SORTING ALGORITHMS ANALYSIS:

Input Array:

Sorted Elements:
{1,4,6,7,9,11,14,17,24,28,33,37,41,44,48,53,58,65,69,74,80,86,92,100,102,104,107,119,122,125,135,140};

Reverse Sorted Elements:
{140,135,125,122,119,107,104,102,100,92,86,80,74,69,65,58,53,48,44,41,37,33,28,24,17,14,11,9,7,6,4,1};

Random32 Elements:
{191,135,478,33,6,7234,78,56,23,2,2396,34557,65446,865,1245,8066,3456,743,66,2444,567,787,9189,1334,7766,876,8899,5167,7819,573,7788,1856};

Constant rate:
Merge Sort:

Sorted Array:
(n = 32)
O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 80 / 160 = 0.5

Reverse Sorted Array:
(n = 32)
O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 124 / 160 = 0.775

Random 32:
O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 80 / 160 = 0.5

Random 2^10 (1024):
O(nlogn) = 1024 * log 1024
= 1024 * 10 = 10240

Key comparisons / nlogn = Constant factor
Constant factor = 5120 / 10240 = 0.5

Random 2^15 (32768):
O(nlogn) = 32768 * log 32768
= 32768 * 15 = 491520

Key comparisons / nlogn = Constant factor
Constant factor = 245820 / 491520 = 0.5001

Random 2^20 (1048576):
O(nlogn) = 1048576 * log 1048576
= 1048576 * 20 = 20971520

Key comparisons / nlogn = Constant factor
Constant factor = 10538932 / 20971520 = 0.5025

Quick Sort:

Sorted Array:
(n = 32)

O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 496 / 160 = 3.1

Reverse Sorted Array:
(n = 32)
O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 130 / 160 = 0.8125

Random 32:
O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 496 / 160 = 3.1

Random 2^10 (1024):
O(nlogn) = 1024 * log 1024
= 1024 * 10 = 10240

Key comparisons / nlogn = Constant factor
Constant factor = 145 / 10240 = 0.014

Random 2^15 (32768):
O(nlogn) = 32768 * log 32768
= 32768 * 15 = 491520

Key comparisons / nlogn = Constant factor
Constant factor = 219 / 491520 = 0.0004

Random 2^20 (1048576):
O(nlogn) = 1048576 * log 1048576
= 1048576 * 20 = 20971520

Key comparisons / nlogn = Constant factor
Constant factor = 342 / 20971520 = 0.000016

Heap Sort:

Sorted Array:
(n = 32)

O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 421 / 160 = 2.631

Reverse Sorted Array:
(n = 32)
O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 388 / 160 = 2.425

Random 32:
O(nlogn) = 32 * log 32
= 32 * 5 = 160

Key comparisons / nlogn = Constant factor
Constant factor = 339 / 160 = 2.118

Random 2^10 (1024):
O(nlogn) = 1024 * log 1024
= 1024 * 10 = 10240

Key comparisons / nlogn = Constant factor
Constant factor = 276005 / 10240 = 26.953

Random 2^15 (32768):
O(nlogn) = 32768 * log 32768
= 32768 * 15 = 491520

Key comparisons / nlogn = Constant factor
Constant factor = 267993330 / 491520 = 545.233

Random 2^20 (1048576):
O(nlogn) = 1048576 * log 1048576
= 1048576 * 20 = 20971520

Key comparisons / nlogn = Constant factor
Constant factor = 348023325 / 20971520 = 16.595

	MergeSort		QuickSort		HeapSort	
	Number of Key Comparisons	Measured clock time (in ns)	Number of Key Comparisons	Measured clock time (in ns)	Number of Key Comparisons	Measured clock time (in ns)
Best Case (Sorted Array)	80	0.430284	496	0.169309	421	0.166951
Average Case (Random Array)	124	0.061052	130	0.04994	388	0.116406
Worst Case (Reverse Sorted Array)	80	0.07489	496	0.029349	339	0.131873
Random 2^10 = 1024	5120	5.617048	145	0.022394	276005	8.317122
Random 2^15 = 32768	245820	47.283714	219	0.029786	267993330	1413.270431
Random 2^20 = 1048576	10538932	508.501448	342	0.030268	348023325	2477566.877369