2.6.1 Heapsort

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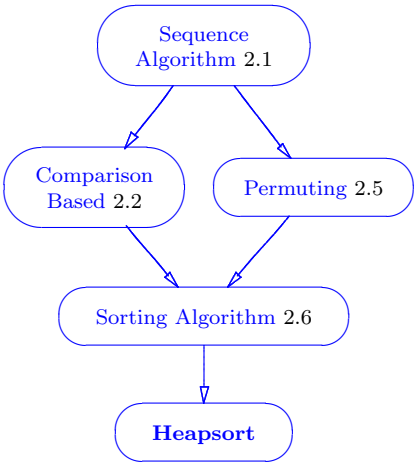


Refinement of: Sequence Sorting Algorithm (§2.6), therefore of Comparison Based (§2.2), Permuting (§2.5), Sequence Algorithm (§2.1).

Prototype:
```
template<class RandomAccessIterator>
void heapsort(RandomAccessIterator first,
              RandomAccessIterator last)
```

Effects: Standard effects of a Sequence Sorting Algorithm (§2.6). In brief: the elements in [first, last) after execution are a permutation of the original elements in the range, and they are in nondecreasing order according the comparison operator.

Asymptotic complexity: Let $N = \text{last} - \text{first}$.

- Average case (random data): $O(N \log N)$
- Worst case: $O(N \log N)$

Complexity in terms of operation counts:

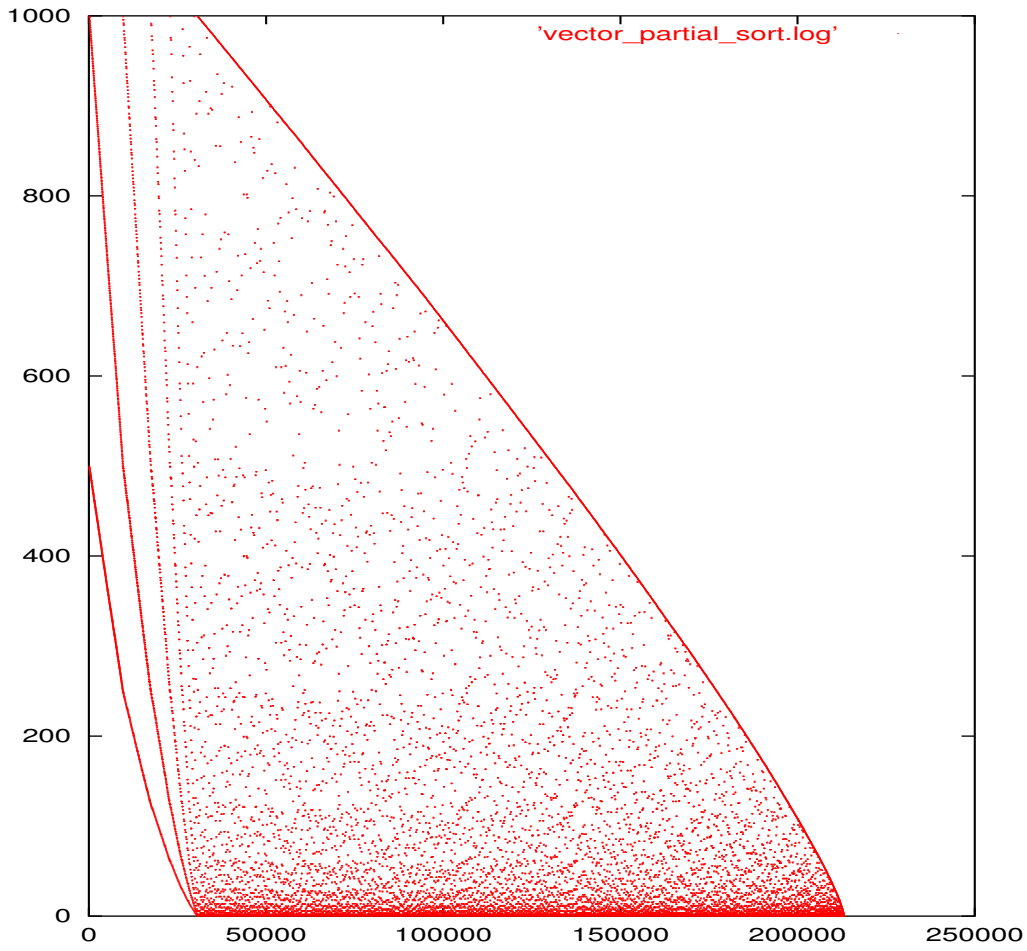
- Average case:

  Value comparisons: $N \log_2 N + 0.36N$
  Value assignments: $1.2N \log_2 N + 3.2N$
  Iterator operations: $12.4N \log_2 N + 10N$
  Integer operations: $14.5N \log_2 N + 17N$

- See also Sorting Algorithm Operation Counts (§2.91) for sample counts on random data for heapsort and other sorting algorithms.

2.6.2 Heapsort iterator trace plot

Compare with other algorithms: Introsort (§2.6.4), Mergesort (§??).



One thousand elements are being sorted by the version of heapsort (actually a special case of `partial_sort`) implemented in SGI STL. From time 0 to about time 30,000 the algorithm is building a heap (with algorithm makeheap). Then, for the rest of the time, it is repeatedly extracting the maximum element and reheaping.