SELECTION

The problem is to find the kth smallest element.

Complexity worst case is $T(n) = O(n^2)$ by repeated application of partition and the complexity is average case $T(n) = O(n)$.

Using median of medians as pivot complexity is $T(n) = O(n^2)$.

COMPLEXITY
WORST CASE
PIVOT IS ARBITRARY
$T(n) = O(n^2)$

COMPLEXITY
AVERAGE CASE
$T(n) = O(n)$

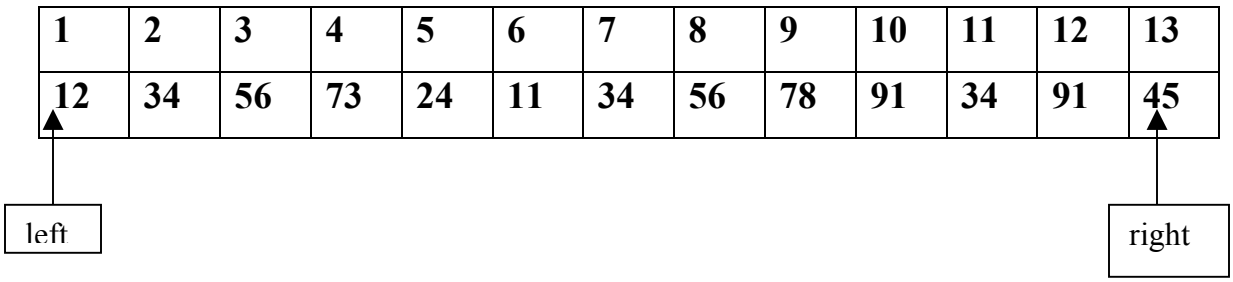
COMPLEXITY
WORST CASE
PIVOT IS MEDIAN OF MEDIANS
$T(n) = O(n)$

PROBLEM FOR SIMULATION

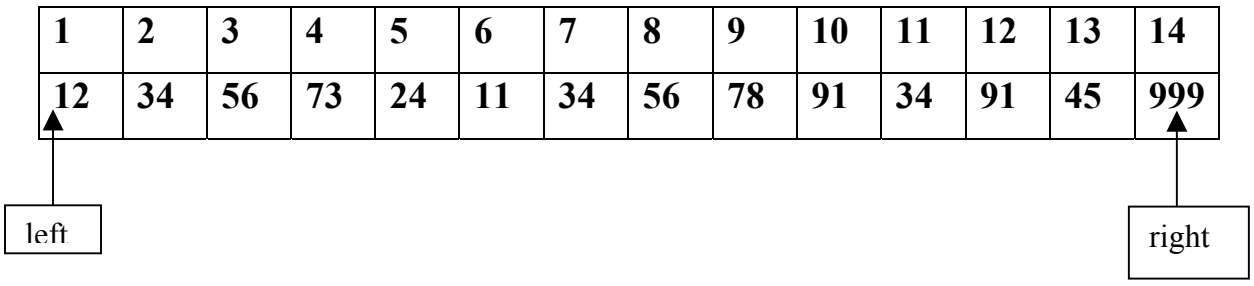
Consider the set {12,34,56,73,24,11,34,56,78,91,34,91,45}

FIND THE 5^{TH} SMALLEST ELEMENT

INITIAL



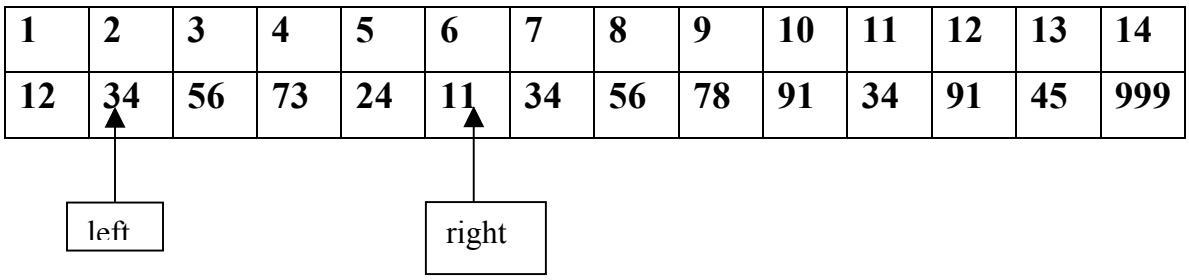
KEEP A VERY LARGE ELEMENT A THE RIGHT END



