Quick Sort(n=10000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	0.002592	0.015757	0.002360
Pivote_2	0.032730	0.032906	0.032939
Pivote_3	0.002573	0.002231	0.001707
Pivote_4	0.002346	0.001455	0.001540

Quick Sort(n=100000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	0.021726	0.218549	0.026780
Pivote_2	0.324617	0.280552	0.280952
Pivote_3	0.023757	0.024253	0.021179
Pivote_4	0.025350	0.016249	0.017671

Quick Sort(n=1000000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	0.244447	3.135580	0.338356
Pivote_2	3.377431	3.544594	4.475770
Pivote_3	0.263125	0.326828	0.217733
Pivote_4	0.289285	0.199582	0.205873

Quick Sort(n=10000000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	2.822957	44.411758	3.779875

Pivote_2	37.270622	41.312969	41.308641
Pivote_3	2.887685	4.670725	3.815877
Pivote_4	2.911639	2.338098	2.407053

Marge Sort

Pivote_type	Random	Shorted	Almost Sorted
n = 10000	0.002930	0.001890	0.002023
n = 100000	0.032618	0.022705	0.023903
n = 1000000	0.724812	0.479621	0.499767
n = 10000000	217.792412	213.530912	214.987556

What is your observation? Which short is faster and why?

Ans :- From the two sorting algorithm that we have used, I observed that quick sort is better than merge sort. Though merge sort has the time complexity of O(n log n) in the best, average and worst case but when the input size is increasing to 10^7 merge sort taking long time to provide output. That is why according to my observation quick sort is better. Now observing closely to the 4 pivoting techniques of quick sort, I found the technique 4 that is median of n/4 , middle, 3n/4 is best because analyzing the worst case time complexity of this technique, the recursive equation is

$T(n) = 2T(n/2) + n$

Solving the recursive equation of the worst case time complexity comes to

$O(n \log n)$.

Another way we can say that quick sort is better is through space complexity analysis. Quick sort does not require any support of an additional array but merge sort requires the support of an additional array.

Hence we can say that this technique of quick sort is faster and efficient.

But if we compare between merge sort and quick sort in terms of the theoretical aspects then we have to say that merge sort is faster. This is because the recursive equation for the worst case time complexity for quick sort is $T(n) = T(n – 1) + n$ which is $O(n^2)$ but for merge sort the equation is $T(n) = 2T(n/2) + n$ which is $O(n \log n)$.