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ASSIGNMENT NUMBER : 02

1.a What are the seven sorting strategies discussed in class? Identify them as having a run-time of θ(n), or θ(n log n) or θ (n^2)?

Ans : The seven sorting strategies are :

1. Insertion sort
2. Bubble sort
3. Heap sort
4. Quick sort
5. Merge sort
6. Bucket sort
7. Radix sort.

Run Time for θ (n) sorting algorithm are :

- Bucket sort
- Radix sort

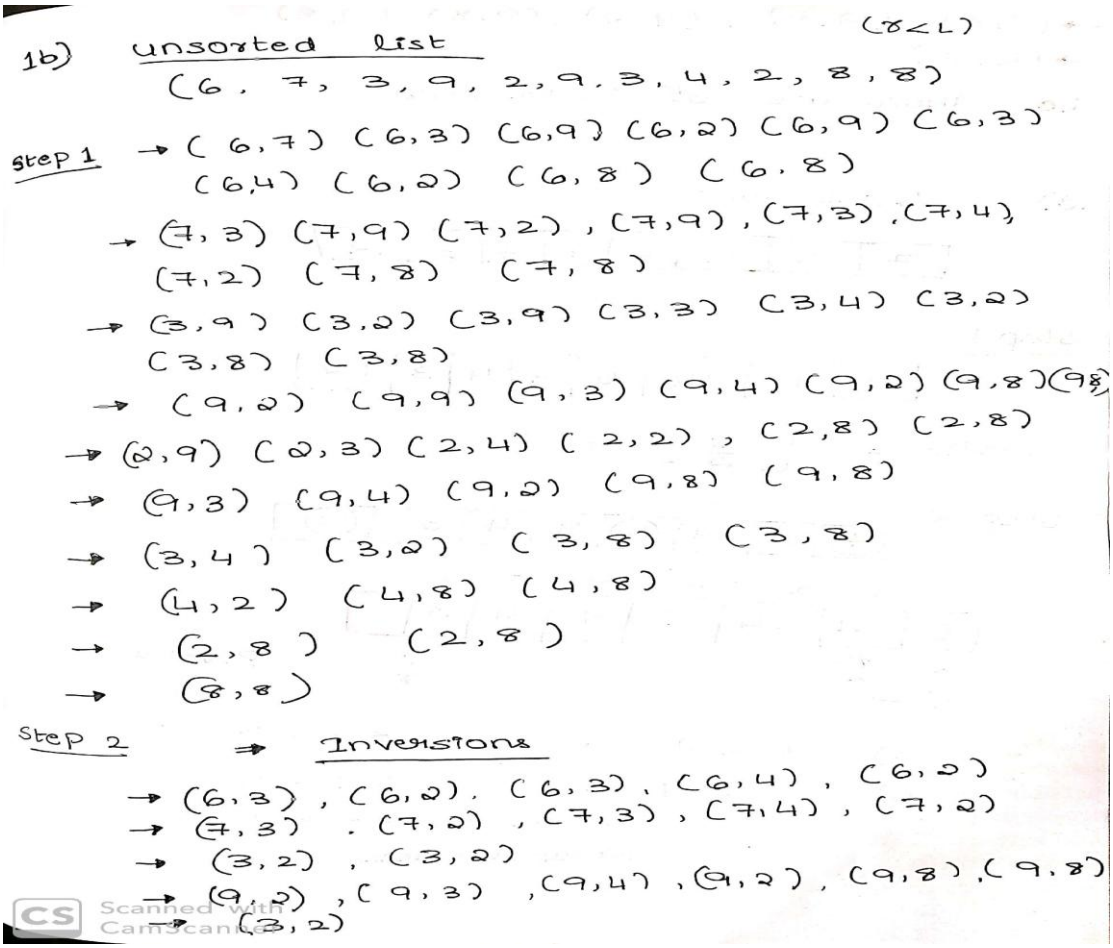
Run Time for θ(n log n) sorting algorithm are :

- Heap sort
- Quick sort
- Merge sort

Run Time for θ (n^2) sorting algorithm are :

- Insertion sort
- Bubble sort

1.b. What are the number of inversion pairs in the following unsorted list (6, 7, 3, 9, 2, 9, 3, 4, 2, 8, 8)?