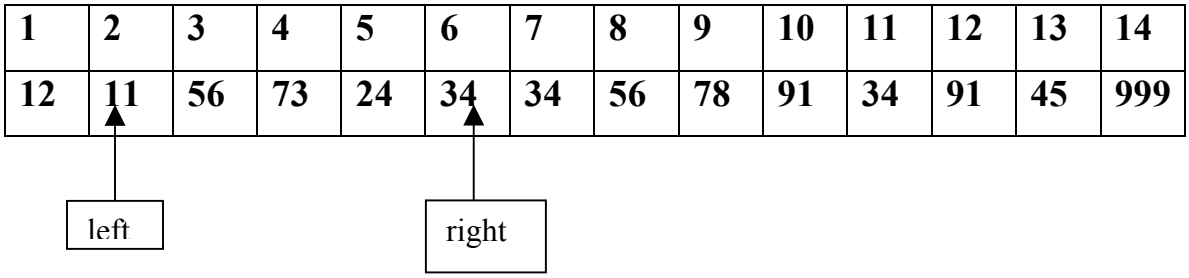
CALL PARTITION

The pointer “left” moves to the right skipping over smaller elements and the pointer “right” moves to the left skipping over larger elements.

MOVE

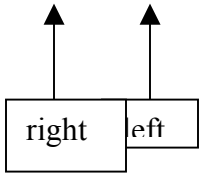


SWAP



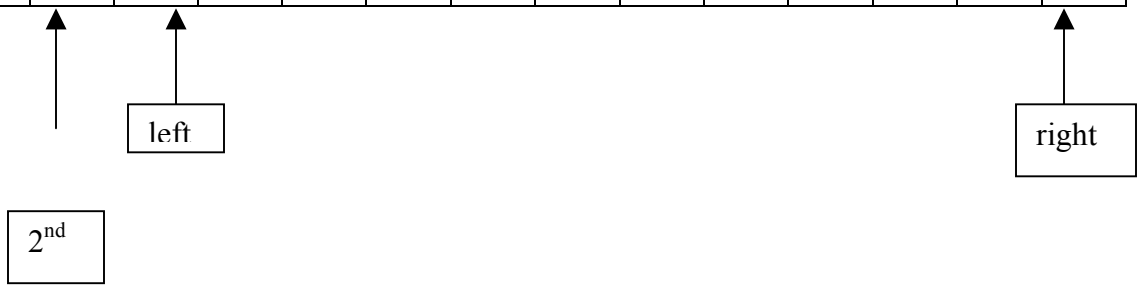
MOVE

1	2	3	4	5	6	7	8	9	10	11	12	13	14
12	11	56	73	24	34	34	56	78	91	34	91	45	999



POSITION FOR PIVOT ELEMENT 12 IS 2 i.e. 2 IS THE 2ND SMALLEST ELEMENT

1	2	3	4	5	6	7	8	9	10	11	12	13	14
11	12	56	73	24	34	34	56	78	91	34	91	45	999

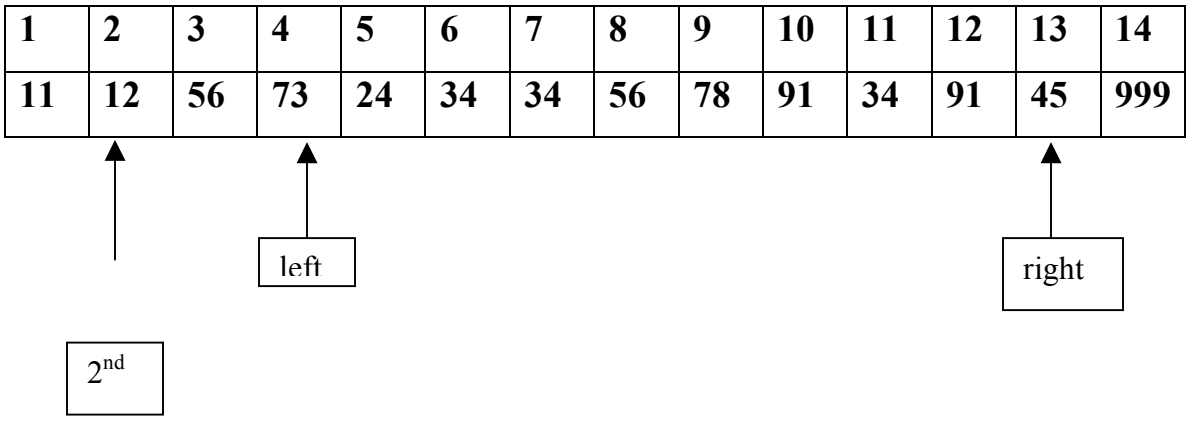


SEARCHING TO THE RIGHT OF 2ND ELEMENT

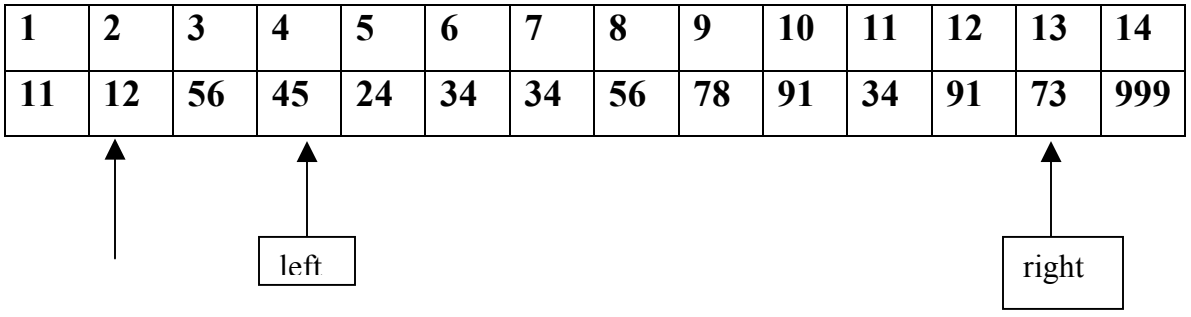
CALL PARTITITON

The pointer “left” moves to the right skipping over smaller elements and the pointer “right” moves to the left skipping over larger elements.

