

Sorting:-

It is mainly of three types :- Selection sort, Insertion Sort, Bubble Sort.

1.Selection Sorting

a) From unsorted array find maximum element's position

b) then swap maximum element with last element in unsorted array

0 1 2 3 4 5 6 7

8 1 2 7 6 3 4 5 --> i/p

5 1 2 7 6 3 4 8 p1

5 1 2 4 6 3 7 8 p2

5 1 2 4 3 6 7 8 p3

3 1 2 4 5 6 7 8 p4

3 1 2 4 5 6 7 8 p5 ---- no change

2 1 3 4 5 6 7 8 p6

1 2 3 4 5 6 7 8 p7

0 1 2 3 4 5 6 7

22 11 77 33 44 88 55 23 --> i/p

22 11 77 33 44 23 55 88 p1

22 11 55 33 44 23 77 88 p2

22 11 23 33 44 55 77 88 p3

22 11 23 33 44 55 77 88 p4 ---- no change

22 11 23 33 44 55 77 88 p5 ---- no change

22 11 23 33 44 55 77 88 p6 ---- no change

11 22 23 33 44 55 77 88 p7

0	1	2	3	4	5	6	7
8	1	2	7	6	3	4	5
5	1	2	7	6	3	4	8
5	1	2	4	6	3	7	8
5	1	2	4	3	6	7	8
3	1	2	4	5	6	7	8
3	1	2	4	5	6	7	8
2	1	3	4	5	6	7	8
1	2	3	4	5	6	7	8

--> i/p

p1

p2

p3

p4

p5 ---- no change |

p6

p7

0	1	2	3	4	5	6	7
22	11	77	33	44	88	55	23
22	11	77	33	44	23	55	88
22	11	55	33	44	23	77	88
22	11	23	33	44	55	77	88
22	11	23	33	44	55	77	88
22	11	23	33	44	55	77	88
22	11	23	33	44	55	77	88
11	22	23	33	44	55	77	88

--> i/p

p1

p2

p3

p4 ---- no change

p5 ---- no change

p6 ---- no change

p7

2.Insertion Sorting

i = 0 n-1

j = i-1 -----> 0

temp = arr[i] -->

if arr[j] < temp ----> true ----> arr[j+1] = temp , break

false ----> copy arr[j+1] = a[j] j--

j == -1 ----> arr[0] = temp

Example:-

j

-->20 5 10 2 100 50 60 30 22

i

j

-->5 20 10 2 100 50 60 30 22

i

j

--->5 10 20 2 100 50 60 30 22

i

-->temp = 2

--> 5 10 20 20 100 50 60 30 22

--> 5 10 10 20 100 50 60 30 22

--> 5 5 10 20 100 50 60 30 22

--> 2 5 10 20 100 50 60 30 22

j

---> 2 5 10 20 100 50 60 30 22

i

j

---> 2 5 10 20 100 50 60 30 22

i

j

---> 2 5 10 20 50 100 60 30 22

i

j

---> 2 5 10 20 50 60 100 30 22

i

-->temp = 30

--> 2 5 10 20 50 60 100 100 22

--> 2 5 10 20 50 60 60 100 22

--> 2 5 10 20 50 50 60 100 22

--> 2 5 10 20 30 50 60 100 22

j

---> 2 5 10 20 30 50 60 100 22

i

--> temp = 22

-->2 5 10 20 30 50 60 100 100

-->2 5 10 20 30 50 60 60 100

-->2 5 10 20 30 50 50 60 100

-->2 5 10 20 30 30 50 60 100

-->2 5 10 20 22 30 50 60 100

```
---->20  j
         5  10  2  100  50  60  30  22
         i

---->5   20  j
         10  2  100  50  60  30  22
         i

---->5   10  20  j
         2  100  50  60  30  22
         i

      -->temp = 2
      --> 5  10  20  20  100  50  60  30  22
      --> 5  10  10  20  100  50  60  30  22
      --> 5  5  10  20  100  50  60  30  22
      --> 2  5  10  20  100  50  60  30  22

----> 2  5  10  20  j
                100  50  60  30  22
                i

----> 2  5  10  20  j
                100  50  60  30  22
                i

----> 2  5  10  20  j
                50  100  60  30  22
                i

----> 2  5  10  20  j
                50  60  100  30  22
                i

      -->temp = 30
      --> 2  5  10  20  50  60  100  100  22
      --> 2  5  10  20  50  60  60  100  22
      --> 2  5  10  20  50  50  60  100  22
      --> 2  5  10  20  30  50  60  100  22

----> 2  5  10  20  30  50  60  j
                                100  22
                                i

      --> temp = 22
      -->2  5  10  20  30  50  60  100  100
      -->2  5  10  20  30  50  60  60  100
      -->2  5  10  20  30  50  50  60  100
      -->2  5  10  20  30  30  50  60  100
      -->2  5  10  20  22  30  50  60  100
```

