
5th batch: 1 pm to 2 pm (8 pm to 9 pm)	7	5	2	4	3	1	6
6th batch: 2 pm to 3 pm (9 pm to 10 pm)	2	7	1	4	6	3	5

55. (e) 7 pm – 8 pm: pen with write pencil nice time day
 5 6 7 4 1 2 3

11 am to 12 noon:

With day pen pencil time write nice

6 3 5 4 2 7 1

56. (b) Batch -I (4 : 00 pm – 5 : 00 pm)
 go to office in time every day
 1 2 3 4 5 6 7
 Batch-VI (2 : 00 pm – 3 : 00 pm)
 to day go in every office time
 2 7 1 4 6 3 5

59. (e) The above field over in and out.

(60-64) The words get arranged one by one on the basis of the no. of letters, the word with least no. of words gets arranged first. If the no. of letters is the same, the word that comes first in the dictionary gets arranged first. While one word gets arranged, the other shift rightwards.

60. (a) **Step II:** is to for while they were going day
Step III: is to day for while they were going
Step IV: is to day for they while were going
61. (d) Previous step can't be determined.
62. (c) **Input:** lack of a common safe in the
Step I: a lack of common safe in the
Step II: a in lack of common safe the
Step III: a in of lack common safe the
63. (e) Six
64. (b) **Step I:** If there was no good man
Step II: If no there was good man
Step III: If no man there was good