Merge Sort:

A)

| 12 | 34 | 54 | 2 | 3 | 4 | 25 | 6 | 87 | 23 |

| 12 | 34 | 54 | 2 | 3 |

| 4 | 25 | 6 | 87 | 23 |

| 12 | 34 | 54 | | 2 | 3 |

| 4 | 25 | 6 | | 87 | 23 |

| 12 | 34 | | 54 | | 2 | | 3 |

| 4 | 25 | | 6 | | 87 | | 23 |

| 12 | | 34 | | 54 | | 2 | | 3 |

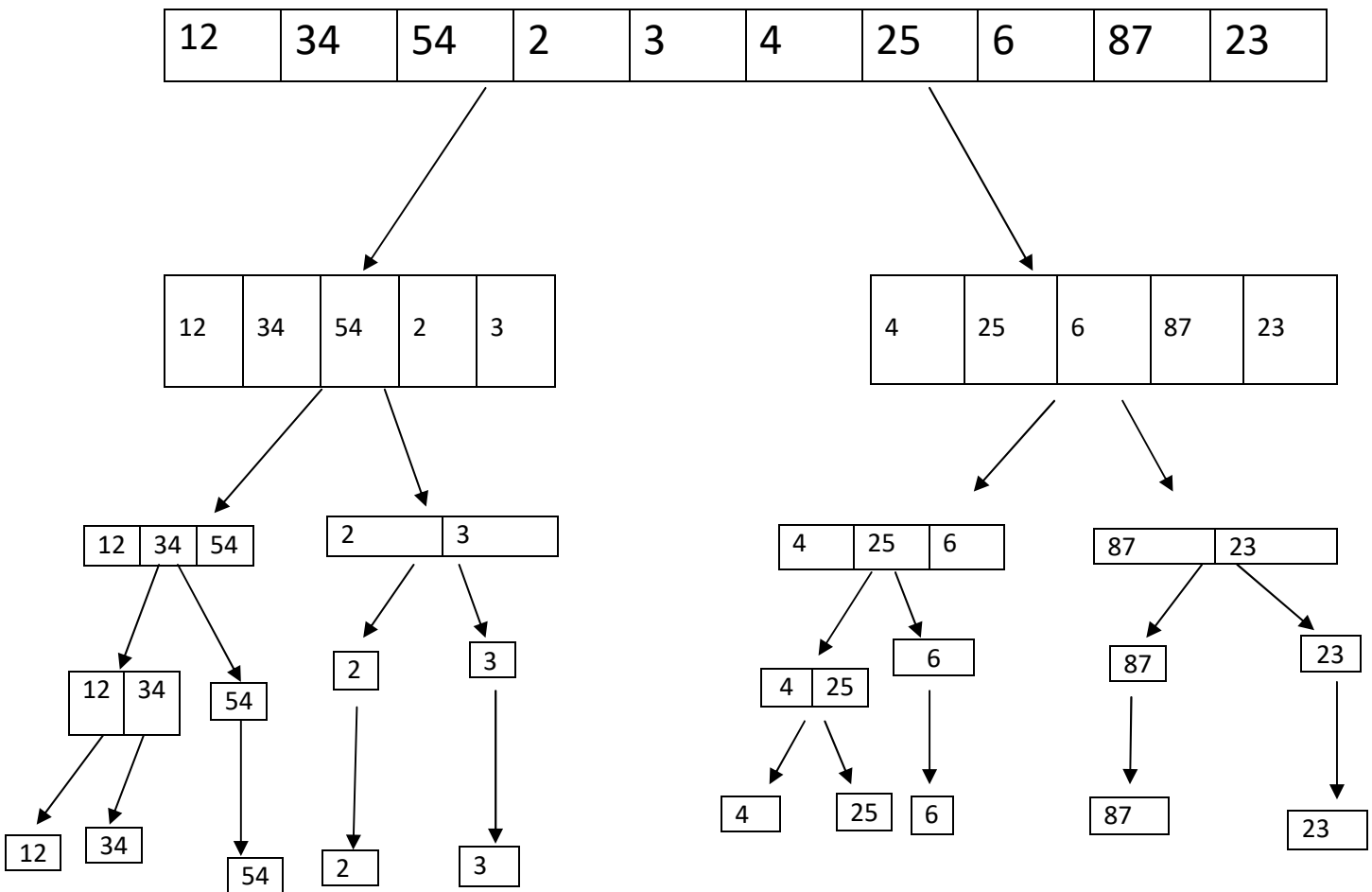| 4 | | 25 | | 6 | | 87 | | 23 |

1.Compare(12-34)

2.Compare(12-54)

3.Compare(2-3)

4.Compare(4-25)

5.Compare(4-6)

6.Compare(87-23)

   12 34 54 2 3 | 4 6 25 23 87

7.Compare(12-34)

8.Compare(12-54)

9.Compare(12-2) Displacement=1   { 2 34 54 12 3}

10.Compare(2-3)

11.Compare(34-54)

12.Compare(34-12) Displacement=2   { 2 12 54 34 3}

13.Compare(54-34)   Displacement=3   { 2 12 34 54 3}

14.Compare(54-3)   Displacement=4   { 2 12 34 3 54}

15.Compare(34-3) Displacement=5   { 2 12 3 34 54}

16.Compare(12-3) Dispalecement=6   {2 3 12 34 54}

17.Compare(2-3)

                    {2 3 12 34 54} | {4 6 25 23 87}

18.Compare(4-6)

19.Compare(4-25)

20.Compare(4-23)

21.Compare(4-87)

22.Compare(6-25)

23.Compare(6-23)

24.Compare(6-87)

25.Compare(6-25)

26.Compare(6-23)

27.Compare(6-87)

28.Compare(25-23)   Displacement=7   {4 6 23 25 87}

29.Compare(25-87)

                    {2 3 12 34 54} | {4 6 23 25 87}

30.Compare(2-4)