→ (9,3), (9,4), (9,2), (9,8), (9,8)

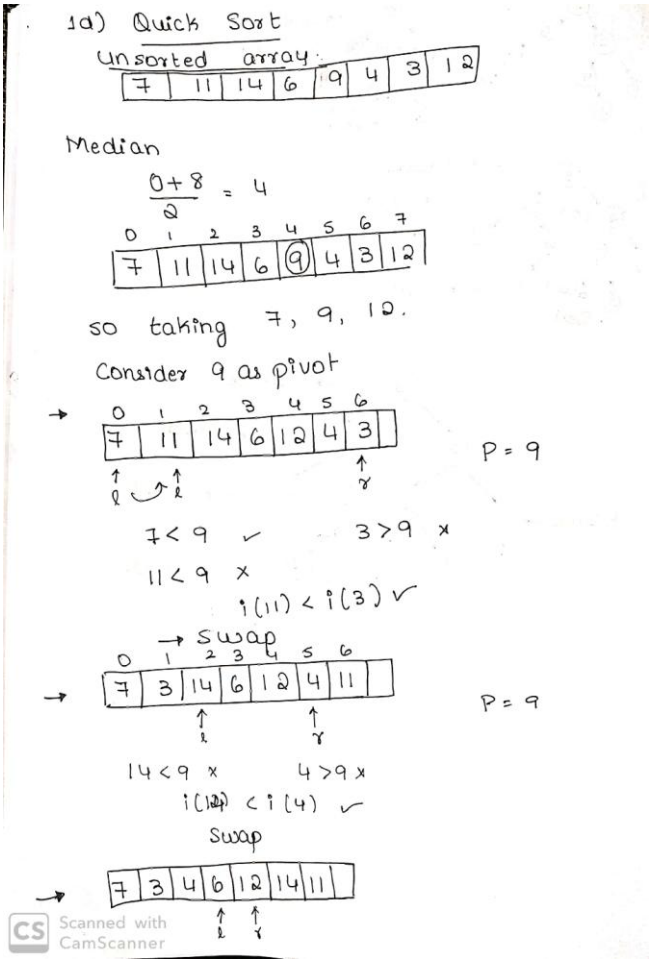
→ (4,2)

i.e, There are 25 inversion's

1.c. Why is an in-place sorting algorithm more preferable to one that is not?

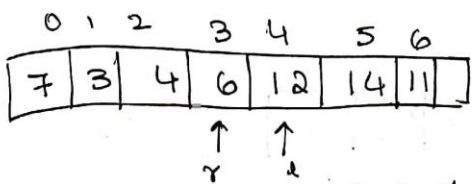
Ans : In-Place sorting algorithm is preferred because other sorting algorithms require the allocation of second array of equal size. ie., it requires Θ(n) additional memory.

1.d. Apply Quick Sort (using 3 medians) on this sequence : 7,11,14,6,9,4,3,12 ?

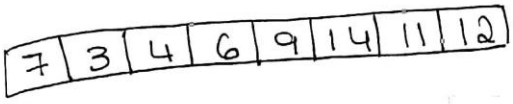


CONTINUE….

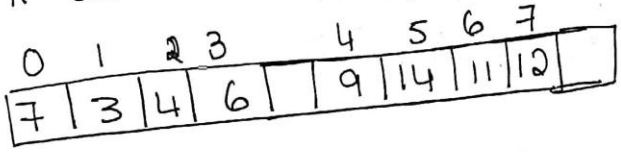
6<9 ✓ 12>9 ✓



i(12) < i(6) X

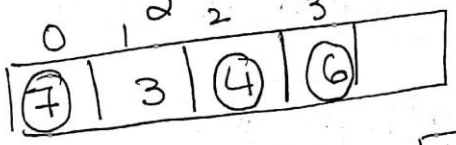


Now left side of pivot is smaller than pivot & right side element are larger than pivot so it will ~~swap~~ sort accordingly

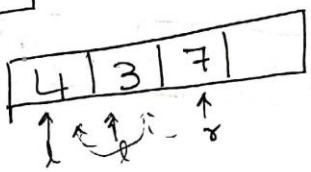


Mid point for Left array — (1)

$\frac{0+4}{2} = 2$



~~pivot~~ so



P = 6

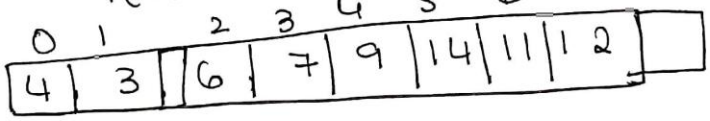
4<6 ✓ 7>6 ✓

3<6 ✓ 3>6 X

7<6 X

i(7) < i(3) X

so,



mid point → $\frac{0+2}{2}$ = (1)