MOVE

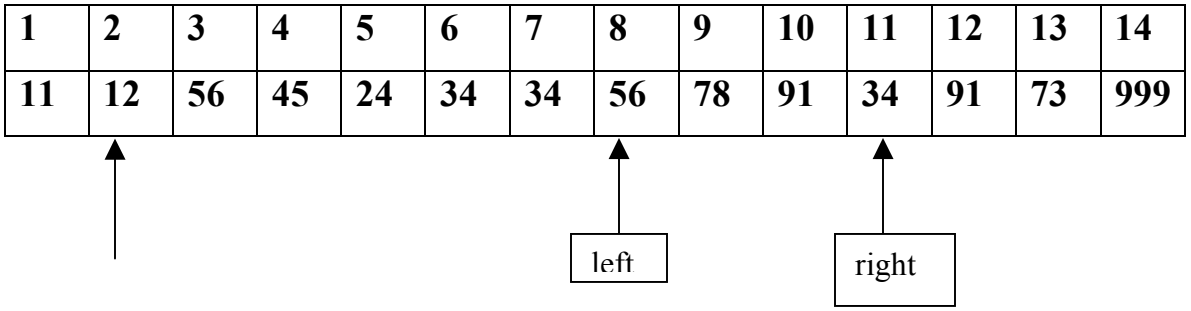


SWAP

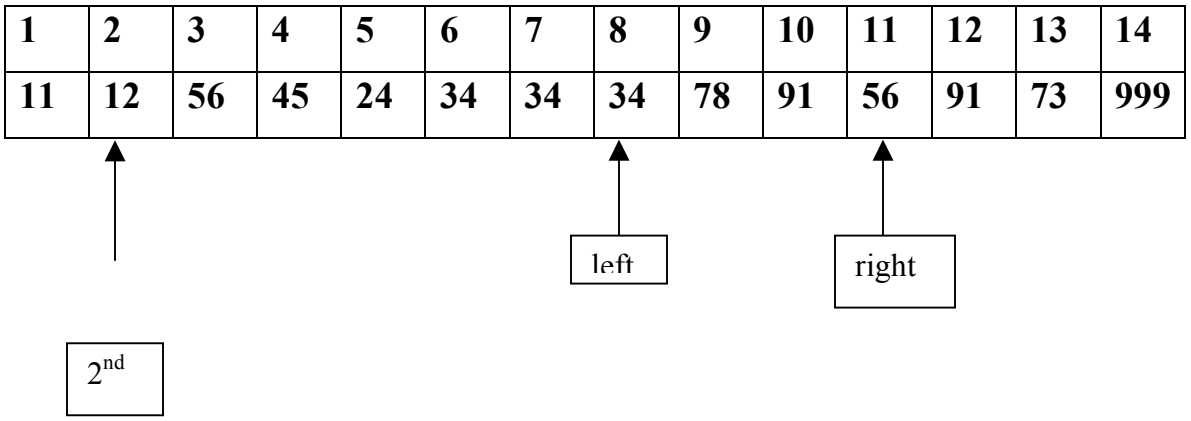


2nd

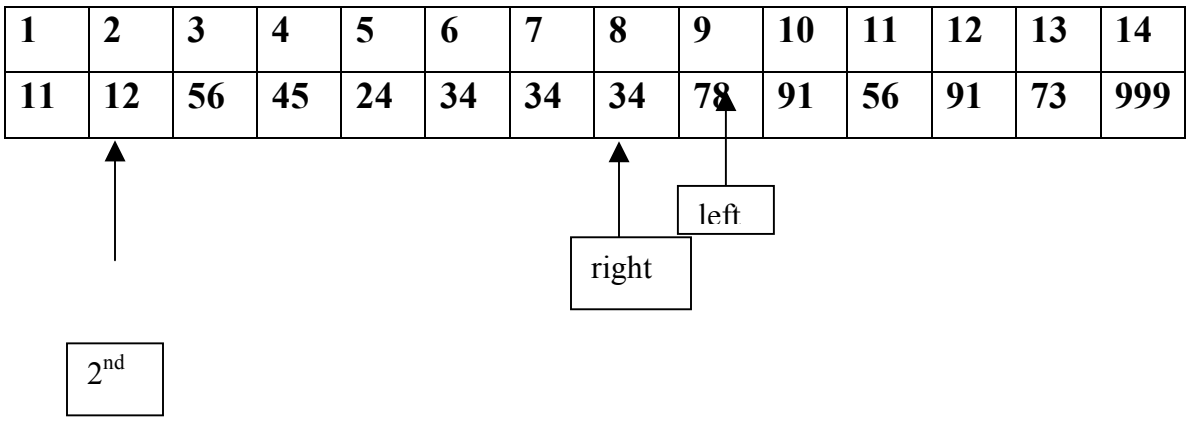
MOVE



SWAP

