

# Sort Week 10

## Exercise

a) 36, 49, 48, 29, 47, 40, 11, 15, 31, 40

b) 57, 48, 43, 42, 36, 30, 21, 20, 14, 5.

a. Selection sort:

36 49 48 29 47 40 11 15 31 40

11 49 48 29 47 40 36 15 31 40

11 15 48 29 47 40 36 49 31 40

11 15 29 48 47 40 36 49 31 40

11 15 29 31 47 40 36 49 48 40

11 15 29 31 36 40 47 49 48 40

11 15 21 31 36 40 47 49 48 40

11 15 29 31 36 40 40 49 48 47

11 15 29 31 36 40 40 47 48 49

11 15 29 31 36 40 40 47 48 49

b. Insertion sort:

36 49 48 29 47 40 11 15 31 40

36 49 48 29 47 40 11 15 31 40

36 48 49 29 47 40 ...

29 36 48 49 47 40 11 ...

29 36 48 48 49 40 11 15 ...

29 36 40 47 48 49 11 15 31 ...

29 36 40 47 48 49 15 31 40

15 29 36 40 47 48 49 31 40

15 29 31 36 40 47 48 49 40

15 29 31 36 40 40 47 48 49

## Q. Shell Sort

K=5

36	49	48	29	47	40	11	15	31	40
36	49	48	29	47	40	11	--		

3 swap

36	11	48	29	47	40	49	15	31	--
36	11	48	29	47	40	49	15	31	--

36	11	15	29	47	40	49	48	31	40
36	11	15	29	47	40	49	48	31	40

36	11	15	29	40	40	49	48	31	47
36	11	15	29	40	40	49	48	31	47

K=3

36	11	15	29	--	--	--	--	--	--
36	11	15	29	--	--	--	--	--	--

29	11	15	36	40	40	--	--	--	--
29	11	15	36	40	40	--	--	--	--

29	11	15	36	40	40	49	48	--	--
29	11	15	36	40	40	49	48	--	--

29	11	15	36	40	40	49	48	31	--
29	11	15	36	40	40	49	48	31	--

29	11	15	36	40	40	49	48	31	47
29	11	15	36	40	40	49	48	31	47

29	11	15	36	40	31	47	48	40	49
29	11	15	36	40	31	47	48	40	49

K=1

29	11	15	--	--	--	--	--	--	--
29	11	15	--	--	--	--	--	--	--

11	15	29	36	40	31	--	--	--	--
11	15	29	36	40	31	--	--	--	--

11	15	29	36	40	31	47	--	--	--
11	15	29	36	40	31	47	--	--	--

Sc Insert Delete

shift

11	15	29	31	40	36	47	48	...	
11	15	29	31	36	40	47	48	40	49

11 15 29 31 36 40 40 48 42 49

shift

11	15	29	31	36	40	40	48	48	49
----	----	----	----	----	----	----	----	----	----

### 1. Tim Sort

36	49	48	29	47
40	11	15	31	40

36	49	...		
36	49	48	...	
36	48	49	29	47
29	36	48	49	47
29	36	47	48	49

40	11	15	...	
11	40	15	31	...
11	15	40	31	40
11	15	31	40	40
11	15	31	40	40

7 swap

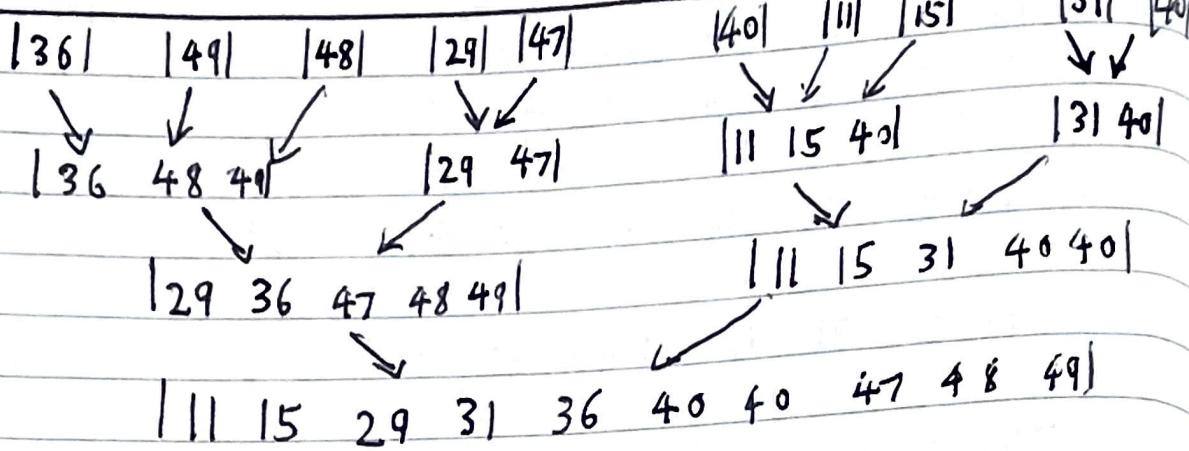
29	36	47	48	49	11	15	31	40	43
----	----	----	----	----	----	----	----	----	----

