Advanced Sorting
Algorithms and Datastructures

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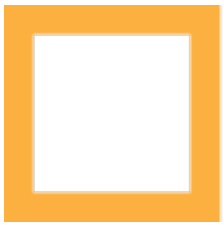

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Outline

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Sorting

- Divide and Conquor
- Merge Sort
- Quick Sort

Divide and Conquor

- Divide and break
  - Break the problem in to smalle sub-problem recursively
  - Sub-problem should represent a part of the original problem
  - Keep on dividing until no more division is possible
- Conquer/Solve
  - Smalles sub-problem are solved
  - Solutions of all the sub-problems are merged
- Merge/Combine
  - Recursively combines small solutions to the big solutions

Merge sort - top down

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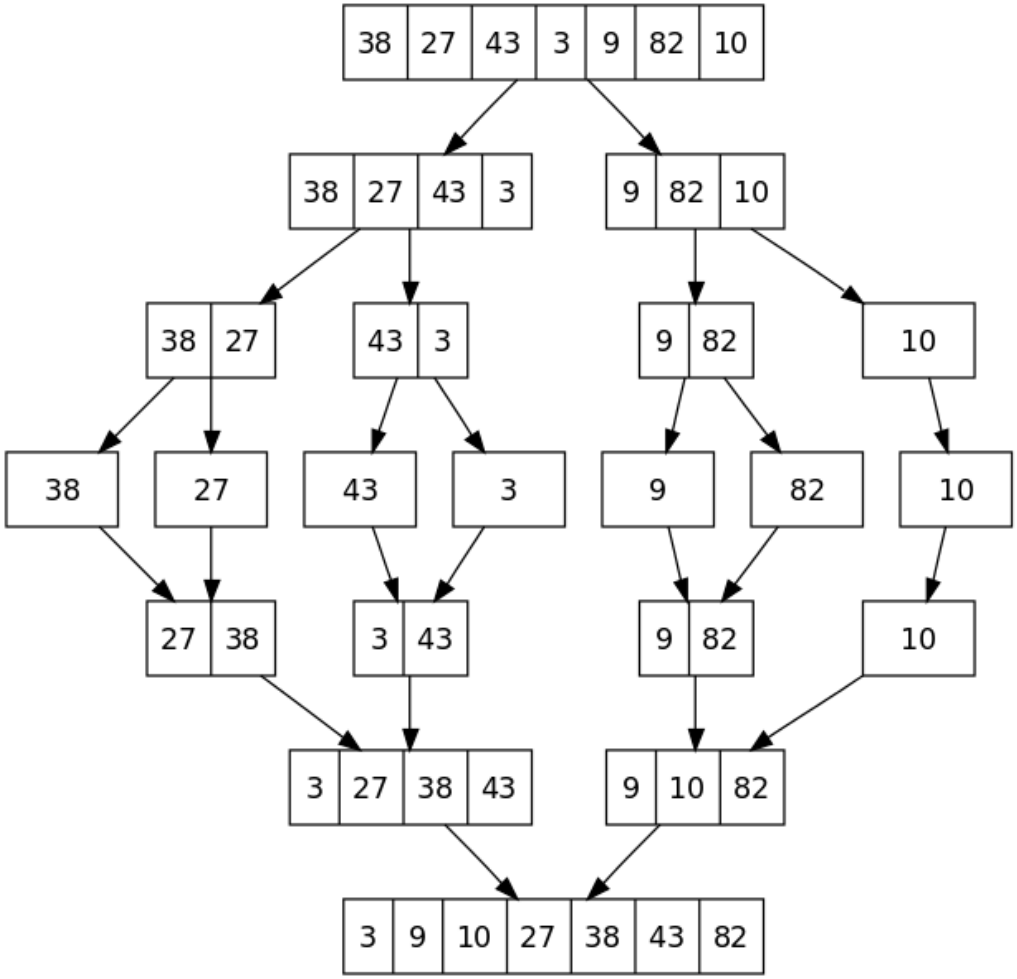
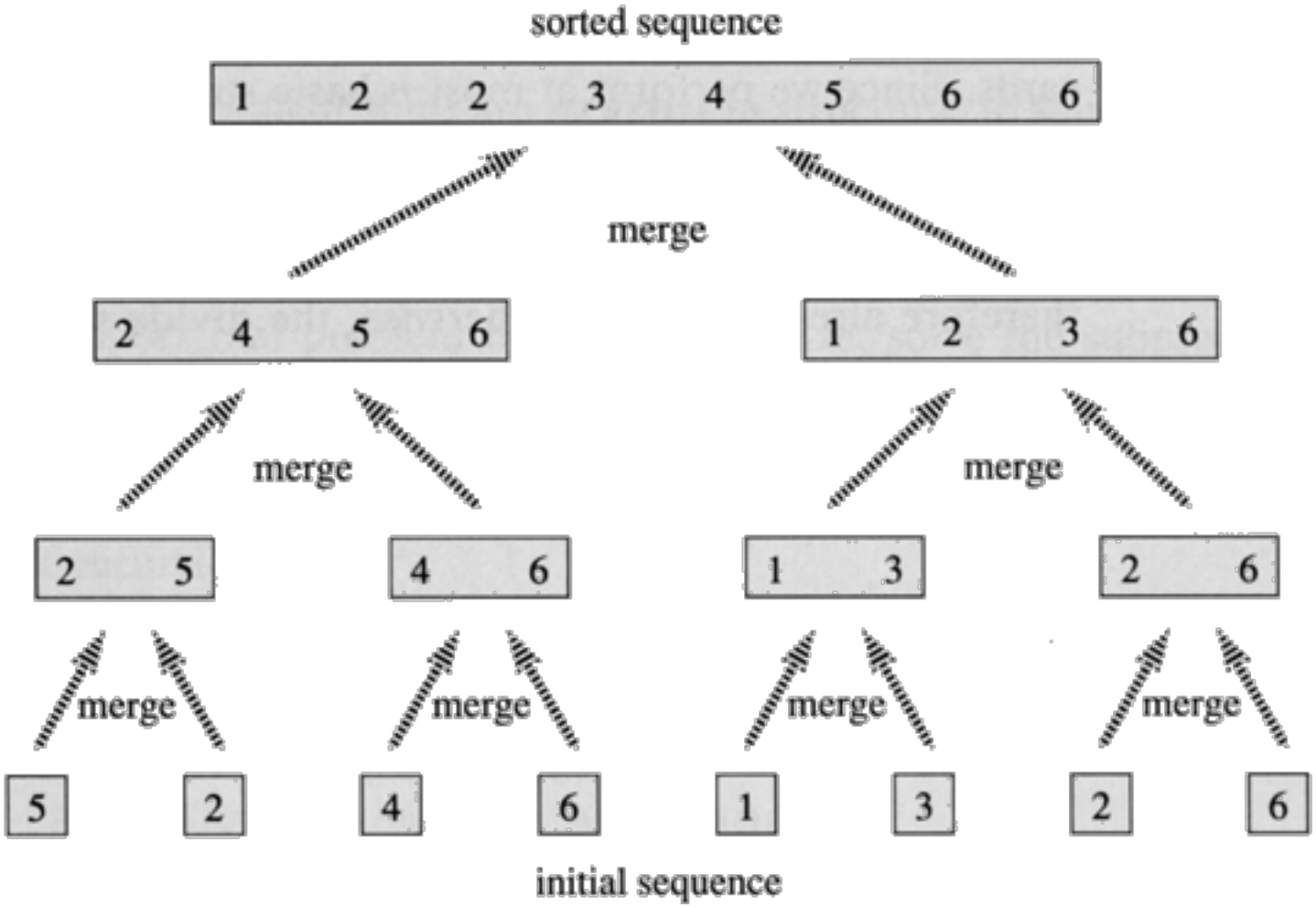
Divide and Conqour