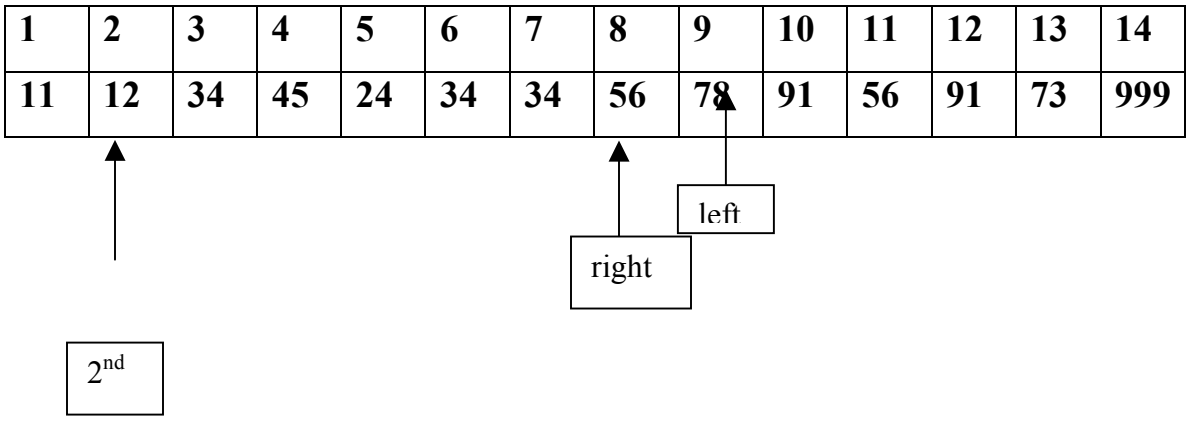


MOVE

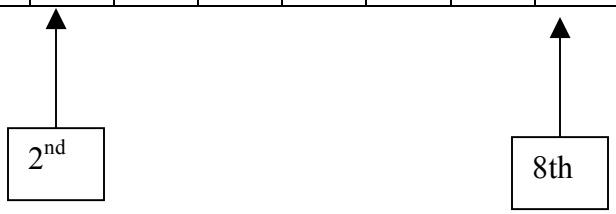


POSITION FOR PIVOT ELEMENT HAS BEEN FOUND AS THE POINTERS HAVE CROSSED. THE 8TH SMALLEST ELEMENT IS 56.

