

# PSA – Assignment 1

## Hits as Time Predictor

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### 1. Relationship:-

Based on the analysis, several factors can impact the duration required for sorting an array using merge sort, dual pivot quick sort, or heap sort algorithms. Each of these sorting methods results in varying numbers of swaps, compares, and copies. As per the findings, merge sort requires the least number of swaps and compares, but has the highest number of copies compared to quick sort and heap sort, which do not require any copies.

### 2. Test cases:-

Merge sort

```
Run: MergeSortTest
Tests passed: 15 of 15 tests - 1sec 196 ms

MergeSortTest (edu.neu.coe.inf.1sec 196 ms)
  testSort11_partialsorted 435 ms
  testSort9_partialsorted 123 ms
  testSort1 9 ms
  testSort2 30 ms
  testSort3 15 ms
  testSort4 56 ms
  testSort5 124 ms
  testSort6 57 ms
  testSort7 69 ms
  testSort10_partialsorted 122 ms
  testSort8_partialsorted 119 ms
  testSort12 25 ms
  testSort13 6 ms
  testSort14 3 ms
  testSort1a 3 ms

Instrumenting helper for insertion sort with 128 elements
partial sorted average time partialsorted_Cutoff + Insurance + NoCopy: 345996
Instrumenting helper for insertion sort with 128 elements
partial sorted average time partialsorted_Cutoff + NoCopy: 108309
Instrumenting helper for merge sort with 128 elements
StatPack {hits: 1,684, normalized=2.711; copies: 640, normalized=1.030; inversions: 4,224, normalized=6.801; swaps: 101, normalized=0.000; fixes: 0, normalized=0.000; worstCompares: 769}
Worst Compares769
Instrumenting helper for insertion sort with 128 elements
Instrumenting helper for merge sort with 128 elements
StatPack {hits: 1,792, normalized=2.885; copies: 896, normalized=1.443; inversions: <unset>; swaps: 0, normalized=0.000; fixes: 0, normalized=0.000; worstCompares: 769}
Instrumenting helper for insertion sort with 128 elements
average time random_Cutoff: 52426
Instrumenting helper for insertion sort with 128 elements
average time random_Cutoff + NoCopy: 98642
Instrumenting helper for insertion sort with 128 elements
average time random_Cutoff + Insurance: 45101
Instrumenting helper for insertion sort with 128 elements
average time random_Cutoff + Insurance + NoCopy: 62553
Instrumenting helper for insertion sort with 128 elements
partial sorted average time partialsorted_Cutoff + Insurance: 114287
```

Heap sort

```
Run: HeapSortTest
Tests passed: 5 of 5 tests - 557 ms

HeapSortTest (edu.neu.coe.inf.557 ms)
  testMutatingHeapSort 476 ms
  sort0 42 ms
  sort1 19 ms
  sort2 17 ms
  sort3 3 ms

Helper for HeapSort with 4 elements
Process finished with exit code 0
```

## Quick sort

