2. Suppose that, even unrealistically, we are to search a list of 700 million items using Binary Search, Recursive (Algorithm 2.1). What is the maximum number of comparisons that this algorithm must perform before finding a given item or concluding that it is not in the list?

7. Use the divide-and-conquer approach to write an algorithm that finds the largest item in a list of $n$ items. Analyze your algorithm, and show the results in order notation.

Section 2.2

8. Use Mergesort (Algorithms 2.2 and 2.4) to sort the following list. Show the actions step by step.

123 34 189 56 150 12 9 240

16. Suppose that, in a divide-and-conquer algorithm, we always divide an instance of size $n$ of a problem into 10 subinstances of size $n/3$, and the dividing and combining steps take a time in $\Theta(n^2)$. Write a recurrence equation for the running time $T(n)$, and solve the equation for $T(n)$.

19. Use Quicksort (Algorithm 2.6) to sort the following list. Show the actions step by step.

123 34 189 56 150 12 9 240

24. Assuming that Quicksort uses the first item in the list as the pivot item:

(a) Give a list of $n$ items (for example, an array of 10 integers) representing the worst-case scenario.

(b) Give a list of $n$ items (for example, an array of 10 integers) representing the best-case scenario.
40. Write an efficient algorithm that searches for a value in an \( n \times m \) table (two-dimensional array). This table is sorted along the rows and columns—that is,

\[
\begin{align*}
\text{Table}[i][j] & \leq \text{Table}[i][j+1] \\
\text{Table}[i][j] & \leq \text{Table}[i+1][j]
\end{align*}
\]

Problem 45. is EXTRA CREDIT

45. Use the divide-and-conquer approach to write a recursive algorithm that finds the maximum sum in any contiguous sublist of a given list of \( n \) real values. Analyze your algorithm, and show the results in order notation.