SWAP RIGHT WITH PIVOT

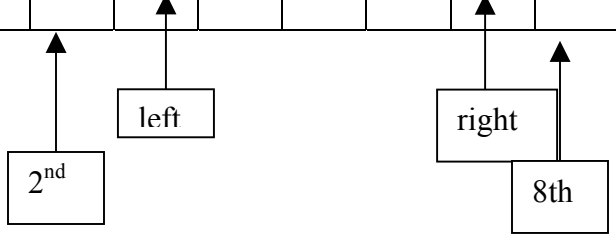


1	2	3	4	5	6	7	8	9	10	11	12	13	14
11	12	34	45	24	34	34	56	78	91	56	91	73	999

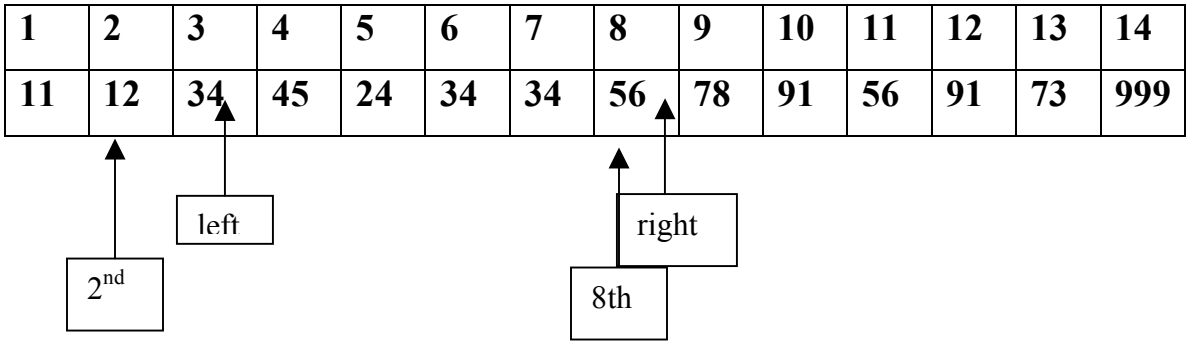


SEARCH BETWEEN 3 AND 7

1	2	3	4	5	6	7	8	9	10	11	12	13	14
11	12	34	45	24	34	34	56	78	91	56	91	73	999



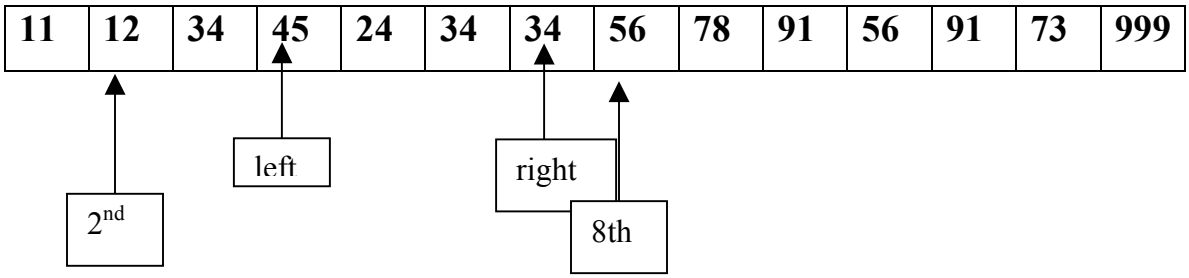
CALL PARTITION (3,8)



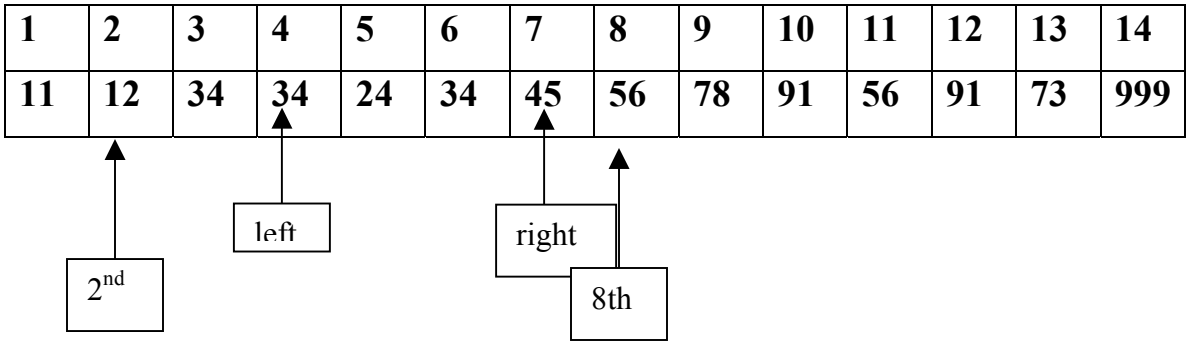
MOVE

The pointer "left" moves to the right skipping over smaller elements and the pointer "right" moves to the left skipping over larger elements.

