Randomized Quick sorts

1. Discuss the worst-case time complexity of Quick Sort and Randomized Quick Sort, and analyze how the randomization in Randomized Quick Sort helps improve the average-case performance. 2 marks
2. Investigate different strategies for pivot selection in Randomized Quick Sort, such as choosing a random pivot, using the median-of-three pivot. 2 marks
3. Why do we analyze the expected running time of a randomized algorithm and not its worst-case running time? 2 marks
4. What is the difference between the Lomuto partition scheme and the Hoare partition scheme in Quicksort? 2 marks
5. What is the significance of randomizing the pivot selection in Quicksort? 2 marks
6. Compare and contrast the worst-case time complexity of Quick Sort and Randomized Quick Sort. Explain how the randomization in Randomized Quick Sort helps mitigate the worst-case scenarios and improves the average-case performance. 2+3
7. Discuss the concept of pivot selection in Quick Sort and how it affects the efficiency of the algorithm. Explain the advantages and disadvantages of choosing the pivot as the first or last element, and how the Randomized Quick Sort addresses these limitations. 2+3
8. Analyze the expected running time of Randomized Quick Sort and derive an upper bound on its time complexity. Discuss the factors that contribute to the expected running time and how they differ from the worst-case running time. 4+1
9. Describe the Median-3 Partitions method in Quicksort and explain how it improves the time complexity compared to the standard Quicksort algorithm. Discuss the process of selecting the pivot elements and how it affects the partitioning and sorting steps. Analyze the time complexity of the Median-3 Partitions method. 4+1