31.Compare(3-4)

32.Compare(12-4) Displacement=8   {2 3 4 34 54} | {12 6 23 25 87}

33.Compare(4-6)

34.Compare(4-23)

35.Compare(4-25)

36.Compare(4-87)

37.Compare(34-12) Displacement=9   {2 3 4 12 54} | {34 6 23 25 87}

38.Compare(12-6) Displacement=10   {2 3 4 6 54} | {34 12 23 25 87}

39.compare(54-34) Displacement=11   {2 3 4 6 34} | {54 12 23 25 87}

40.Compare(34-12) Displacement=12   {2 3 4 6 12} | {54 34 23 25 87}

41.Compare(54-34) Displacement=13   {2 3 4 6 12} | {34 54 23 25 87}

42.Compare(54-23) Displacement=14   {2 3 4 6 12} | {34 23 54 25 87}

43.Compare(23-34) Displacement=15   {2 3 4 6 12} | {23 34 54 25 87}

44.Compare(54-25) Displacement=16   {2 3 4 6 12} | {23 34 25 54 87}

45.Compare(34-25) Displacement=17   {2 3 4 6 12} | {23 25 34 54 87}
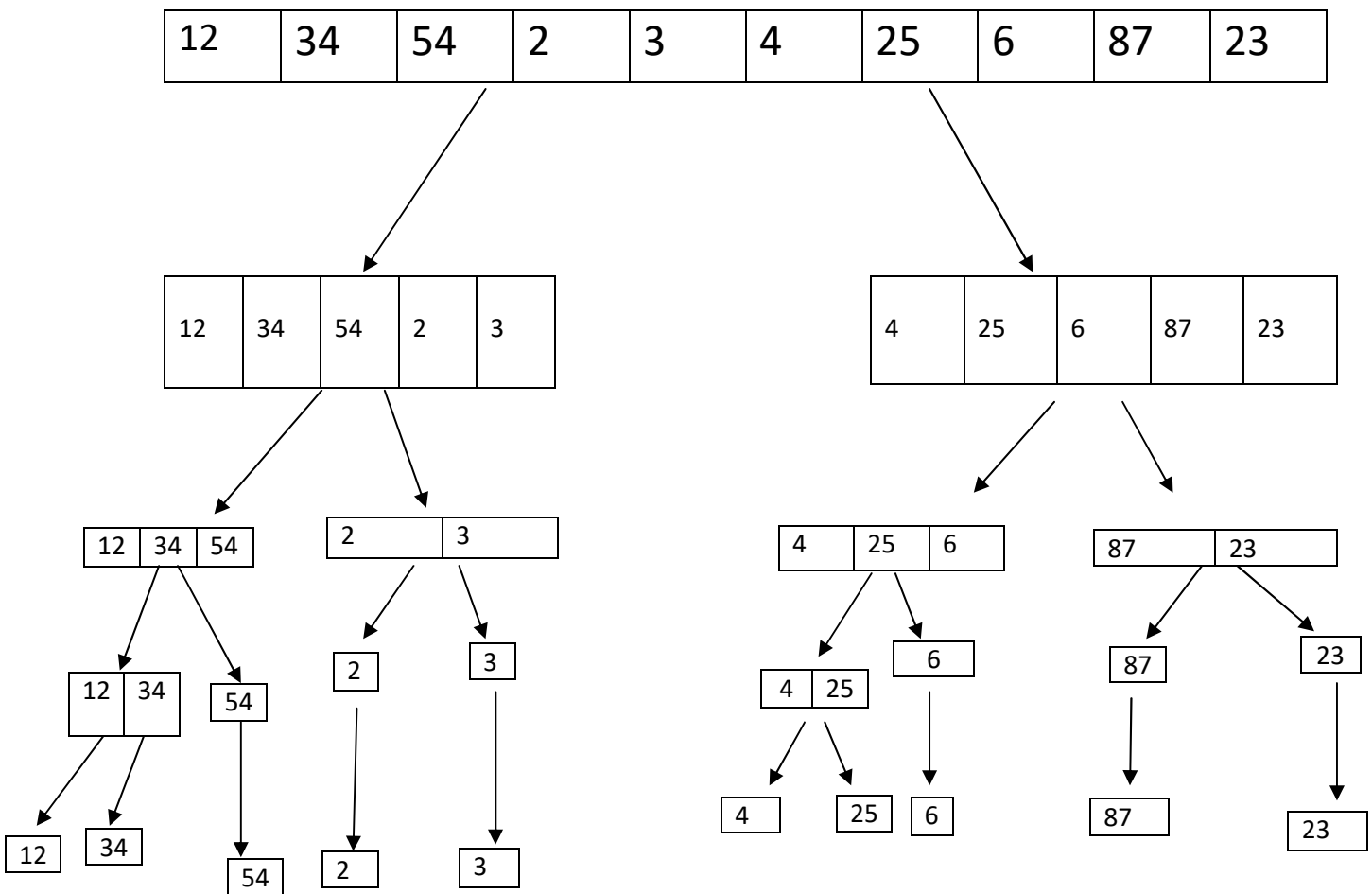
46.Compare(54-87)

Sorted Array:

                2 3 4 6 12 23 25 34 54 87

Displacement=17

Compare=46

B)

| 12 | 34 | 54 | 2 | 3 | 4 | 25 | 6 | 87 | 23 |

| 12 | 34 | 54 | 2 | 3 |

| 4 | 25 | 6 | 87 | 23 |

| 12 | 34 | 54 |

| 2 | 3 |

| 4 | 25 | 6 |

| 87 | 23 |

| 12 | 34 |

| 54 |

| 2 |

| 3 |

| 4 | 25 |

| 6 |

| 87 |

| 23 |

| 12 |

| 34 |

| 54 |

| 2 |

| 3 |

| 4 |

| 25 |

| 6 |

| 87 |

| 23 |

1.compare=12-34   (Displacement=1)