3.Bubble Sorting

0 1 2 3 4 5 6 7

---->2 3 1 5 6 7 4 8

---->2 1 3 5 6 7 4 8 p1 sc = 4

---->1 2 3 5 6 7 4 8 p2 sc = 3

---->1 2 3 5 6 7 4 8 p3 sc = 1

---->1 2 3 4 5 6 7 8 p4 sc = 0

0 1 2 3 4 5 6 7

7 5 3 8 2 4 6 1

---->5 3 7 2 4 6 1 8 p1 sc= 6

---->3 5 2 4 6 1 7 8 p2 sc= 5

---->3 2 4 5 1 6 7 8 p3 sc=3

---->2 3 4 1 5 6 7 8 p4 sc=2

---->2 3 1 4 5 6 7 8 p5 sc=1

---->2 1 3 4 5 6 7 8 p6 sc=1

---->1 2 3 4 5 6 7 8 p7 sc=0

0 1 2 3 4 5 6 7

---->2 3 1 5 6 7 4 8

---->2 1 3 5 6 7 4 8

p1

sc = 4

---->1 2 3 5 6 7 4 8

p2

sc = 3

---->1 2 3 5 6 7 4 8

p3

sc = 1

---->1 2 3 4 5 6 7 8

p4

sc = 0

7 5 3 8 2 4 6 1

---->5 3 7 2 4 6 1 8

p1

sc= 6

---->3 5 2 4 6 1 7 8

p2

sc= 5

---->3 2 4 5 1 6 7 8

p3

sc=3

---->2 3 4 1 5 6 7 8

p4

sc=2

---->2 3 1 4 5 6 7 8

p5

sc=1

---->2 1 3 4 5 6 7 8

p6

sc=1

---->1 2 3 4 5 6 7 8

p7

sc=0

4.Merge Sorting

-----> Merge

In this we consider two or more sorted arrays in this concept.

arr1 :- 10 20 30 40 50

arr2 :- 2 4 5 7 15 25 30 60 100

Merged array is 2 4 5 7 10 15 20 25 30 30 40 50 60 100

---> set i,j,k=0

---> if A[i]<B[j] --> True

A[i] = C[k]

i++; k++;

False

B[j]= C[k]

j++;k++

---> copy remaining elements of either A or B into Array C

---> If we don't use the following loops after writing the above condition,

the result as 2 4 5 7 10 15 20 25 30 30 40 50 0 0
two merged arrays we didn't get last two sorted elements

we get
i.e; Since we have taken

while(j<m)

{res[k]=a2[j];

j++;

k++;}

while(i<n)

{res[k]=a1[i];

i++;

k++;

}

-----> Merge using Insertion

2 5 13 23 25 1 7 9 20 34

0 1 2 3 4 5 6 7 8 9

L M H

Take res =

0 0 0 0 0 0 0 0 0 0

0 1 2 3 4 5 6 7 8 9

i

j

--> 2 5 13 23 25 1 7 9 20 34

0 1 2 3 4 5 6 7 8 9

L M H 2>1

res =

0 0 0 0 0 0 0 0 0 0

0 1 2 3 4 5 6 7 8 9

k

i

j

p1-->2 5 13 23 25 1 7 9 20 34

0 1 2 3 4 5 6 7 8 9

L M H 2<7

res =

1 0 0 0 0 0 0 0 0 0

0 1 2 3 4 5 6 7 8 9

k

i

j

p2-->2 5 13 23 25 1 7 9 20 34

0 1 2 3 4 5 6 7 8 9

L M H 5<7

res =

1 2 0 0 0 0 0 0 0 0

0 1 2 3 4 5 6 7 8 9

k

i

j

p3-->2 5 13 23 25 1 7 9 20 34

0 1 2 3 4 5 6 7 8 9

L M H 13>7

res =

1 2 5 0 0 0 0 0 0 0

0 1 2 3 4 5 6 7 8 9

k

i

j

p4-->2 5 13 23 25 1 7 9 20 34

0 1 2 3 4 5 6 7 8 9

L M H 13>9

res =

1 2 5 7 0 0 0 0 0 0

0 1 2 3 4 5 6 7 8 9

k

i

		j									
p5-->	2	5	13	23	25	1	7	9	20	34	
	0	1	2	3	4	5	6	7	8	9	
L						M					H
res =											13<20
	1	2	5	7	9	0	0	0	0	0	
	0	1	2	3	4	5	6	7	8	9	
						k					

	i					j					
p6-->	2	5	13	23	25	1	7	9	20	34	
	0	1	2	3	4	5	6	7	8	9	
	L				M				H		23>20
res =											
	1	2	5	7	9	13	0	0	0	0	
	0	1	2	3	4	5	6	7	8	9	
	k										

i										j
p7-->2	5	13	23	25	1	7	9	20	34	
0	1	2	3	4	5	6	7	8	9	
L				M					H	23<34
res =										
1	2	5	7	9	13	20	0	0	0	
0	1	2	3	4	5	6	7	8	9	
										k

