Bubble and Insertion Sort

Introduction to Computer Programming

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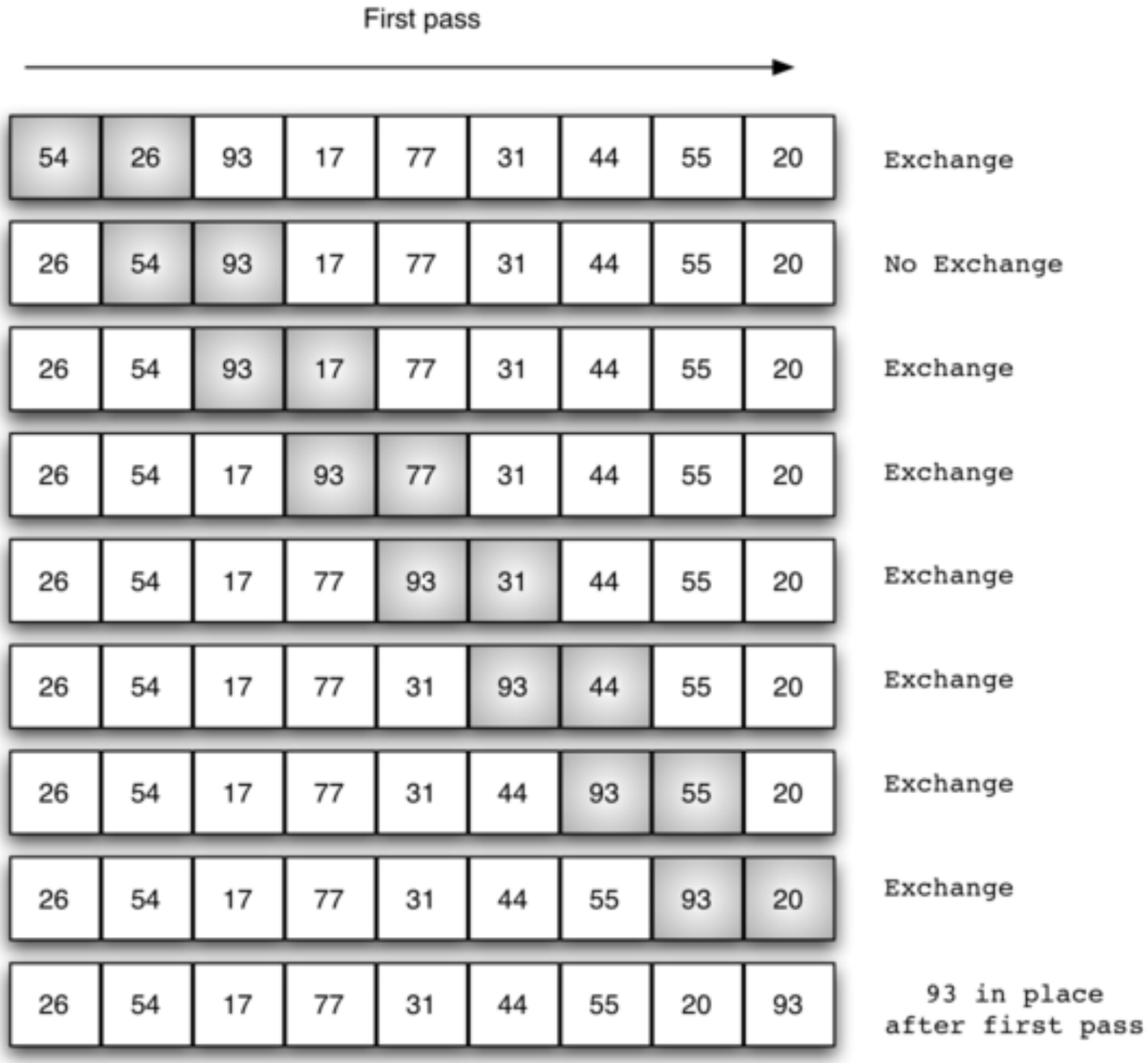
Question

Suppose the only operation we could perform on lists was swapping adjacent cells. Could we sort this list?

Bubble Sort

Pass through the list swapping elements so that larger element move forward when swapping (for ascending order). In other words, larger elements bubble to the top. Make repeated passes until the list is sorted.


