$\log n$ - Space, $n^{3/2}$ Time Quantum Sort.

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[Kla03], [Fun21]

Result: Sorting $A_1, A_2, ..A_n$
for $i \in [n]$ **do**
  for $j \in [n]$ **do**
    if $A_i < A_j$ **then**
      swap $A_i \leftrightarrow A_j$
    end
  end
end

Algorithm 1: "ICan'tBelieveItCanSort" alg.

Result: Sorting $A_1, A_2, ..A_n$
swap $A_1 \leftrightarrow \max A$
for $i \in [n-1]$ **do**
  Find the first k such $A_k > A_i$
  Set $A \leftarrow A_1, A_2..A_{k-1}, A_i, A_k, A_{k+1}, .., A_{i-1}, A_{i+1}.., A_n$
end

Algorithm 2: "ICan'tBelieveItCanSort" alg.

Result: Sorting $A_1, A_2, ..A_n$
swap $A_1 \leftrightarrow \max A$
for $i \in [n-1]$ **do**
  Set current $\leftarrow$ head.next
  k-pointer $\leftarrow$ Find the first '$k < i$' node such '$A_k > A_i$' using Grover querying the follow
    Ask if (node.color = red and node.value > current.value
      and node.back.value $\leq$ current.value)
  Set head.next $\leftarrow$ head.next.next
  Set head.next.back $\leftarrow$ head
  Set current.next $\leftarrow$ k-pointer
  Set current.back $\leftarrow$ k-pointer.back
  Set current.back.next $\leftarrow$ current
  Set current.color $\leftarrow$ red
end

Algorithm 3: "Quantum ICan'tBelieveItCanSort" alg.

References

[Kla03] Hartmut Klauck. *Quantum Time-Space Tradeoffs for Sorting*. 2003. arXiv: quant-ph/0211174 [quant-ph].

[Fun21] Stanley P. Y. Fung. "Is this the simplest (and most surprising) sorting algorithm ever?" In: *CoRR* abs/2110.01111 (2021). arXiv: 2110.01111. URL: https://arxiv.org/abs/2110.01111.