### 2. Merge

36	49	48	29	47	40	11	15	31	40
----	----	----	----	----	----	----	----	----	----

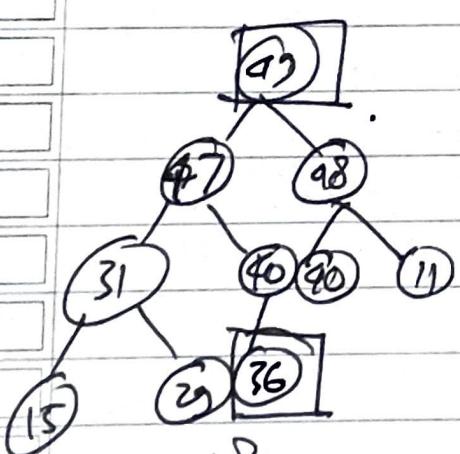
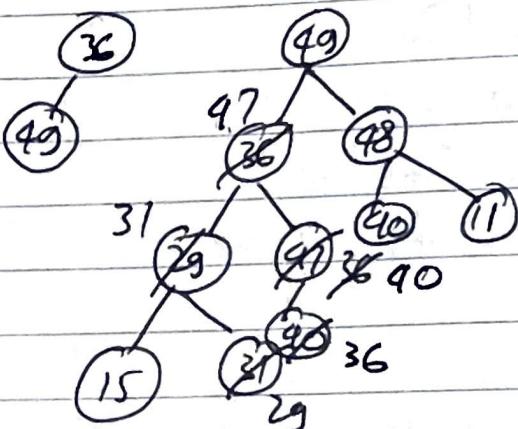
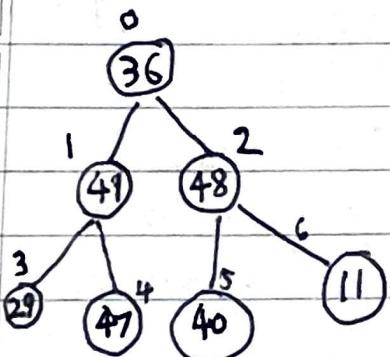
36	49	48	29	47	40	11	15	31	40
36	49	48	29	47	40	11	15	31	40
36	49	48	29	47	40	11	15	31	40
36	49	48	29	47	40	11	15	31	40
36	49	48	29	47	40	11	15	31	40

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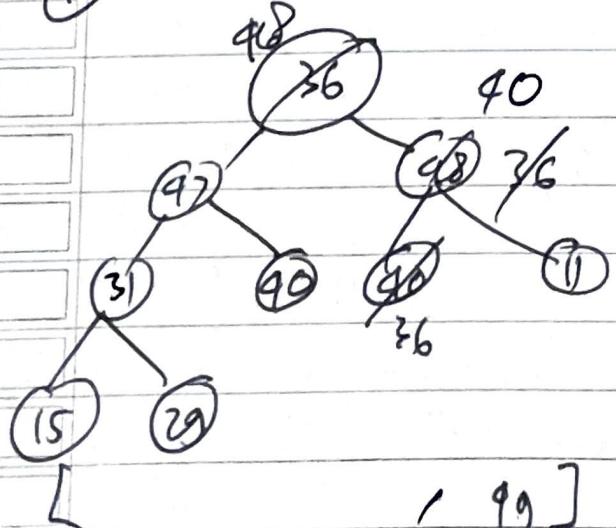
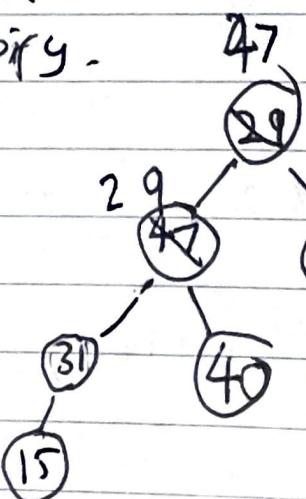