Merge sort - button up

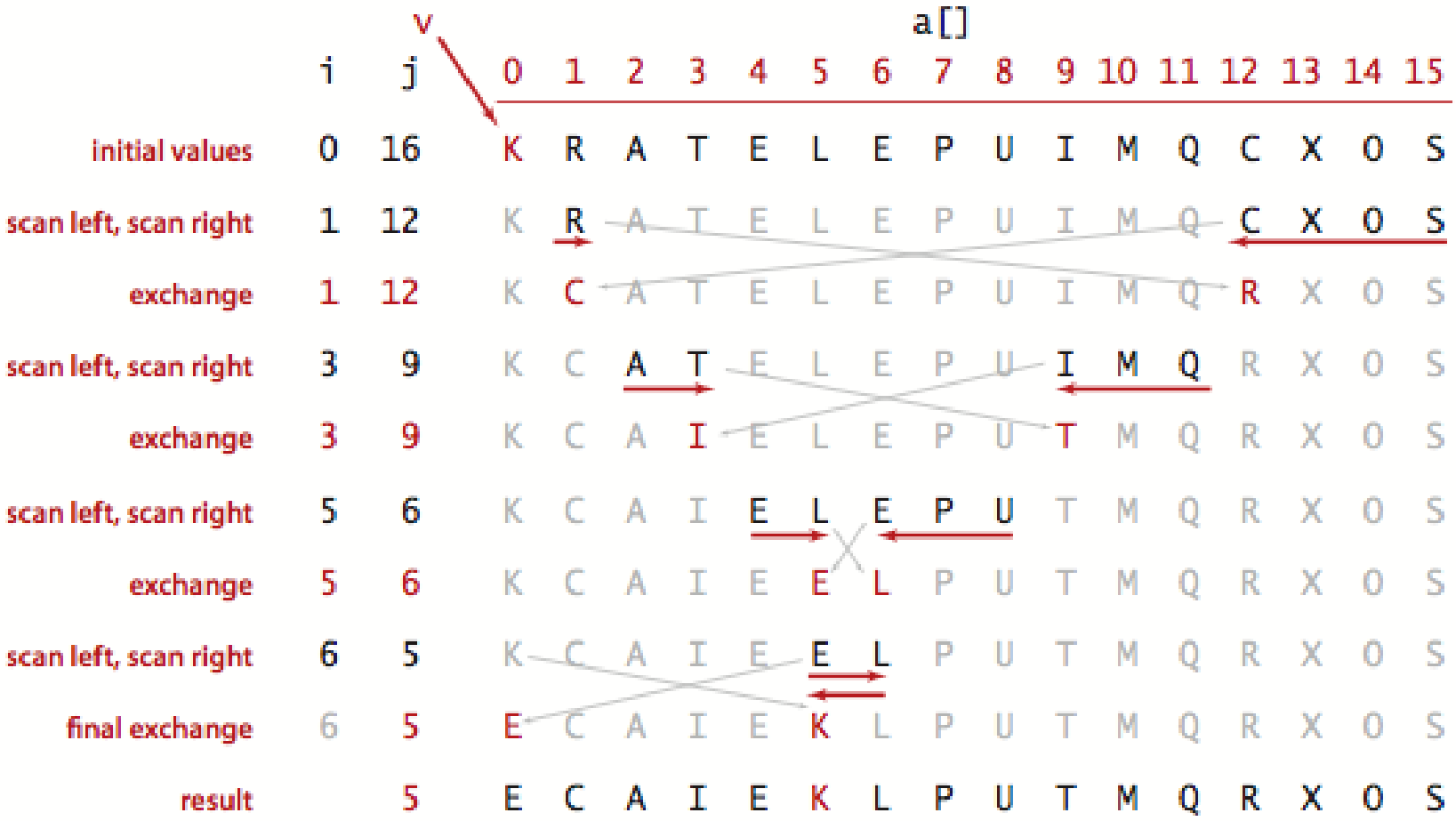


Quick Sort

Quick sort doesn't use auxiliary space

1. Choose a pivot p, e.g: first element of array
2. Bring all element less than the pivot to one end of the array and all elements greater to the other.
3. Place the pivot in between.
4. Sort items left of the pivot
5. Sort items right of the pivot

Quick Sort



Partitioning trace (array contents before and after each exchange)

Exercise 1

- Show using pen and paper trace of sorting the string "EASYQUESTION" with top-down and bottom up merge sort.
- Re-design your `SortingAlgorithms` class. This time do the following:
  1. Implement a method for merge sort
     - 1.1 Create another method that checks if small arrays are already sorted
     - 1.2 Implement if possible, a merge sort without using an auxilary array
     - 1.3 Implement a bottom up merge sort
  2. Implement one method for quick sort

Identify Big-O for all the above