1	2	3	4	5	6	7	8	9	10	11	12	13	14

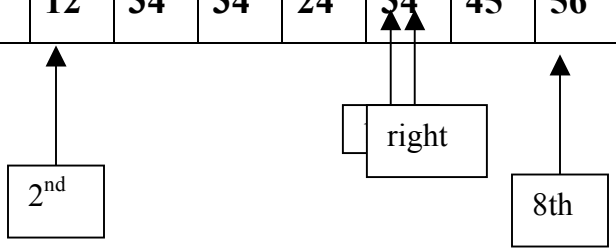

11 12 34 45 24 34 34 56 78 91 56 91 73 999
left
right
2nd
8th

SWAP


1 2 3 4 5 6 7 8 9 10 11 12 13 14
11 12 34 34 24 34 45 56 78 91 56 91 73 999
left
right
2nd
8th

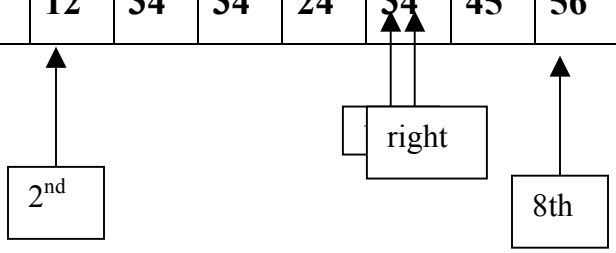
MOVE

1	2	3	4	5	6	7	8	9	10	11	12	13	14
11	12	34	34	24	34	45	56	78	91	56	91	73	999



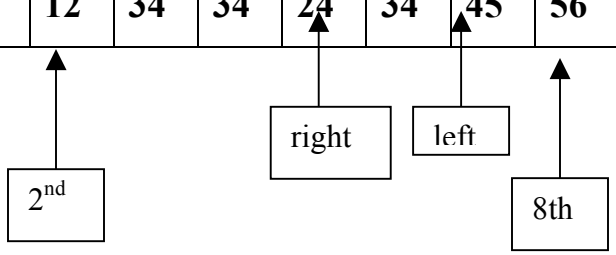
SWAP

1	2	3	4	5	6	7	8	9	10	11	12	13	14
11	12	34	34	24	34	45	56	78	91	56	91	73	999

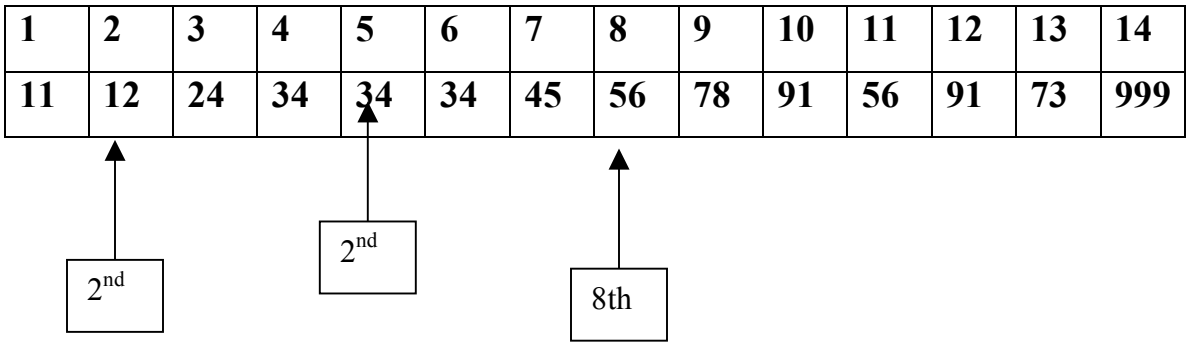


MOVE

1	2	3	4	5	6	7	8	9	10	11	12	13	14
11	12	34	34	24	34	45	56	78	91	56	91	73	999



POINTERS HAVE CROSSED SO 5 IS THE POSITION OF THE PIVOT ELEMENT 34.



POINTERS HAVE CROSSED SO 5 IS THE POSITION OF THE PIVOT ELEMENT 34.