## 2. Heap Sort

0	1	2	3	4	5	6	7	8	9
136	49	48	29	47	40	11	15	31	40

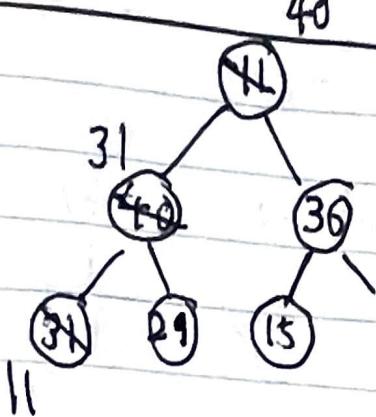
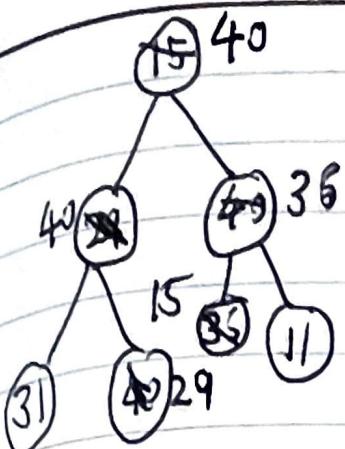


- ① Swap
- ② remove
- ③ heapify -



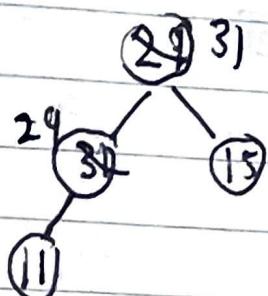
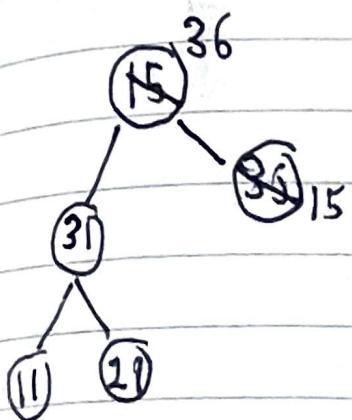
1 99]

48, 99]