2.compare=2-3   (Displacement=2)

3.compare=4-25   (Displacement=3)

4.compare=87-23

34-12-54-3-2 | 25-4-6-87-23

5.compare=34-54   (Displacement=4)

6.compare=54-3

54-34-12-3-2

7.compare=25-6

8.compare=4-6   (Displacement=5)

25-6-4

9.compare=25-87   (Displacement=6)

10.compare=25-23

11.compare=6-23   (Displacement=7)

87-25-23-6-4

54-34-12-3-2 87-25-23-6-4

12.compare=54-87   (Displacement=8)

13.compare=54-25

14.compare=34-25

15.compare=12-25   (Displacement=9)

16.compare=12-23   (Displacement=10)

17.compare=12-6

18.compare=3-6

19.compare=3-4

Sorted array(from large to small):

87-54-34-25-23-12-6-4-3-2

Compare->19

Displacement→10

c)   C = {5, 2, 13, 9, 1, 7, 6, 8, 1, 15, 4, 11}

{5,2,13,9,1,7}   {6,8,1,15,4,11}

{5,2,13}   {9,1,7}   {6,8,1}   {15,4,11}

{5,2}   {13}   {9,1}   {7}   {6,8}   {1}   {15,4} {11}

5   2   13   9   1   7   6   8   1   15   4   11

1.compare=5-2   (Displacement=1)

2.compare=2-13

3.compare=5-13

(2-5-13)

4.compare=1-9

5.compare=1-7

6.compare=9-7   (Displacement=2)

(1-7-9)

7.compare=6-8

8.compare=1-6

9.compare=1-8

(1-6-8)

10.compare=15-4   (Displacement=3)

11.compare=4-11

12.compare=11-15

(4-11-15)

(2-5-13)   (1-7-9)   (1-6-8)   (4-11-15)

13.compare=1-2

14.compare=2-7

15.compare=5-7

16.compare=13-7   (Displacement=4)

17.compare=13-9   (Displacement=5)

(1-2-5-7-9-13)

18.compare=1-4

19.compare=4-6

20.compare=6-11

21.compare=8-11

(1-4-6-11-15)

22.compare=1-1

23.compare=2-4

24.compare=4-5

25.compare=5-6

26.compare=6-7

27.compare=7-11

28.compare=9-11

29.compare=11-13

30.compare=13-15

Sorted array

1 1 2 4 5 6 7 8 9 11 13 15

Compare→30   Displacement→11

D) D = {'S', 'B', 'I', 'M', 'H', 'Q', 'C', 'L', 'R', 'E', 'P', 'K'}

{'S', 'B', 'I', 'M', 'H', 'Q'}   {'C', 'L', 'R', 'E', 'P', 'K'}

{'S', 'B', 'I'}   {'M', 'H', 'Q'}   {'C', 'L', 'R'}   {'E', 'P', 'K'}

{'S', 'B'} {'I'}   {'M', 'H'} {'Q'}   {'C', 'L'} {'R'}   {'E', 'P'} {'K'}

{'S'} {'B'} | {'I'}   {'M'}{'H'}{'Q'}   {'C'}{'L'} | {'R'} {'E'}{'P'} | {'K'}
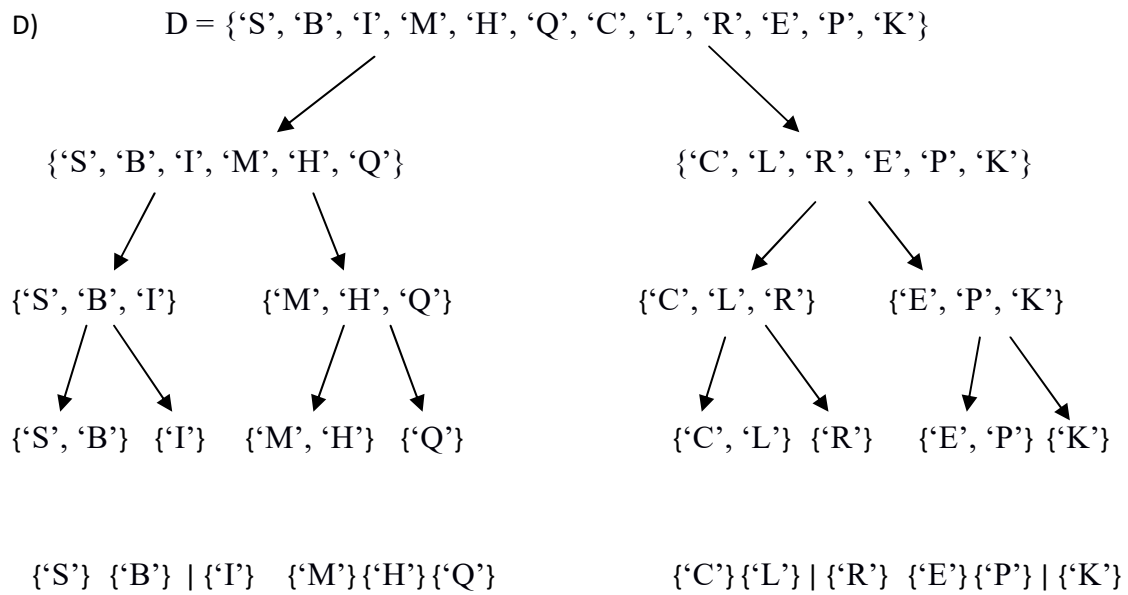
1.compare=S-B

2.compare=S-I

3.compare=B-I

(B-I-S)

4.compare=M-H

5.compare=M-Q

6.compare=H-Q

(H-Q-M)

7.compare=C-L

8.compare=C-R

9.compare=L-R

(C-L-R)

10.compare=E-P

11.compare=P-K

12.compare=E-K

(E-K-P)