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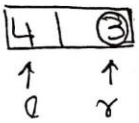
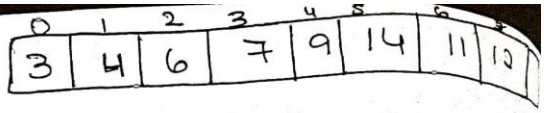
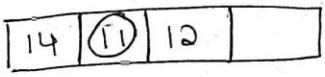


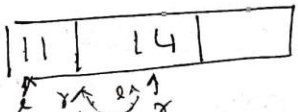
→



Mid point for 

is

$\frac{5+8}{2} = 6$

so, 

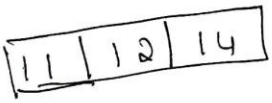
P = 12

$11 < 12$ ✓ $14 > 12$ ✓ move pointer

$14 < 12$ ✗ $11 > 12$ ✗

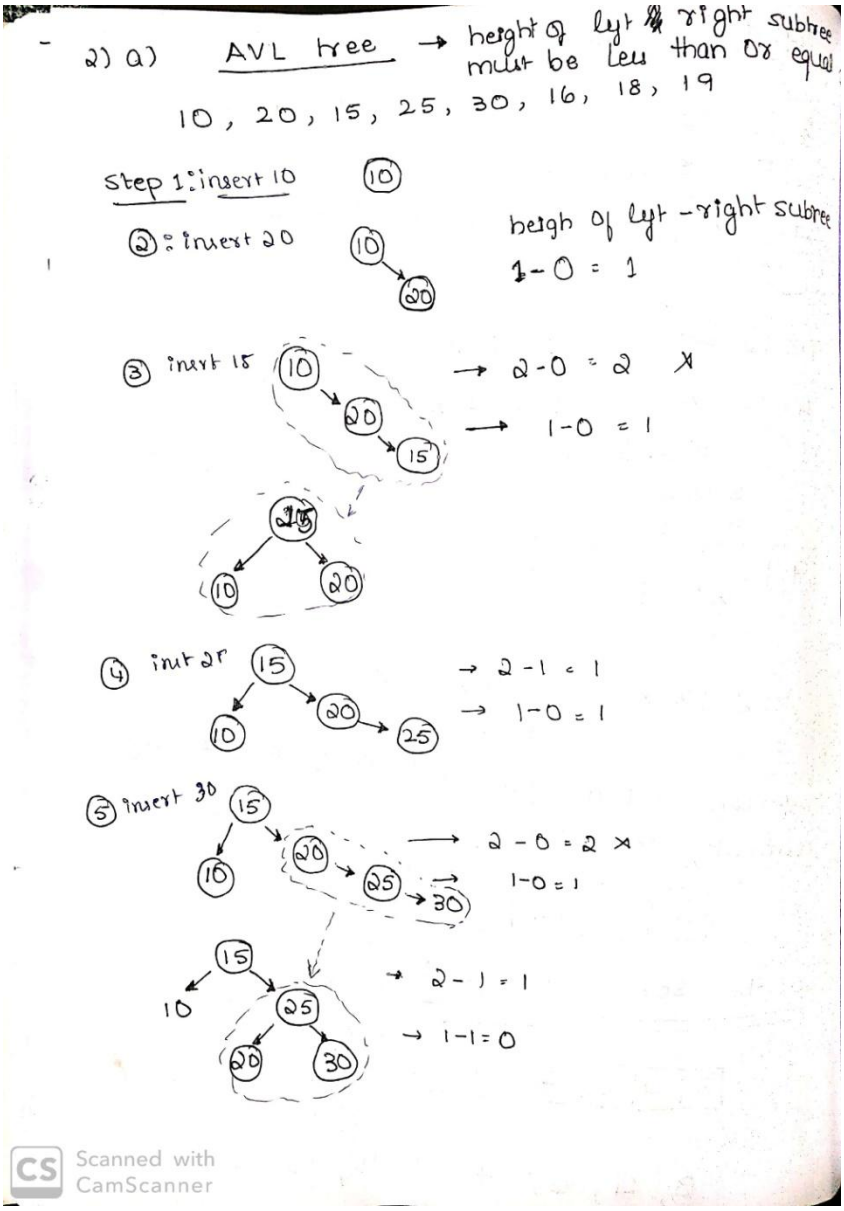
$i(14) < i(11)$ ✗

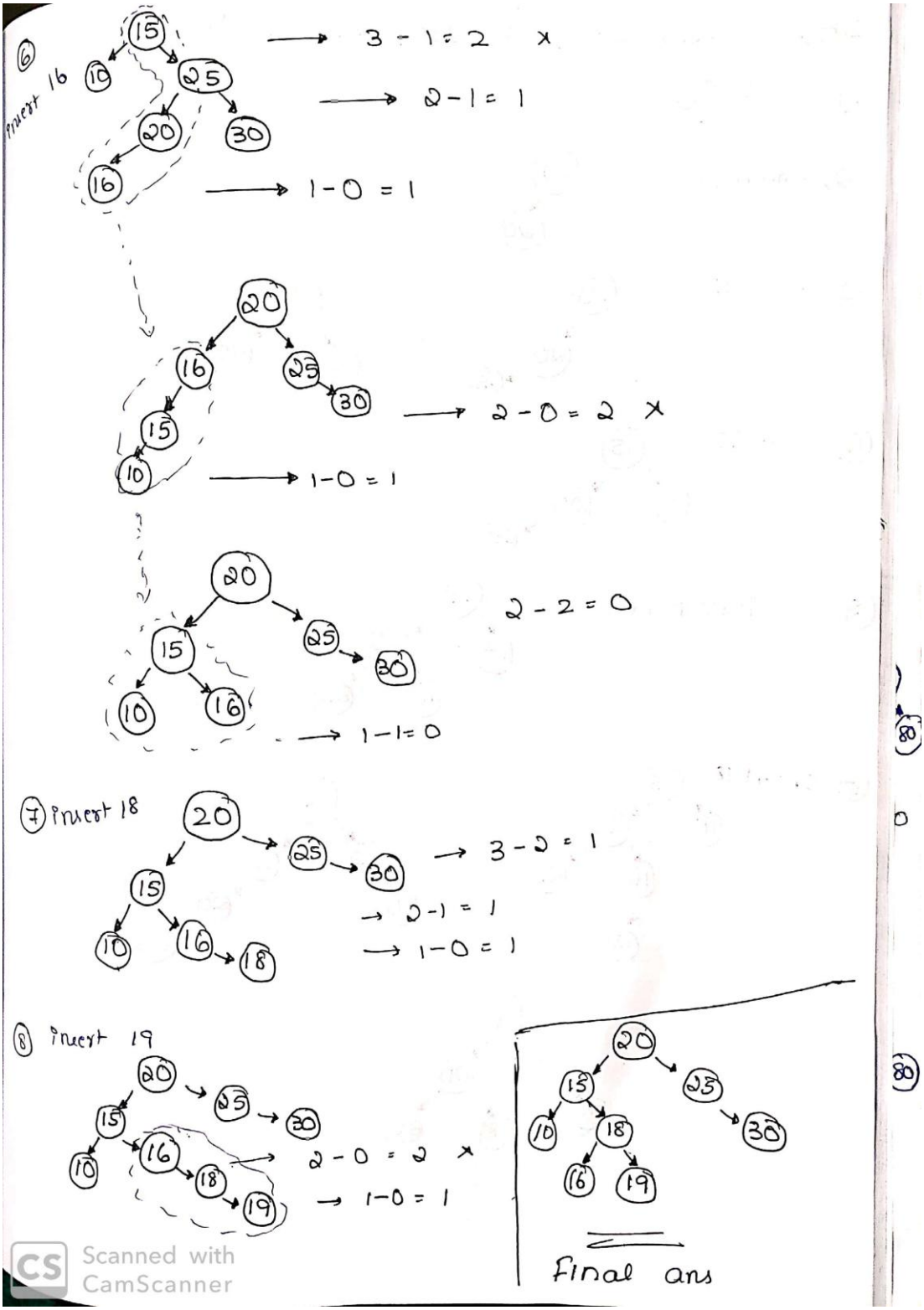
so



→ so the entire sorted array is

2.a. Insert the following sequence of elements into an AVL tree, starting with an empty tree (show each step) : 10, 20, 15, 25, 30, 16, 18, 19 ?