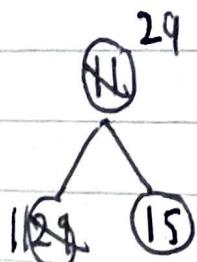
$[47, 48, 49]$

$[40, 47, 48, 49]$



$[40, 40, 47, 48, 49]$

$[35, 40, 40, 47, 48, 49]$



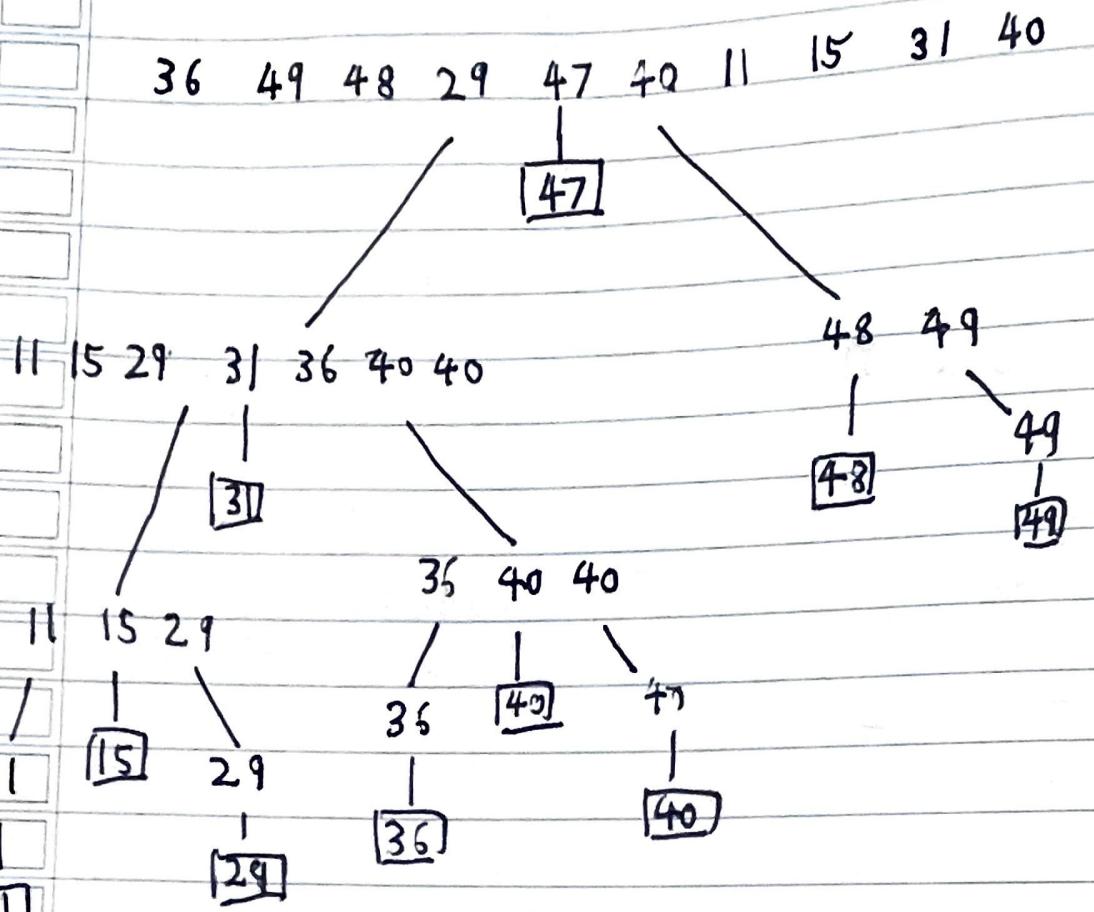
$[31, 36, 40, 40, 47, 48, 49]$

$[29, 31, 36, 40, 40, 47, 48, 49]$

11

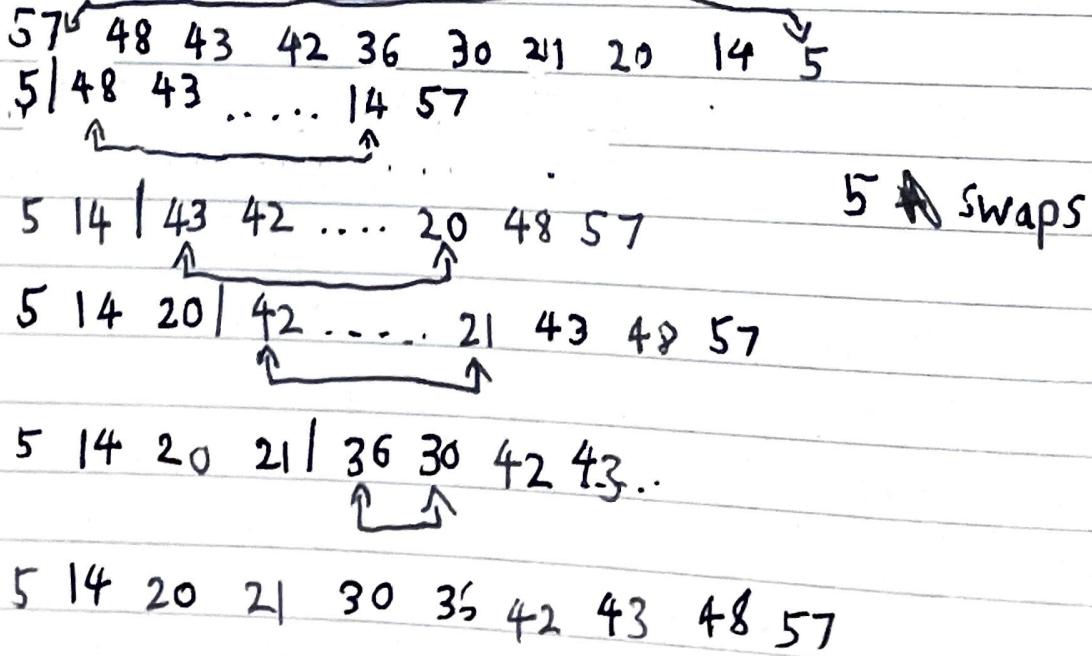
$[11, 15, 29, 31, 36, 40, 40, 47, 48, 49]$

### a. Quick sort:



[11, 15, 29, 31, 36, 40, 40, 47, 48, 49]

### b. Selection sort:



### b. Insertion sort:

57 48 43 42 36 30 21 20 14 5

57 | 48 43 ...

48 57 | 43 42 ...

43 48 57 | 42 36 ...

