Project 1 - Report

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Class – Analysis of Algorithms

Chart –

	tmax/tmin	n ratio	Nln(n) ratio	n^2 ratio	Behavior
SC	6541.25	80	121.1593	6400	n^2
SS	6560.75	80	121.1593	6400	n^2
SR	6589	80	121.1593	6400	n^2
IC	90.8	100	128.5714	10000	n
IS	97.6	100	128.5714	10000	n
IR	47094.5	200	324.4146	40000	n^2
MC	3296	1666.667	2647.063	2777778	nln(n)
MS	3313	1666.667	2647.063	2777778	nln(n)
MR	8210.5	5000	8698.97	25000000	nln(n)
QC	23620.667	142.8571	222.9183	20408.16	n^2
QS	1496.6667	1000	1526.411	1000000	nln(n)
QR	7979.5	5000	8698.97	25000000	nln(n)

Analysis –

1. **Selection Sort –**
    - The algorithm behaves like the theoretical model for all three (sorted, constant, and random lists), as it has a time complexity of n^2. This is according to the algorithm, the content of the list does not matter, as it traverses through the entire list anyway.
2. Insertion Sort –
    - The algorithm behaves like the theoretical model for both constant and sorted lists, as these are the condition for best case(Omega of n). The second for loop does not come into play when the list is in order.
    - The algorithm also behaves like the theoretical model for the random list, as it traverses through the list by a factor of n times for each iteration for n number of iterations. Hence it is big O of n^2.
3. Merge Sort –
    - Merge sort is a very fast algorithm which again does not depend on the content of the list. Hence the complexity for all three kinds of list is similar to the theoretical model (i.e – theta of nln(n)).
4. Quick Sort –
    - The quick sort shows us both the best- and worst-case scenarios. In the case of a sorted and unsorted list, the quick sort works fine and has a time complexity of nlg(n).
    - However running quick sort when all elements the list are same will be the worst case running, since no matter what pivot is picked, it will have to go

through all the values in A. And since all values are the same, each recursive call will lead to unbalanced partitioning. Hence the complexity is n^2.