13.compare=B-H

14.compare=I-H

15.compare=I-Q

16.compare=Q-S

17.compare=S-M

(B-H-I-M-Q-S)

18.compare=C-E

19.compare=E-L

20.compare=L-K

21.compare=L-P

22. .compare=P-R

(C-E-K-L-P-R)

23.compare=B-C

24.compare=C-H

25.compare=H-E

26.compare=H-K

27.compare=K-I

28.compare=K-M

29.compare=M-L

30.compare=M-P

31.compare=P-Q

32.compare=Q-R
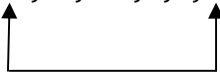
33.compare=R-S

Sorted array

B-C-E-H-I-K-L-M-P-Q-R-S

SHELLSORT

A) {12,34, 54,2,3,4,25,6, 87, 23}

1.Compare=(12-4) /1.Displacements

1.Compare=(34-25) >>{4 ,34, 54, 2 ,3, 12, 25, 6, 87, 23}

2.Displacement

2.Compare(54-6) >> {4 ,25, 54, 2 ,3, 12, 34, 6, 87, 23}

3.Displacement

3.Compare(2-87) >> {4 ,25, 6, 2 ,3, 12, 34, 54, 87, 23}

4.Compare(3-23) >> {4 ,25, 6, 2 ,3, 12, 34, 54, 87, 23}

 Gap Value=2

 {4 ,25, 6, 2 ,3, 12, 34, 54, 87, 23}

6.Compare(25-2)>>{4,25, 6, 2, 3, 12 ,34, 54, 87, 23}

4.Displacement

7.Compare(6-3) >> {4, 2, 6, 25, 3, 12 ,34, 54, 87, 23}

5.Displacement

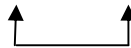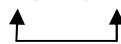8.Compare(25-12) >>{4, 2,3, 25, 6, 12 ,34, 54, 87, 23}

6.Displacement

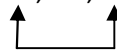9.Compare(6-34)>> {4, 2, 3, 12, 6, 25 , 34, 54, 87, 23}
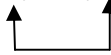
10.Compare(25-54)>> {4, 2, 3, 12, 6, 25 , 34, 54, 87, 23}

11.Compare(34-87)>> {4, 2, 3, 12, 6, 25 , 34, 54, 87, 23}

12.Compare(54-23)>> {4, 2, 3, 12, 6, 25 , 34, 54, 87, 23}

7.Displacement

{4, 2, 3, 12, 6, 25 , 34, 23, 87, 54}

Gap Value=1

13.Compare(4-2)>{4, 2, 3, 12, 6, 25 , 34, 23, 87, 54}

8.Displacement

14.Compare(4-3) >>{2, 4, 3, 12, 6, 25 , 34, 23, 87, 54}

9.Displacement

15.Compare(4-12)>>{2, 3, 4, 12, 6, 25 , 34, 23, 87, 54}

16.Compare(12-6)>>{2, 3, 4, 12, 6, 25 , 34, 23, 87, 54}

10.Displacement

17.Compare(12-25))>>{2, 3, 4, 6, 12, 25 , 34, 23, 87, 54}

18.Compare(34-25))>>{2, 3, 4, 6, 12, 25 , 34, 23, 87, 54}

19.Compare(34-23))>>{2, 3, 4, 6, 12, 25 , 34, 23, 87, 54}
                                          ↑ ↑

Displacement =10+2=12

{2, 3, 4, 6, 12, 23 , 25, 34, 87, 54}

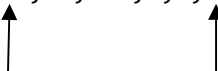20.Compare(87-54)>> {2, 3, 4, 6, 12, 23 , 25, 34, 87, 54}
                                               ↑ ↑

Displacement=12+1=13

Sorted Array:
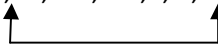
{2, 3, 4, 6, 12, 23 , 25, 34, 54, 87}

Displacement=13
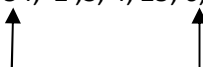
Compare=20
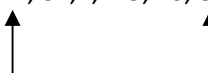
B） {12,34, 54,2,3,4,25,6, 87, 23}

1.Compare=(12-4)

1.Compare=(34-25) >>{12 ,34, 54, 2 ,3, 4, 25, 6, 87, 23}

2.Compare(54-6) >> {12 ,34, 54, 2 ,3, 4, 25, 6, 87, 23}

3.Compare(2-87) >> {12,34,54, 2 , 3 ,4, 25,   6, 87, 23}

Displacement=1

4.Compare(3-23) >> {12,34, 54,87,3, 4, 25, 6, 2, 23}

Displacement=2

                (12,34, 54,87,23, 4, 25, 6, 2, 3)

 Gap Value=2

                (12, 34, 54, 87, 23, 4, 25, 6, 2, 3)

6.Compare(12-54)>>(12, 34, 54, 87, 23, 4, 25, 6, 2, 3)

Displacement=3

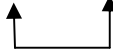7.Compare(34-87) > > (54, 34, 12, 87, 23, 4, 25, 6, 2, 3)

Displacement=4

8.Compare(23-12) >> (54, 87,12, 34, 23, 4, 25, 6, 2, 3)

Displacement=5

9.Compare(4-34)   >> (54, 87, 23,34, 12, 4,25, 6, 2, 3)

10.Compare(25-12)>> (54, 87, 23,34, 12, 4,25, 6, 2, 3)

Displacement=6

11.Compare(4-6)>> (54, 87, 23, 34, 25, 4,12, 6, 2, 3)

Displacement=7

12.Compare(12-2)>> (54, 87, 23, 34, 25, 6,12, 4, 2, 3)

(54, 87, 23, 34, 25, 6,12, 4, 2, 3)

Gap Value=1

13.Compare(54-87)> (54, 87, 23, 34, 25, 6,12, 4, 2, 3)

Displacement=8

14.Compare(54-3) >>(87, 54,23, 34, 25, 6,12, 4, 2, 3)