42 43 48 57 | 36 30 ...

36 42 43 48 57 | 30 21 ...

30 36 42 43 48 57 | 21 20 ...

21 30 36 42 43 48 57 | 20 14 5

20 21 30 36 42 43 48 57 | 14 5

14 20 21 30 36 42 43 48 57

5 14 20 21 30 36 42 43 48 57

### c. Shell sort

$k=5$

57 48 43 42 36 | 30 21 20 14 5

30 | 48 | 43 42 36 | 57 | 21 20 14 5

30 21 | 43 | 42 36 57 48 | 20 14 5

30 21 20 | 42 | 36 57 48 43 | 14 5

30 21 20 14 | 36 | 57 48 43 42 | 5

30 21 20 14 5 57 48 43 42 36

$K=3$

$$14 \boxed{21} 20 | 14 5 57 48 43 42 36$$

$\downarrow$

$$14 \boxed{21} 20 \underline{30} | 5 57 48 \dots \dots$$

$\downarrow$

$$14 5 \boxed{21} 30 21 | 57 48 43 \dots \dots$$

$\boxed{14} 5 20 \underline{30} 21 57 | 48 43 \dots \dots$

$$14 \boxed{5} 20 30 \boxed{21} 57 48 | 43 42 36$$

$$14 5 \boxed{25} 30 21 \boxed{57} 48 43 | 42 36$$

$\downarrow$

$$\boxed{14} 5 20 \boxed{30} 21 42 \boxed{48} 43 57 | 36$$

$\downarrow$

$$14 5 20 36 21 42 36 43 57 48$$

$K=1$

$\_ = \square$

$$14 | 5 20 30 21 42 36 43 57 48$$

$\overline{\boxed{1}}$

$$5 \boxed{14} | 20 30 21 42 36 43 57 48$$

$$5 \boxed{14} \underline{20} | 30 21 \dots \dots \dots$$

$$5 \boxed{14} \underline{20} \underline{30} | 21 42 36 \dots \dots$$

$\overline{\boxed{1}}$

$$5 \boxed{14} \underline{20} \underline{21} \underline{30} | 42 36 \dots \dots$$

$$5 \boxed{14} \underline{20} \underline{21} \underline{30} \underline{42} | 36 43 \dots \dots$$

$\downarrow$

$$5 \boxed{14} \underline{20} \underline{21} \underline{30} \underline{36} \underline{42} | 43 57 48$$

$$5 \boxed{14} \underline{20} \underline{21} \underline{30} \underline{36} \underline{42} \underline{43} | 57 48$$

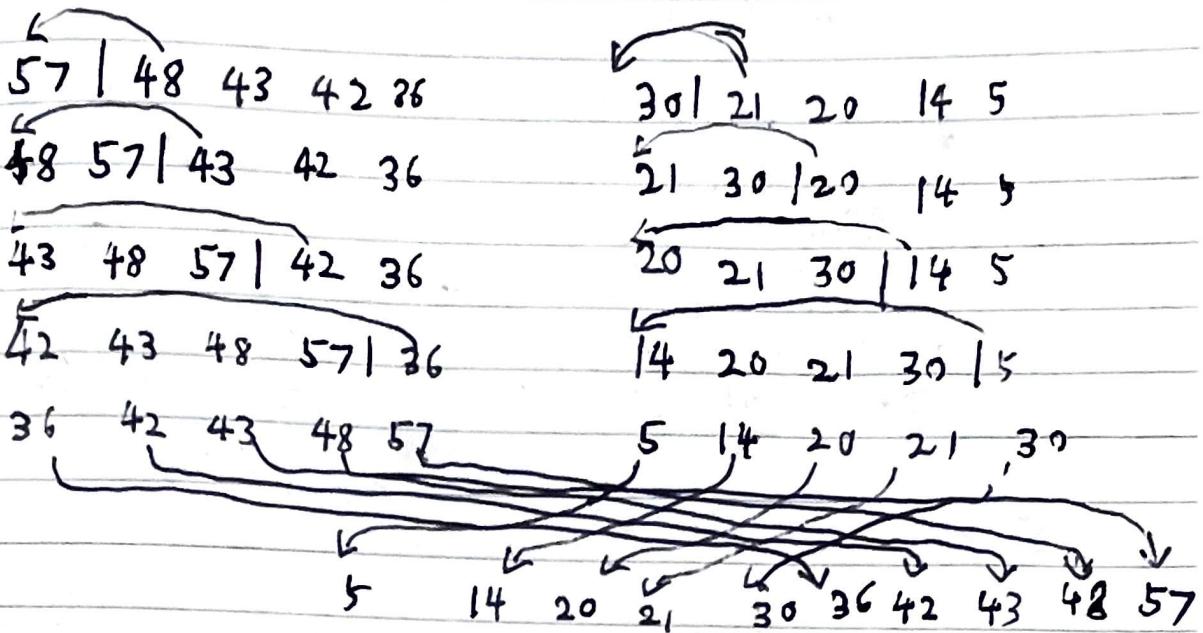
$$5 \boxed{14} \underline{20} \underline{21} \underline{30} \underline{36} \underline{42} \underline{43} \underline{57} | 48$$

