Quick Sort(n=10000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	150547.0	3015374.0	473066.0
Pivote_2	135208.0	149355.0	146944.0
Pivote_3	138814.0	243694.0	221290.0
Pivote_4	135118.0	126418.0	126605.0

Quick Sort(n=100000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	1786804.0	46384812.0	4903253.0
Pivote_2	1669218.0	1865657.0	1993185.0
Pivote_3	1650195.0	3718978.0	2881630.0
Pivote_4	1638167.0	1606366.0	1605727.0

Quick Sort(n=1000000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	21612678.0	655566752.0	50752683.0
Pivote_2	20661766.0	21093044.0	22588707.0
Pivote_3	20656385.0	52145810.0	28164316.0
Pivote_4	20135680.0	19310418.0	19331717.0

Quick Sort(n=10000000)

Pivote_type	Random	Shorted	Almost Sorted
Pivote_1	245748196.0	8075847012.0	521390389.0

Pivote_2	238397003.0	245932872.0	260042304.0
Pivote_3	240615934.0	648602604.0	337892915.0
Pivote_4	230832603.0	228256071.0	227992829.0

Marge Sort

Pivote_type	Random	Shorted	Almost Sorted
n = 10000	9999.000000	9999.000000	9999.000000
n = 100000	99999.000000	99999.000000	99999.000000
n = 1000000	999999.000000	999999.000000	999999.000000
n = 10000000	Undefined	Undefined	`Undefined

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 fails 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

$O(n \log n)$.

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

But if we compare between merge sort and quick sort 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 $O(n \log n)$.