15.Compare(34-23)>> (87, 54, 23, 34, 25, 6,12, 4, 2, 3)

16.Compare(12-6)>>{2, 3, 4, 12,   6, 25 , 34, 23, 87, 54}

10.Displacements

17.Compare(12-25))>>{2, 3, 4, 6,   12, 25 , 34, 23, 87, 54}

18.Compare(34-25))>>{2, 3, 4, 6,   12, 25 , 34, 23, 87, 54}

19.Compare(34-23))>>{2, 3, 4, 6, 12, 25 , 34, 23, 87, 54}

Displacement =10+2=12

{2, 3, 4, 6, 12, 23 , 25, 34, 87, 54}

20.Compare(87-54)>> {2, 3, 4, 6, 12, 23 , 25, 34, 87, 54}

Displacement=12+1=13

Sorted Array:

{2, 3, 4, 6, 12, 23 , 25, 34, 54, 87}

Displacement=13

Compare=20

C = {5, 2, 13, 9, 1, 7, 6, 8, 1, 15, 4, 11}

Gap Value=12/2=6
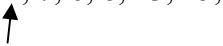
1.Compare(5-6){5, 2, 13, 9, 1, 7, 6, 8, 1, 15, 4, 11}

2.Compare(2-8)>> {5, 2, 13, 9, 1, 7, 6, 8, 1, 15, 4, 11}

3.Compare(13-1)>> {5, 2, 13, 9, 1, 7, 6, 8, 1, 15, 4, 11}

Displacement=1

4.Compare(9-15)>> {5, 2, 1, 9, 1, 7, 6, 8, 13, 15, 4, 11}

5.Compare(1-4)>> {5, 2, 1, 9, 1, 7, 6, 8, 13, 15, 4, 11}

6.Compare(7-11)>> {5, 2, 1, 9, 1, 7, 6, 8, 13, 15, 4, 11}

{5, 2, 1, 9, 1, 7, 6, 8, 13, 15, 4, 11}

Gap Value=3

7.Compare(5-9)>> {5, 2, 1, 9, 1, 7, 6, 8, 13, 15, 4, 11}

8.Compare(2-1)>> {5, 2, 1, 9, 1, 7, 6, 8, 13, 15, 4, 11}

Displacement=2

9.Compare(1-7)>> {5, 1, 1, 9, 2, 7, 6, 8, 13, 15, 4, 11}

10.Compare(9-6)>> {5, 2, 1, 9, 1, 7, 6, 8, 13, 15, 4, 11}

Displacement=3

11.Compare(1-8)>>{5, 2, 1, 6, 1, 7, 9, 8, 13, 15, 4, 11}

12.Compare(7-13)>> {5, 2, 1, 6, 1, 7, 9, 8, 13, 15, 4, 11}

13.Compare(9-15)>> {5, 2, 1, 6, 1, 7, 9, 8, 13, 15, 4, 11}

14.Compare(8-4)>> {5, 2, 1, 6, 1, 7, 9, 8, 13, 15, 4, 11}

Displacement=4

15.Compare(13-11)>> {5, 2, 1, 6, 1, 7, 9, 4, 13, 15, 8, 11}

Displacement=5

{5, 2, 1, 6, 1, 7, 9, 4, 11, 15, 8, 13}

Gap Value=1

16.Compare(5-2)>> {5, 2, 1, 6, 1, 7, 9, 4, 13, 15, 8, 11}

Displacement=6

17.Compare(5-1 || 2-1)>>{2, 5, 1, 6, 1, 7, 9, 4, 13, 15, 8, 11}

Displacement=7

Displacement=8

19.Compare(5-6)>> {1, 2, 5, 6, 1, 7, 9, 4, 11, 15, 8, 13}

20.Compare(6-1)>> {1, 2, 5, 6, 1, 7, 9, 4, 11, 15, 8, 13}

20.Compare+4Compare=(24Compare)

Displacement=11

25.Compare(6-7)>>{1, 1, 2, 5, 6, 7, 9, 4, 11, 15, 8, 13}

26.Compare(7-9)>> {1, 1, 2, 5, 6, 7, 9, 4, 11, 15, 8, 13}

27.Compare(9-4)>>{1, 1, 2, 5, 6, 7, 9, 4, 11, 15, 8, 13}

+5 Compare=(32Compare)

+4 Displacement=11+4=15

33.Compare(9-11)>>{1, 1, 2, 4, 5, 6, 7, 9, 11, 15, 8, 13}

34.Compare(11-15)>>{1, 1, 2, 4, 5, 6, 7, 9, 11, 15, 8, 13}

35.Compare(15-8)>>{1, 1, 2, 4, 5, 6, 7, 9, 11, 15, 8, 13}

+4Compare=(39Compare)

+3Displacement=15+3=18

40.Compare(15-13)>>{1, 1, 2, 4, 5, 6, 7, 8,9, 11, 15, 13}

+2Compare= 42Compare

Displacement=19

Sorted Array:

$$\{1, 1, 2, 4, 5, 6, 7, 8,9, 11, 13, 15\}$$

42->Compare

19->Displacement

D = {'S', 'B', 'I', 'M', 'H', 'Q', 'C', 'L', 'R', 'E', 'P', 'K'}

Gap Value=6

1.Compare(S-C)>>{'S', 'B', 'I', 'M', 'H', 'Q', 'C', 'L', 'R', 'E', 'P', 'K'}

Displacement=1

2.Compare(B-L)>>{'C', 'B', 'I', 'M', 'H', 'Q', 'S', 'L', 'R', 'E', 'P', 'K'}

3.Compare(I-R)>>{'C', 'B', 'I', 'M', 'H', 'Q', 'S', 'L', 'R', 'E', 'P', 'K'}

4.Compare(M-E)>>{'C', 'B', 'I', 'M', 'H', 'Q', 'S', 'L', 'R', 'E', 'P', 'K'}
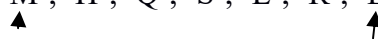
Displacement=2

