

Problem #2: (30pts)

(a) Given the following list of numbers:

90, 8, 7, 56, 123, 235, 9, 1, 653

trace the execution for:

(a.1) Selection Sort (only the first 5 steps)

Base

90	8	7	56	123	235	9	1	653
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↑
1 is min, swap with 90

1	8	7	56	123	235	9	90	653
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↑
7 is min, swap with 8

1	7	8	56	123	235	9	90	653
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↑
8 is min, swap with 8 (remains unchanged)

1	7	8	56	123	235	9	90	653
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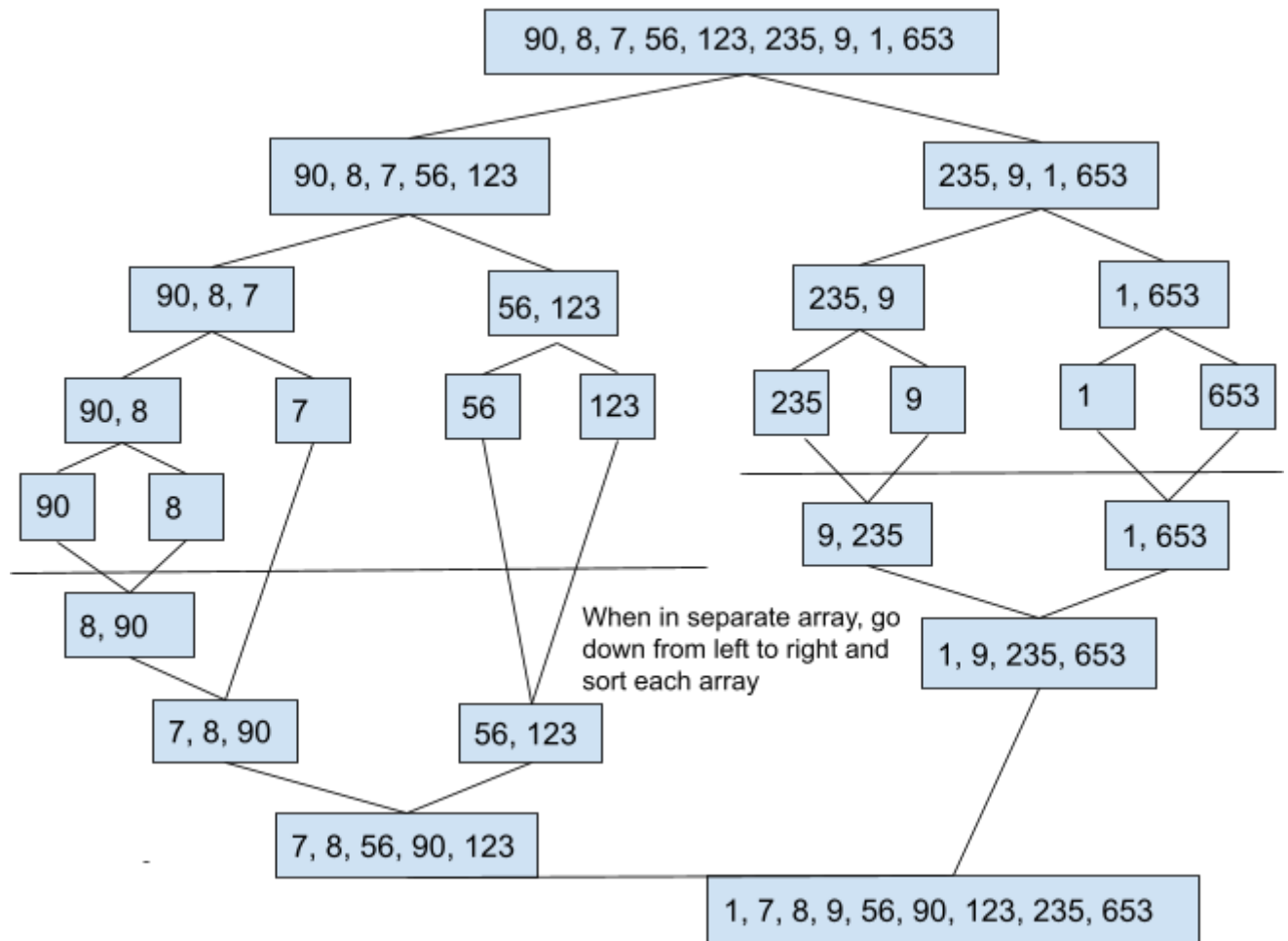
↑
9 is min, swap with 56

1	7	8	9	123	235	56	90	653
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↑
56 is min, swap with 123

1	7	8	9	56	235	123	90	653
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(a.2) MergeSort



(b) Given the following list of numbers:

3, 1, 4, 1, 5, 9, 2, 6, 5, 3, 5

trace the execution for quicksort with median-of-three partitioning and a cutoff of 3.

Step 1: Pick pivot as median of 3. 3, 9, and 5 are the medians, Sort them. 5 at index 5 will be used as the pivot.

3, 1, 4, 1, 5, 5, 2, 6, 5, 3, 9

Step 2: Hide the pivot element in the second to last index.

3, 1, 4, 1, 5, 3, 2, 6, 5, 5, 9

Step 3: itemFromLeft = 6 and itemFromRight = 2. Swap itemFromLeft with pivot.

All items from the left of pivot are smaller and all items from right of pivot are bigger.

3, 1, 4, 1, 5, 3, 2, 5, 5, 6, 9

Step 4: Recursion is used for partitioning. Left Side.

3, 1, 4, 1, 5, 3, 2

Step 5: Median of 3: 3, 1, 2. Sort them. Pivot = 2 at index 3

1, 1, 4, 2, 5, 3, 3

Step 6: Hide pivot with second to last element.

1, 1, 4, 3, 5, 2, 3

Step 7: itemFromLeft = 4, and itemFromRight = 1. Swap the itemFromLeft with pivot.

All items from the left of the pivot are smaller and all items from the right of the pivot are bigger.

1, 1, 2, 3, 5, 4, 3

Step 8: Recursion partitioning used. Right side.

3, 5, 4, 3

Step 9: Median of 3: 3, 5, 3. Sort them. Pivot = 3 at index 1

3, 3, 4, 5

Step 10: Hide pivot with second to last element. (Even though we as humans know that it is already ordered, the computer doesn't know so it will continue the next steps.)

3, 4, 3, 5

Step 11: itemFromLeft = 4 and itemFromRight = 3 at index 0. Swap itemFromLeft with pivot.

All items from the left of the pivot are smaller and all items from the right of the pivot are bigger.

3, 3, 4, 5

Step 12: All elements in the list are sorted.

1, 1, 2, 3, 3, 4, 5, 5, 5, 6, 9