2.12 Hoare Select

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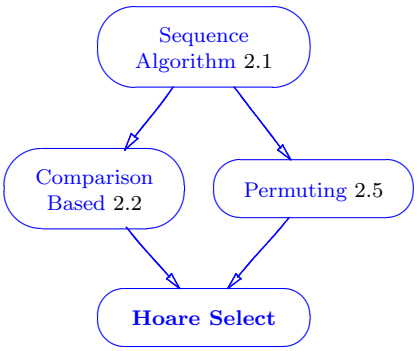


Refinement of: Comparison Based (§2.2), Permuting (§2.5), Sequence Algorithm (§2.1).

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

Input: Iterators first and last delimiting a range of elements, and iterator nth specifying the end of the section to be sorted.

Ouput: The same range of elements modified so that the iterator nth points to the element that would be in that position if the entire range had been sorted.

Effects: All elements in the range from first to nth are less than or equal to elements from nth to last.

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

- Average case (random data): $O(N)$

- Worst case: $O(N^2)$

Complexity in terms of operation counts:

- Random nth element used for each trial. All sizes and op counts are in multiples of 1000. 100000 trials were run for each size.

Size:	1
Comparisons:	3.056
Assignments:	2.713
Other:	6.989
Total:	12.758

Size:	2
Comparisons:	6.074
Assignments:	5.305
Other:	13.905
Total:	25.284

Size:	4
Comparisons:	12.087
Assignments:	10.475
Other:	27.727
Total:	50.289

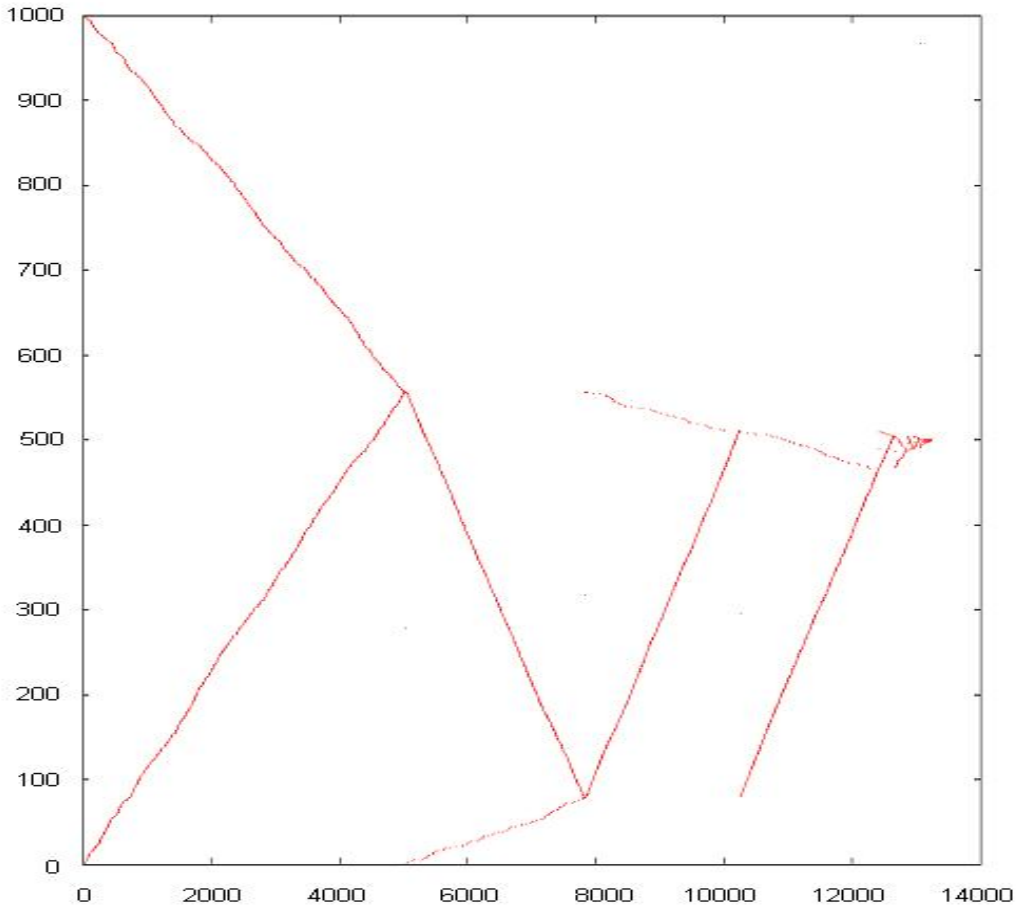
Size:	8
Comparisons:	24.067
Assignments:	20.756
Other:	55.235
Total:	100.058

Size:	16
Comparisons:	48.139
Assignments:	41.36
Other:	110.513
Total:	200.012

- Average case:

Comparisons:	$3.1N - 148.4 \log_2 N + 1532.3$
Assignments:	$2.6N - 101.2 \log_2 N + 1162.4$
Other:	$7N - 305 \log_2 N + 3123.1$
Total:	$12.7N - 554.6 \log_2 N + 5817.8$

2.12.1 Hoare Select iterator trace plot



The version of Hoare Select implemented in SGI STL is being run on a random sequence of 1000 elements.