$\downarrow$

$$5 \boxed{14} \underline{20} \underline{21} \underline{30} \underline{36} \underline{42} \underline{43} \underline{48} | 57$$

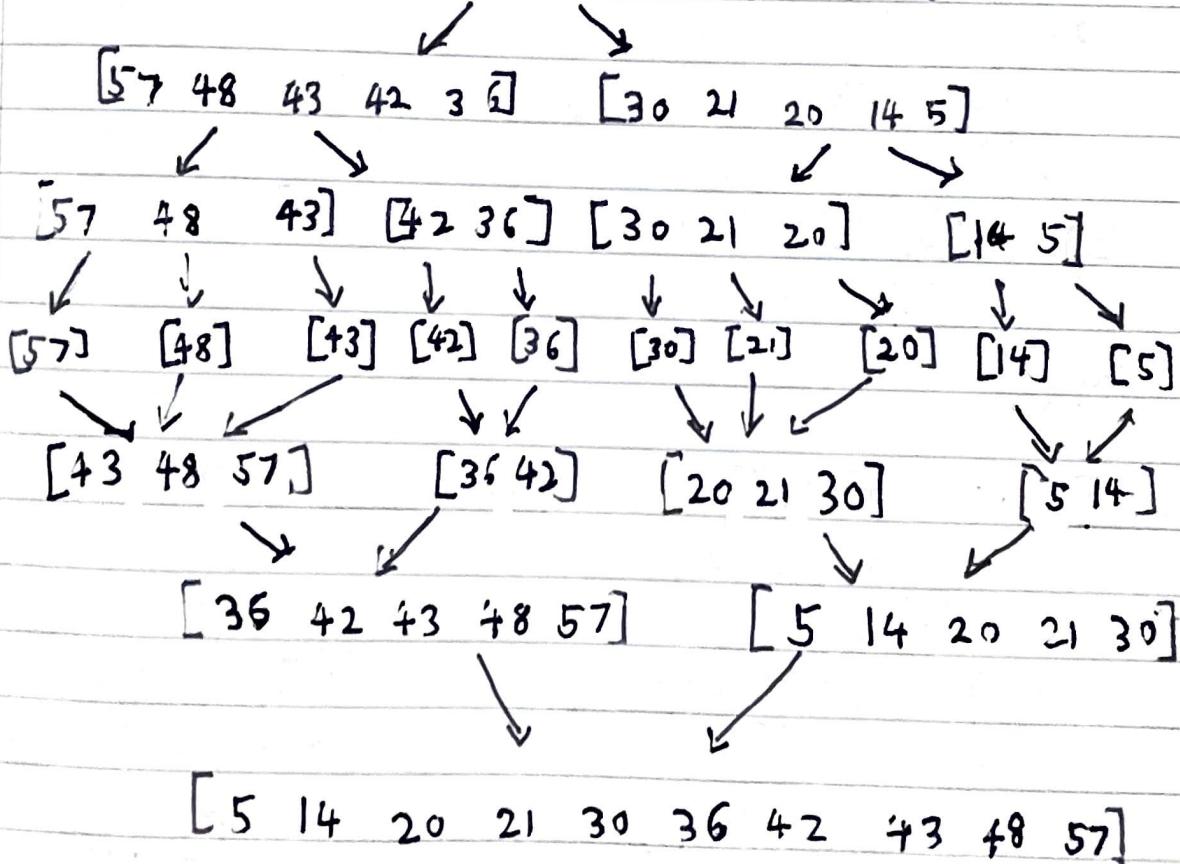
### b. Tim sort

57 48 43 42 36  
30 21 20 14 5