First pass
54 26 93 17 77 31 44 55 20
Exchange
26 54 93 17 77 31 44 55 20
No Exchange
26 54 93 17 77 31 44 55 20
Exchange
26 54 17 93 77 31 44 55 20
Exchange
26 54 17 77 93 31 44 55 20
Exchange
26 54 17 77 31 93 44 55 20
Exchange
26 54 17 77 31 44 93 55 20
Exchange
26 54 17 77 31 44 55 93 20
Exchange
26 54 17 77 31 44 55 20 93
93 in place
after first pass

Tasks

1. Implement bubble sort.

2. Experiment timing with lists of various lengths.

Question

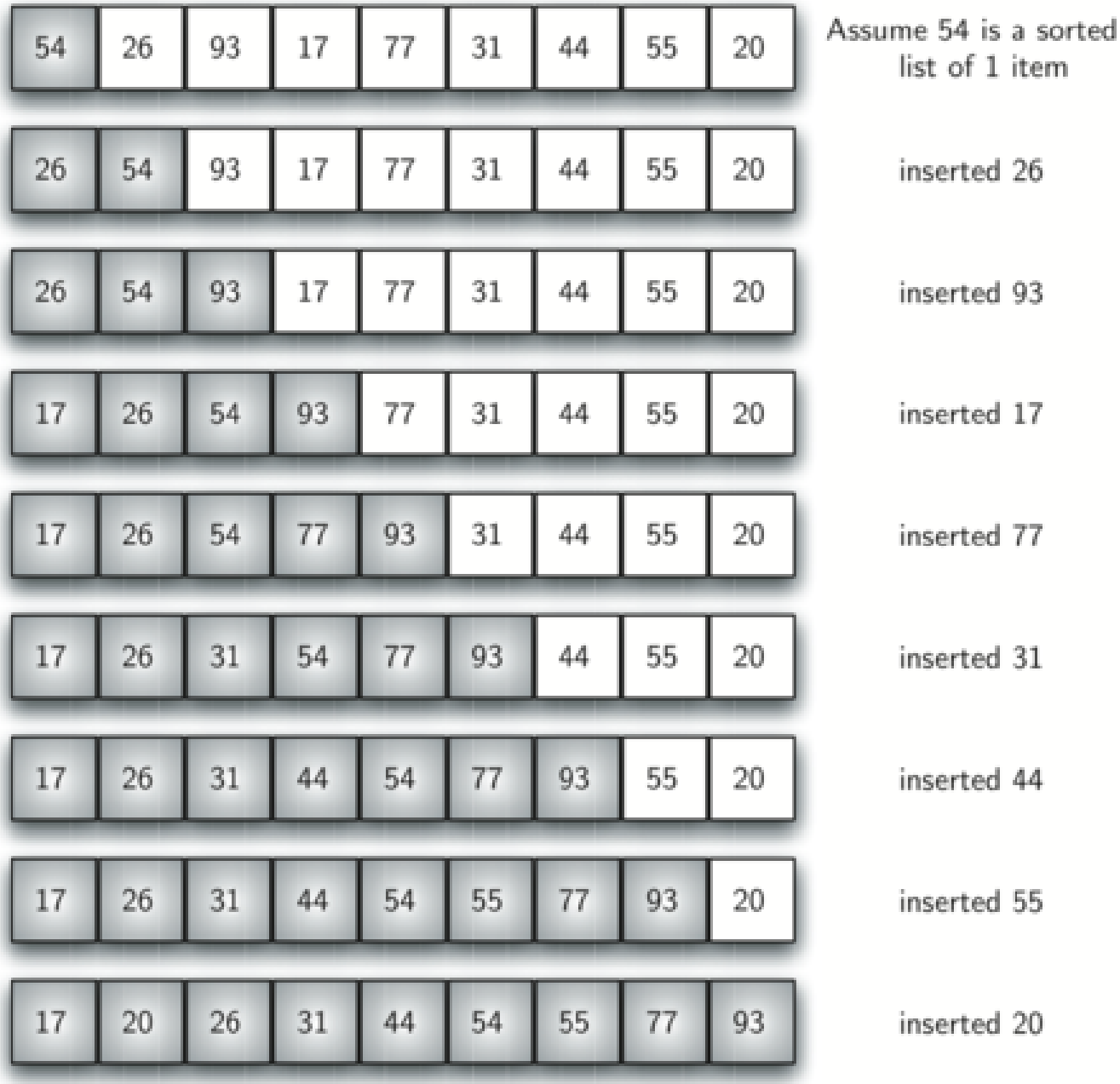
Suppose we could only place an element correctly into a sorted list.

Could we sort a list?

Insertion Sort

Sort the list by inserting elements repeatedly into the front of the list.

After k steps the first k elements of the list will be sorted.


54 26 93 17 77 31 44 55 20
Assume 54 is a sorted list of 1 item
26 54 93 17 77 31 44 55 20
inserted 26
26 54 93 17 77 31 44 55 20
inserted 93
17 26 54 93 77 31 44 55 20
inserted 17
17 26 54 77 93 31 44 55 20
inserted 77
17 26 31 54 77 93 44 55 20
inserted 31
17 26 31 44 54 77 93 55 20
inserted 44
17 26 31 44 54 55 77 93 20
inserted 55
17 20 26 31 44 54 55 77 93
inserted 20

Tasks

1. Implement bubble sort.

2. Experiment timing with lists of various lengths.

Question

Rather than timing we can count how many times some operation is performed in each sorting algorithm — which operation should we count?

Next Time

1. Algorithm Complexity.