[illegible]

```

          i
          j
-->2  5  13  23  25  1  7  9  20  34
     0  1  2  3  4  5  6  7  8  9
     L          M          H
res =

```

1	2	5	7	9	13	20	23	25	34
0	1	2	3	4	5	6	7	8	9

k

```

arr[i] > arr[j]  -->  true    then  res[k] = arr[j]    j++,k++
                    -->false    then  res[k] = arr[i]    i++,k++

```

2	5	13	23	25	1	7	9	20	34		
0	1	2	3	4	5	6	7	8	9		
L				M					H		
Take res =											
0	0	0	0	0	0	0	0	0	0		
0	1	2	3	4	5	6	7	8	9		
i											
-->	2	5	13	23	25	j	7	9	20	34	
	0	1	2	3	4	5	6	7	8	9	
	L				M					H	
res =											
0	0	0	0	0	0	0	0	0	0		
0	1	2	3	4	5	6	7	8	9		
k											
i											
p1-->	2	5	13	23	25	1	j	7	9	20	34
	0	1	2	3	4	5	6	7	8	9	
	L				M						H
res =											
1	0	0	0	0	0	0	0	0	0	0	
0	1	2	3	4	5	6	7	8	9		
k											
i											
p2-->	2	5	13	23	25	1	j	7	9	20	34
	0	1	2	3	4	5	6	7	8	9	
	L				M						H
res =											
1	2	0	0	0	0	0	0	0	0	0	
0	1	2	3	4	5	6	7	8	9		
k											
i											
p3-->	2	5	13	23	25	1	j	7	9	20	34
	0	1	2	3	4	5	6	7	8	9	
	L				M						H
res =											
1	2	5	0	0	0	0	0	0	0	0	
0	1	2	3	4	5	6	7	8	9		
k											
i											
p4-->	2	5	13	23	25	1	7	j	9	20	34
	0	1	2	3	4	5	6	7	8	9	
	L				M						H
res =											
1	2	5	7	0	0	0	0	0	0	0	
0	1	2	3	4	5	6	7	8	9		
k											

2>1

2<7

5<7

13>7

13>9

```

      i
p5--> 2  5  13  23  25  1  7  9  j
      0  1  2  3  4  5  6  7  20 34
      L      M      H      13<20
      res =
      1  2  5  7  9  0  0  0  0  0
      0  1  2  3  4  5  6  7  8  9
      k

```

```

      i
p6--> 2  5  13  23  25  1  7  9  j
      0  1  2  3  4  5  6  7  20 34
      L      M      H      23>20
      res =
      1  2  5  7  9  13  0  0  0  0
      0  1  2  3  4  5  6  7  8  9
      k

```

```

      i
p7--> 2  5  13  23  25  1  7  9  j
      0  1  2  3  4  5  6  7  20 34
      L      M      H      23<34
      res =
      1  2  5  7  9  13  20  0  0  0
      0  1  2  3  4  5  6  7  8  9
      k

```

```

      i
p8--> 2  5  13  23  25  1  7  9  j
      0  1  2  3  4  5  6  7  20 34
      L      M      H      25<34
      res =
      1  2  5  7  9  13  20  23  0  0
      0  1  2  3  4  5  6  7  8  9
      k

```

```

      i
p9--> 2  5  13  23  25  1  7  9  j
      0  1  2  3  4  5  6  7  20 34
      L      M      H
      res =
      1  2  5  7  9  13  20  23  25  0
      0  1  2  3  4  5  6  7  8  9
      k

```

```

      i
--> 2  5  13  23  25  1  7  9  j
   0  1  2  3  4  5  6  7  20 34
   L      M      H
   res =
   1  2  5  7  9  13  20  23  25  34
   0  1  2  3  4  5  6  7  8  9
   k

```

5.Quick Sort:

if $\text{arr}[i] < \text{arr}[p] \rightarrow \text{swap}(\text{arr}[i], \text{arr}[j])$ $i++$ $j++$

False $\rightarrow i++$

$\text{swap}(\text{arr}[j], \text{arr}[p])$

Here j represents the largest element left to the pivot element

