8.1-3 Give a brief argument that the running time of PARTITION on a subarray of size \( n \) is \( \Theta(n) \).

8.2-2 Show that the running time of QUICKSORT is \( \Theta(n^2) \) when the array \( A \) is sorted in nonincreasing order.

9.2-5 Describe an algorithm that, given \( n \) integers in the range 1 to \( k \), preprocesses its input and then answers any query about how many of the \( n \) integers fall into a range \([a \ldots b]\) in \( O(1) \) time. Your algorithm should use \( O(n + k) \) preprocessing time.

9.3-2 Which of the following sorting algorithms are stable: insertion sort, merge sort, heapsort, and quicksort? Give a simple scheme that makes any sorting algorithm stable. How much additional time and space does your scheme entail?