5.Compare(H-P)>>{'C', 'B', 'I', 'E', 'H', 'Q', 'S', 'L', 'R', 'M, 'P', 'K'}

6.Compare(Q-K)>> {'C', 'B', 'I', 'E', 'H', 'Q', 'S', 'L', 'R', 'M, 'P', 'K'}

Displacement=3

{'C', 'B', 'I', 'E', 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

Gap Value=3

7.Compare(C-E)>> {'C', 'B', 'I', 'E', 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}
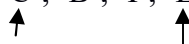
8.Compare(B-H)>> {'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

9.Compare(I-K)>> {'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

10.Compare(E-S)>> {'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

11.Compare(H-L)>> {'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

12.Compare(K-R)>> {'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

13.Compare(S-M)>> {'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

Displacement=4

14.Compare(L-P)>> {'C', 'B', 'I', 'E, 'H', 'K, 'M, 'L', 'R', 'S, 'P', 'Q}

15.Compare(Q-R)>> {'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'R', 'M, 'P', 'Q}

Displacement=5

{'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

Gap Value=1

16.Compare(C-B)>>{'C', 'B', 'I', 'E, 'H', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

Displacement=6

17.Compare(C-I)>>{'B', 'C', 'I', 'E, 'H', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

18.Compare (I-E)>> {'B', 'C', 'I', 'E, 'H', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

Displacement=7

19.Compare(I-H)>>{'B', 'C', 'E', 'I, 'H', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

Displacement=8

20.Compare(I-K)>>{'B', 'C', 'E', 'H, 'I', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

21.Compare(K-S)>> {'B', 'C', 'E', 'I, 'H', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

22.Compare(S-L)>>{'B', 'C', 'E', 'I, 'H', 'K, 'S', 'L', 'Q, 'M, 'P', 'R}

Displacement=9

23.Compare(S-Q)>>{'B', 'C', 'E', 'I, 'H', 'K, 'L', 'S', 'Q, 'M, 'P', 'R}

Displacement=10

24.Compare(S-M)>>{'B', 'C', 'E', 'I, 'H', 'K, 'L', 'Q', 'S, 'M', 'P', 'R}

+3 Compare =27 Compare

+2 Displacement=12 Displacement

28.Compare(S-P)>>{'B', 'C', 'E', 'I, 'H', 'K, 'L', 'M', 'Q, 'S', 'P', 'R}

+3Compare=31 Compare

+2 Displacement=14 Displacement

32.Compare(S-R)>>{'B', 'C', 'E', 'I, 'H', 'K, 'L', 'M', 'P, 'Q', 'S', 'R}

Displacement=15

Sorted Array:

{'B', 'C', 'E', 'I, 'H', 'K, 'L', 'M', 'P, 'Q', 'R', 'S'}

32->Compare

15->Displacement

Quick Sort

A) {12,34, 54,2,3,4,25,6, 87, 23}
   ↑Left   ↑ right

Pivot=12

Swap the pivot with element in the middle(Displacement=1)

{34,54,2,3,4,12,25,6,87,23}
   ↑   ↑
              Pivot

1.Compare(12-34)>> {54,2,3,4,12,34,25,6,87,23}

Displacement=2

2.Compare(12-23)>> {54,2,3,4,12,34,25,6,87,23}
                           ↑   ↑
3.Compare(54-12)>> {2,3,4,12,34,54,25,6,87,23}

Displacement=3

4.Compare(2-12)>> {2,3,4,12,34,54,25,6,87,23}
                     ↑   ↑

5.Compare(3-12)>> {2,3,4,12,34,54,25,6,87,23}

6.Compare(4-12)>> {2,3,4,12,34,54,25,6,87,23}

7.Compare(87-12)>> {2,3,4,12,34,54,25,6,87,23}

8.Compare(12-6)>> {2,3,4,12,34,54,25,6,87,23}
                        ↑   ↑

Displacement=4

9.Compare(25-12)>>{2,3,4,6,12,34,54,25,87,23}

10.Compare(54-12)>>{2,3,4,6,12,34,54,25,87,23}

Pivot=2   {2,3,4,6,12,34,54,25,87,23}
                ↑

11.Compare(2-3)>> {2,3,4,6,12,34,54,25,87,23}

12.Compare(2-4)>> {2,3,4,6,12,34,54,25,87,23}

13.Compare(2-6)>> {2,3,4,6,12,34,54,25,87,23}

Pivot=3   {2,3,4,6,12,34,54,25,87,23}
                  ↑

14.Compare(3-4)>> {2,3,4,6,12,34,54,25,87,23}

15.Compare(3-6)>> {2,3,4,6,12,34,54,25,87,23}

Pivot=34   {2,3,4,6,12,34,54,25,87,23}
                            ↑

Displacement=5

               {2,3,4,6,12,54,25,34,87,23}
                            ↑

16.Compare(34-54)>> {2,3,4,6,12,25,34,54,87,23}

Displacement=6

17.Compare(34-25)>> {2,3,4,6,12,25,34,54,87,23}

18.Compare(34-87)>> {2,3,4,6,12,25,34,54,87,23}

19.Compare(34-23)>> {2,3,4,6,12,25,23,34,54,87}

Pivot=25   {2,3,4,6,12,25,23,34,54,87}
                         ↑

20.Compare(25-23) {2,3,4,6,12,23,25,34,54,87}

Displacement=7

Pivot=54   {2,3,4,6,12,23,25,34,54,87}
                                  ↑

21.Compare(54-87)>> {2,3,4,6,12,23,25,34,54,87}

B) {12,34, 54,2,3,4,25,6, 87, 23}

Pivot=12

Swap the pivot with element in the middle(Displacement=1)

