Quiz-4 Detailed Solutions

1. Merge Sort has best worst case time complexity i.e $O(n \log n)$.

2. If we want to apply binary search, then array should be sorted.

$$\underbrace{\text{Linear search}}_{\text{Element present at } 0^{th} \text{ index. } O(1)} > \overbrace{\text{Binary search}}^{O(\log n)}$$

3. $O(n)$ as we have done one modification in the code that if nothing is swapped in a certain pass, then it means we have already got sorted array.

Best case $\Rightarrow$ Sorted array

4. Insertion sort
   ↳ Best when we have almost sorted array.

5. There is no such criteria for sorted array in linear search.
   Worst case time complexity of linear search is $O(n)$.
   It is faster than binary search in some cases. (like element present at 0th index.

Linear search is an iterative algorithm. We can implement via recursion also.

6. In the given code, the control comes to return -1 only when element / key is not present in array. Hence -1 is the output.

7. Binary search can be applied on ordered list only.

8. $\{5, 6, 77, 88, 99\}$

mid

s e

1st iteration $mid = \frac{0+4}{2} = 2$

$88 > 77 \rightarrow s = mid + 1$

2nd iteration

$\{5, 6, 77, 88, 99\}$

s e

$mid = \frac{3+4}{2} = 3$

Element found in 2 iterations.

9. {45, 77, 89, 90, 94, 99, 100}

↑ s ↑ mid ↑ e

1st iteration

$$mid = \frac{0+6}{2} = 3$$

arr[mid] = 90

100 > 90

s = mid + 1

2nd iteration

{45, 77, 89, 90, 94, 99, 100}

↑ s ↑ e

$$mid = \frac{4+6}{2} = 5$$

arr[mid] = 99

10. Binary search is a divide & conquer technique.

11. Inplace sorting means no additional space is required or at max O(logn) is the space complexity.

12. {5, 4, 3, 2, 1}

Selection ⇒ min element at right place

1st pass

$\{5, 4, 3, 2, 1\}$ → 4 comparasions

2nd pass

$\{1, 4, 3, 2, 5\}$ → 3 comparasions

3rd pass

$\{1, 2, 3, 4, 5\}$ → 2 comparasions

4th pass

$\{1, 2, 3, 4, 5\}$ → 1 comparasion

$4 + 3 + 2 + 1 = 10$

13.

Two lists

Sorted | Unsorted

Selection sort is based on placing the min. element at the right place.

14. For n elements, n-1 passes are required to sort an array.

15. $TC = O(n^2)$ → Average & worst case
$TC = O(n)$ → Best case

Insertion sort

16. {14, 12, 16, 6, 3, 10}

1st pass

12, 14, 16, 6, 3, 10

2nd pass

12, 14, 16, 6, 3, 10

3rd pass

6, 12, 14, 16, 3, 10

4th pass

3, 6, 12, 14, 16, 10

5th pass

3, 6, 10, 12, 14, 16

17. 1st pass → {8, 34, 64, 51, 32, 21}
2nd pass → {8, 34, 64, 51, 32, 21}

18. Playing cards is similar to insertion sort. This example was explained in the class also.

19. Yes as the left list will be sorted, so searching for correct place can be quicker.

20. Sorting ⇒ worst case is sorting a reverse list.