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Problem Statement:

For a Given array M, do the following implementations -   
  
1. Write a program to implement the Modified version of the bubble sort algorithm so that it terminates the outer loop when it detects that the array is sorted. Compare the running time of the modified algorithm with Original Bubble sort.   
  
  
2. Implement Quick sort and Quick Sort 2 ( Refer to PDF, Appendix E and F). Calculate the run time complexity of both the implementation and compare their performance in terms of best, average and worst time complexity.

Solution:

1.

Modified version of Bubble sorting:

Main class with main function:

Text

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BubbleSort class with sort method:

Text

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|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sorting name | Time complexity | | | Space complexity |
| Worst case | Average case | Best case | Worst case |
| Original Bubble sort | O() |  | () | O(1) |
| Modified Bubble sort | O() |  |  | O(1) |

Here, the difference between Original and Modified Bubble sort is if condition that checks swap==0 every iteration of the outer loop. By this we can check whether the array is sorted before total completion of both the loops. So, the best-case time complexity will go down to instead of (.

2.

quickSort1 class with sort method:  
Text

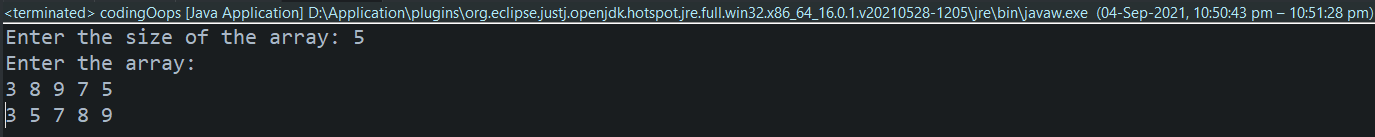
Description automatically generated

Main class with main method

Text

Description automatically generated

Output:



quickSort2 class with sort method:

Text

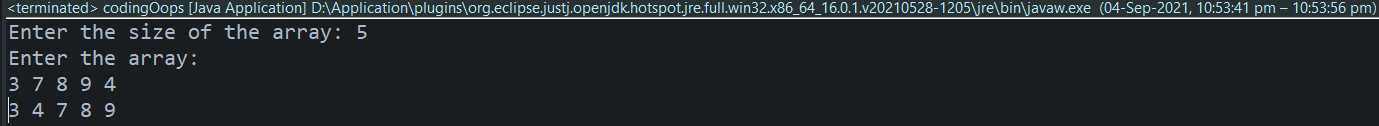
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Main class with main method:

Text

Description automatically generated

Output:



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sorting name | Time Complexity | | | Space Complexity |
| Worst case | Average case | Best case | Worst case |
| quickSort1 | O() | (nlog(n)) | (nlog(n)) | O(1) |
| quickSort2 | O() | (nlog(n)) | (nlog(n)) | O(1) |

The differences between quickSort and quickSort2 are :

1.In quickSort, we are using three methods and in quickSort2, we are using two methods.

2.In quickSort, we are defining the end element as pivot but in quickSort2, we are using mid element as pivot element.