Counting Sort (2 points)

1. [2 points] Describe an algorithm that, given n integers in the range 0 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 $\Theta(n + k)$ preprocessing time.

Bucket Sort (5 points)

2. [2 points] Using Figure 8.4 as a model, illustrate the operation of BUCKET-SORT on the array $A = \langle .79, .13, .16, .64, .39, .20, .89, .53, .71, 42 \rangle$.

3. [3 points] Explain why the worst-case running time for bucket sort is $\Theta\left(n^2\right)$. What simple change to the algorithm preserves its linear average-case running time and makes its worst-case running time $O(n \lg n)$?

Radix Sort (3 points)

4. [3 points] Show how to sort n integers in the range 0 to $n^3 - 1$ in $O(n)$ time.