{34,54,2,3,4,12,25,6,87,23}

1.Compare(34-12)>> {34,54,2,3,4,12,25,6,87,23}

2.Compare(12-23)>> {34,54,2,3,4,12,25,6,87,23}

Displacement=2

3.Compare(12-87)>>{34,54,2,3,4,23,12,25,6,87}

Displacement=3

4.Compare(12-)>>{34,54,2,3,4,23,87,12,25,6}

5.Compare(12-25)>>{34,54,2,3,4,23,87,12,25,6}

Displacement=4

6.Compare(12-6)>>{34,54,2,3,4,23,87,25,12,6}

7.Compare(12-54)>>{34,54,2,3,4,23,87,25,12,6}

8.Compare(12-2)>>{34,54,2,3,4,23,87,25,12,6}

Displacement=5

9.Compare(12-3)>>{34,54,3,4,23,87,25,12,6,2}

Displacement=6

10.Compare(12-4)>>{34,54,4,23,87,25,12,6,2,3}

Displacement=7

11.Compare()>>{34,54,23,87,25,12,6,2,3,4}

Pivot=34

$$\{34,54,23,87,25,12,6,2,3,4\}$$

12.Compare(54-34)>> {34,54,23,87,25,12,6,2,3,4}

Displacement=8

13.Compare(34-23)>>{54,34,23,87,25,12,6,2,3,4}

14.Compare(34-87)>> {54,34,23,87,25,12,6,2,3,4}

Displacement=9

15.Compare(34-25)>>{87,54,34,23,25,12,6,2,3,4}

Pivot=23

$$\{87,54,34,23,25,12,6,2,3,4\}$$

16.Compare(23-25)>> {87,54,34,25,23,12,6,2,3,4}

Displacement=10

$$\{87,54,34,25,23,12,6,2,3,4\}$$

Pivot=6

17.Compare(6-2)>> {87,54,34,25,23,12,6,2,3,4}

18.Compare(6-3)>>{87,54,34,25,23,12,6,2,3,4}

19.Compare(6-4)>> {87,54,34,25,23,12,6,2,3,4}

Pivot=2

20.Compare(2-3)>> {87,54,34,25,23,12,6,2,3,4}

Displacement=11

21.Compare(2-4)>>{87,54,34,25,23,12,6,3,2,4}

Displacement=12

$$\{87,54,34,25,23,12,6,3,4,2\}$$

Pivot=3

22.Compare(3-4)>> {87,54,34,25,23,12,6,3,4,2}

Displacement=13

23.Compare(3-2)>>{87,54,34,25,23,12,6,4,3,2}

```
Sorted Array:
```

$$\{87, 54, 34, 25, 23, 12, 6, 4, 3, 2\}$$

```
Compare→23

Displacement→13
```

$$C = \{5, 2, 13, 9, 1, 7, 6, 8, 1, 15, 4, 11\}$$

```
Pivot=5
```

Swap the pivot with element in the middle(Displacement=1)

$$C = \{2, 13, 9, 1, 7,5, 6, 8, 1, 15, 4, 11\}$$

1.Compare(2-5)>> { 2, 13, 9, 1, 7,5, 6, 8, 1, 15, 4, 11}

2.Compare(5-11)>> { 2, 13, 9, 1, 7,5, 6, 8, 1, 15, 4, 11}

3.Compare(5-13)>> { 2, 13, 9, 1, 7,5, 6, 8, 1, 15, 4, 11}

Displacement=1

4.Compare(5-4)>>{ 2, 9, 1, 7,5, 13,6, 8, 1, 15, 4, 11}

Displacement=2

5.Compare(5-9)>>{ 2, 9, 1, 7,4,5, 13,6, 8, 1, 15, 11}

Displacement=3

6.Compare(5-15)>>{ 2, 1, 7,4,5, 9,13,6, 8, 1, 15, 11}

7.Compare(5-1)>> { 2, 1, 7,4,5, 9,13,6, 8, 1, 15, 11}

8.Compare(5-1)>> { 2, 1, 7,4,5, 9,13,6, 8, 1, 15, 11}

Displacement=4

9.Compare(5-7)>>{ 2, 1, 7,4.1,5, 9,13,6, 8, 15, 11}

Displacement=5

10.Compare(5-8)>>{ 2, 1,4,1,5,7, 9,13,6, 8, 15, 11}

11.Compare(5-6)>> { 2, 1,4,1,5,7, 9,13,6, 8, 15, 11}

Pivot=2

{ 2, 1,4.1,5,7, 9,13,6, 8, 15, 11}
⬆

Swap the pivot with element in the middle(Displacement=6)

{ 1,4,2,1,5,7, 9,13,6, 8, 15, 11}
▲

12.Compare(2-1)>> { 1,4,2,1,5,7, 9,13,6, 8, 15, 11}

13.Compare(2-4)>> { 1,4,2,1,5,7, 9,13,6, 8, 15, 11}

Displacement=7

14.Compare(2-1)>>{ 1,2,4,1,5,7, 9,13,6, 8, 15, 11}

Displacement=8

{ 1,1,2,4,5,7, 9,13,6, 8, 15, 11}

Pivot=7

15.Compare(7-9)>> { 1,1,2,4,5,7, 9,13,6, 8, 15, 11}

16.Compare(7-13)>> { 1,1,2,4,5,7, 9,13,6, 8, 15, 11}

17.Compare(7-6)>> { 1,1,2,4,5,6,7, 9,13, 8, 15, 11}

Displacement=9

18.Compare(7-8)>> { 1,1,2,4,5,6,7, 9,13, 8, 15, 11}

19.Compare(7-15)>> { 1,1,2,4,5,6,7, 9,13, 8, 15, 11}

20.Compare(7-11)>> { 1,1,2,4,5,6,7, 9,13, 8, 15, 11}

Pivot=9

21.Compare(9-13)>> { 1,1,2,4,5,6,7, 9,13, 8, 15, 11}

22.Compare(9-8)>> { 1,1,2,4,5,6,7, 9,13, 8, 15, 11}

Displacement=10

23.Compare(9-15)>>{ 1,1,2,4,5,6,7, 8,9,13, 15, 11}

24.Compare(9-11)>> { 1,1,2,4,5,6,7, 8,9,13, 15, 11}

Pivot=13

25.Compare(13-15)>>{ 1,1,2,4,5,6,7, 8,9,13, 15, 11}

26.Compare(13-11)>> { 1,1,2,4,5,6,7, 8,9,13, 15, 11}

Displacement=11

   Sorted Array:

         { 1,1,2,4,5,6,7, 8,9,11,13, 15}

Compare→26

Displacement→11

         D = {'S', 'B', 'I', 'M', 'H', 'Q', 'C', 'L', 'R', 'E', 'P', 'K'}

Pivot='S'

Swap the pivot with element in the middle(Displacement=1)

         {'B', 'I', 'M', 'H', 'Q', 'S', 'C', 'L', 'R', 'E', 'P', 'K'}
                              ▲
1.Compare(S-B)>> {'B', 'I', 'M', 'H', 'Q', 'S', 'C', 'L', 'R', 'E', 'P', 'K'}

2.Compare(S-K)>> {'B', 'I', 'M', 'H', 'Q', 'S', 'C', 'L', 'R', 'E', 'P', 'K'}

Displacement=2

3.Compare(S-I)>>{'B', 'I', 'M', 'H', 'Q', 'K', 'S', 'C', 'L', 'R', 'E', 'P'}

4.Compare(S-P)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'S', 'C', 'L', 'R', 'E', 'P'}

Displacement=3

5.Compare(S-M)>>{'B', 'I', 'M', 'H', 'Q', 'K', 'P','S', 'C', 'L', 'R', 'E'}

6.Compare(S-E)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P','S', 'C', 'L', 'R', 'E'}

Displacement=4

7.Compare(S-H)>>{'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' ,'S', 'C', 'L', 'R' }

8.Compare(S-R)>>{'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' ,'S', 'C', 'L', 'R' }

Displacement=5

9.Compare(S-Q)>>{'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R','S', 'C', 'L'}

10.Compare(S-L)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R','S', 'C', 'L'}

Displacement=6

11.Compare(S-C)>>{'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L' ,'S', 'C'}

Displacement=7

{'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

Pivot=B

12.Compare(B-I)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

13.Compare(B-M)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

14.Compare(B-H)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

15.Compare(B-Q)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

16.Compare(B-K)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

17.Compare(B-P)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

18.Compare(B-E)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

19.Compare(B-R)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

20.Compare(B-L)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

21.Compare(B-C)>>{'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

Pivot=I

22.Compare(I-M)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

23.Compare(I-H)>> {'B', 'I', 'M', 'H', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

Displacement=8

24.Compare(I-M)>>{'B', 'H' ,'I', 'M', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

25.Compare(I-Q)>> {'B', 'H' ,'I', 'M', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

26.Compare(I-K)>> {'B', 'H' ,'I', 'M', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

27.Compare(I-P)>> {'B', 'H' ,'I', 'M', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

28.Compare(I-E)>> {'B', 'H' ,'I', 'M', 'Q', 'K', 'P', 'E' , 'R', 'L', 'C','S'}

Displacement=9

29.Compare(I-R)>>{'B', 'H' , 'E' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L', 'C','S'}

30.Compare(I-L)>> {'B', 'H' , 'E' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L', 'C','S'}

31.Compare(I-C)>> {'B', 'H' , 'E' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L', 'C','S'}

Displacement=10

{B', 'H' , 'E', 'C' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Pivot=H

32.Compare(H-E)>> {B', 'H' , 'E', 'C' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Displacement=11

33.Compare(H-C)>>{B', 'E' , 'H', 'C' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Displacement=12

34.Compare(H-I)>>{B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

35.compare(H-M)>>{B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

36.Compare(H-Q)>>{B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

37.Compare(H-K)>>{B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

38.Compare(H-P)>>{B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

39.Compare(H-R)>>{B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

40.Compare(H-L)>>{B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Pivot=E

41.Compare(E-C)>> {B', 'E' , 'C', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Displacement=13

{B', 'C' , 'E', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Pivot=M

42.Compare(M-Q)>> {B', 'C' , 'E', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

43.Compare(M-K)>> {B', 'C' , 'E', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Displacement=14

44.Compare(M-P)>> {B', 'C' , 'E', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

45.Compare(M-R)>> {B', 'C' , 'E', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

46.Compare(M-L)>> {B', 'C' , 'E', 'H' ,'I', 'M', 'Q', 'K', 'P', 'R', 'L','S'}

Displacement=15

{B', 'C' , 'E', 'H' ,'I', 'L' ,'M', 'Q', 'K', 'P', 'R','S'}

Pivot=Q

47.Compare(Q-K)>> {B', 'C' , 'E', 'H' ,'I', 'L' ,'M', 'Q', 'K', 'P', 'R','S'}

Displacement=16

48.Compare(Q-P)>>{B', 'C' , 'E', 'H' ,'I', 'L' ,'M', 'K' ,'Q', 'P','R','S'}

Displacement=17

{B', 'C' , 'E', 'H' ,'I', 'L' ,'M', 'K' , 'P' ,'Q','R','S'}

Pivot=L

49.Compare(L-M)>>{B', 'C' , 'E', 'H' ,'I', 'L' ,'M', 'K' , 'P' ,'Q','R','S'}

50.Compare(L-K)>>{B', 'C' , 'E', 'H' ,'I', 'L' ,'M', 'K' , 'P' ,'Q','R','S'}

Displacement=18

Sorted Array:

{B', 'C' , 'E', 'H' ,'I', 'K' ,'L' ,'M', 'P' ,'Q','R','S'}

Compare→50

Displacement→18

Ferdi SÖNMEZ

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