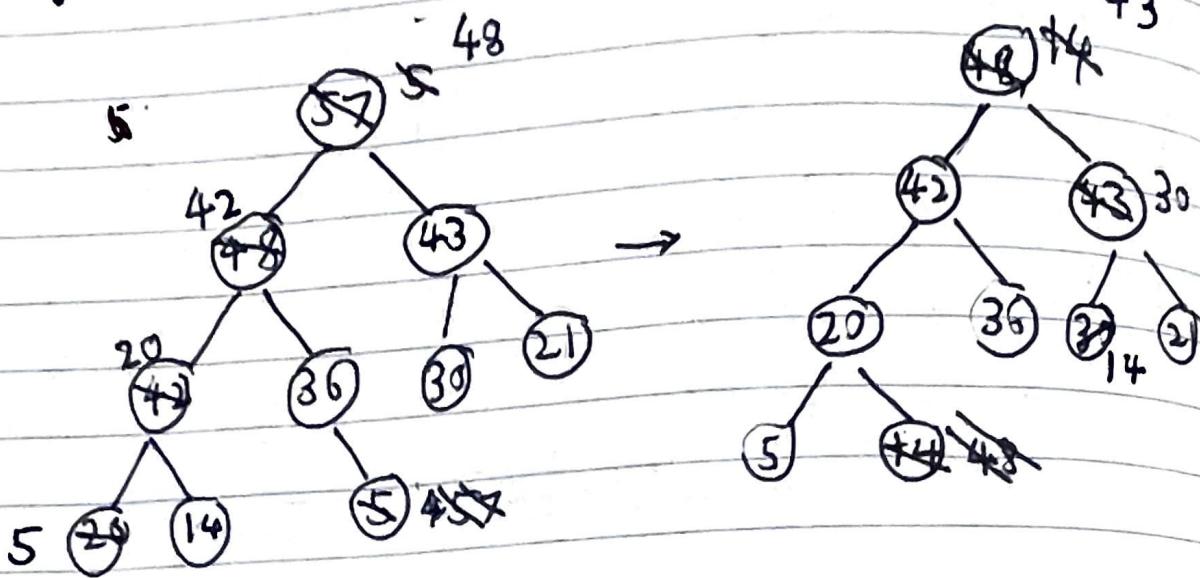
### b. Merge sort

[57 48 43 42 36 30 21 20 14 5]



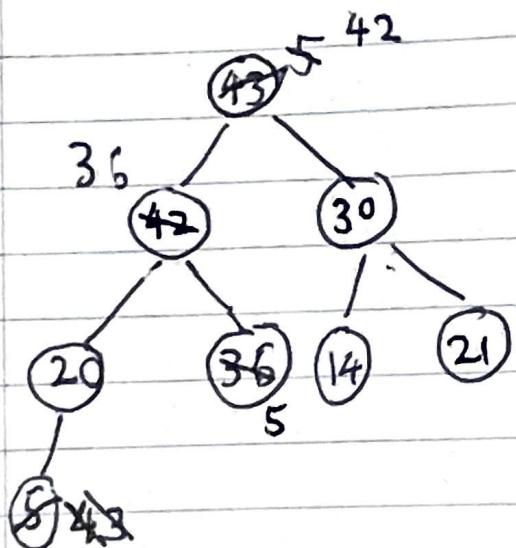
## b. Heap sort

[57 48 43 42 36 30 21 20 14 5]



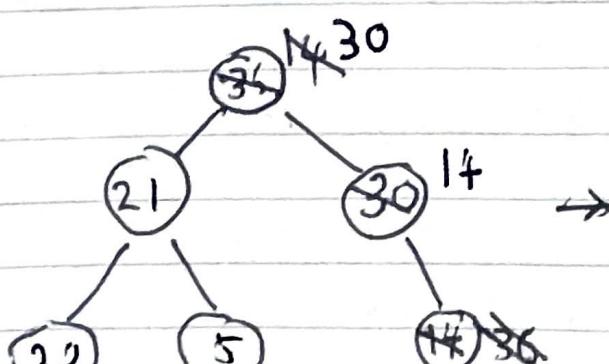
[ , 57 ]

48, 57 ]