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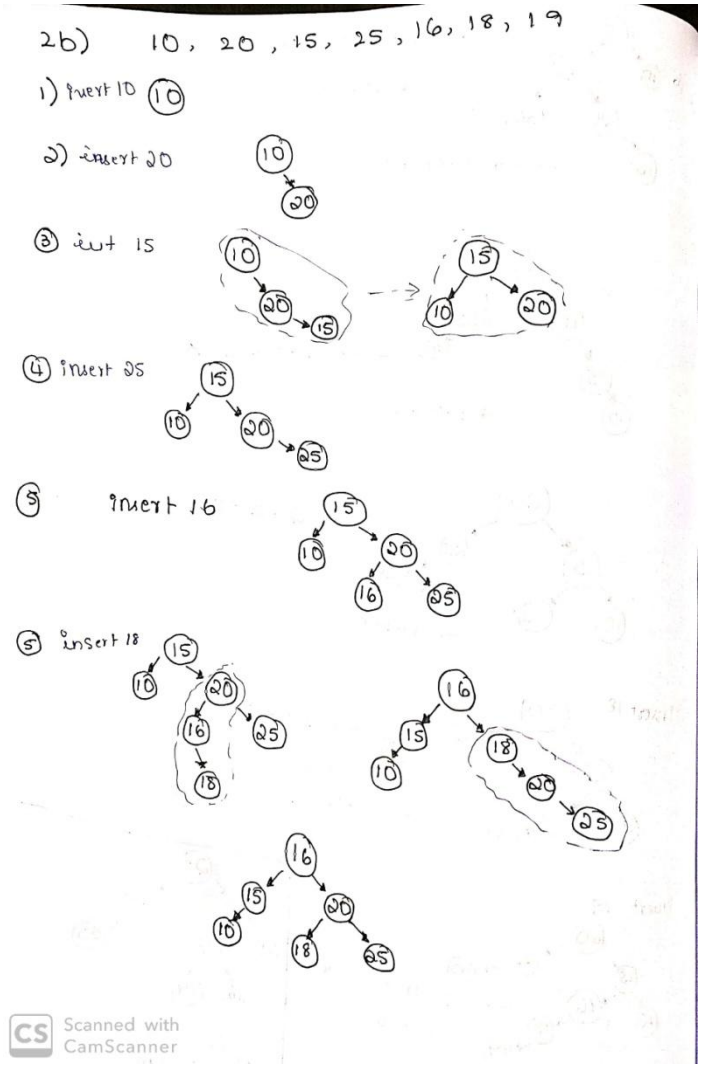
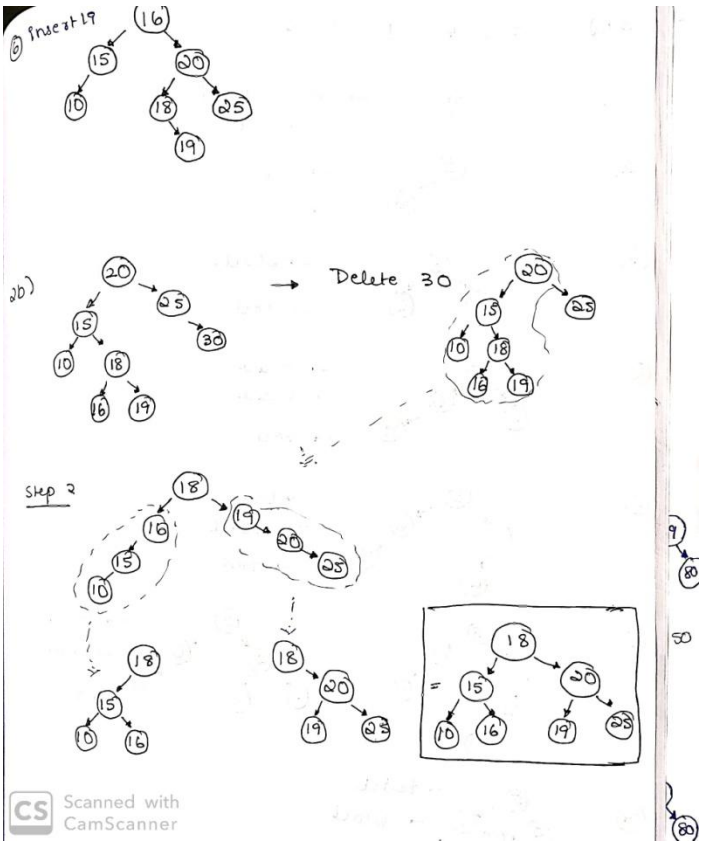
2.b. Delete 30 in the AVL tree that you got ?





2.c. What maximum difference in heights between the leafs of a AVL tree is possible?

ANS : Maximum difference in heights between the leafs of a AVL tree is **1**.

3.a. What are the operations that could be performed in O(log n) time complexity by red-black tree?

ANS : operations that could be performed in O(log n) time complexity are:

- INSERT
- SEARCH
- DELETE.

3.b. Insert the following sequence in to a red black tree (show each step): 5, 6, 1, 9, 2, 4, 3, 8, 7 ?