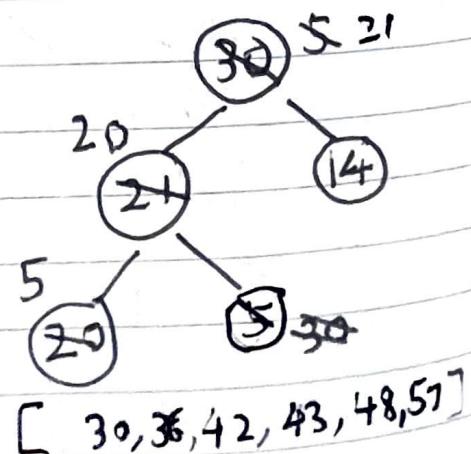


[ , 43, 48, 57 ]

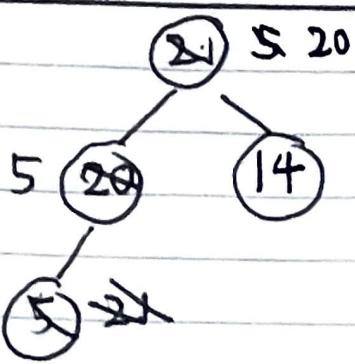
42, 43, 48, 57 ]



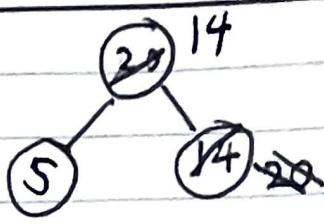
36, 42, 43, 48, 57 ]



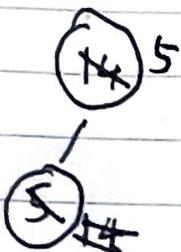
[ 30, 36, 42, 43, 48, 57 ]



[ 21, 30, 36, 42, 43, 48, 57 ]



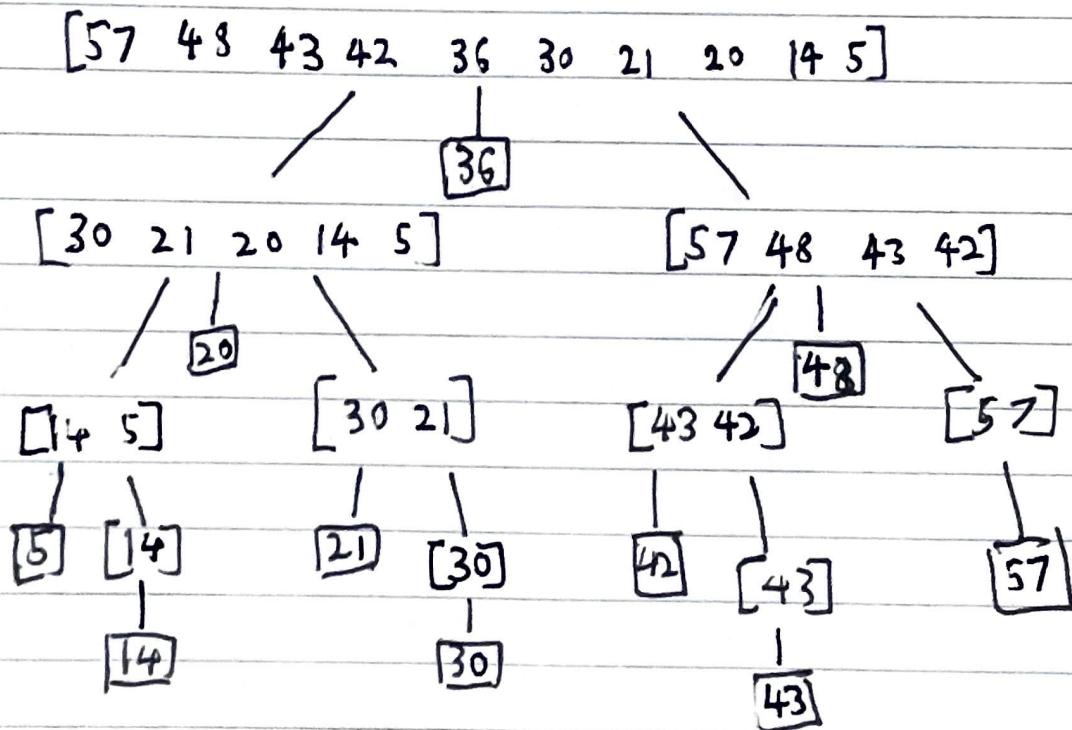
[ 20, 21, 30, 36, 42, 43, 48, 57 ]



[ 14, 20, 21, 30, 36, 42, 43, 48, 57 ]

[ 5, 14, 20, 21, 30, 36, 42, 43, 48, 57 ]

b. Quick sort:



[ 5 14 20 21 30 36 42 43 48 57 ]