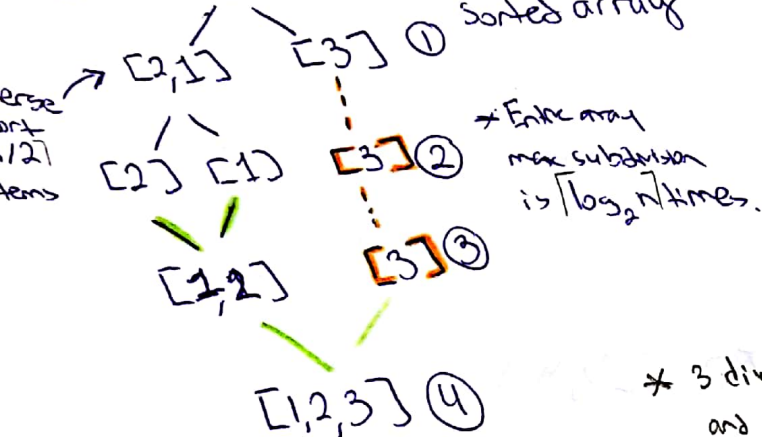


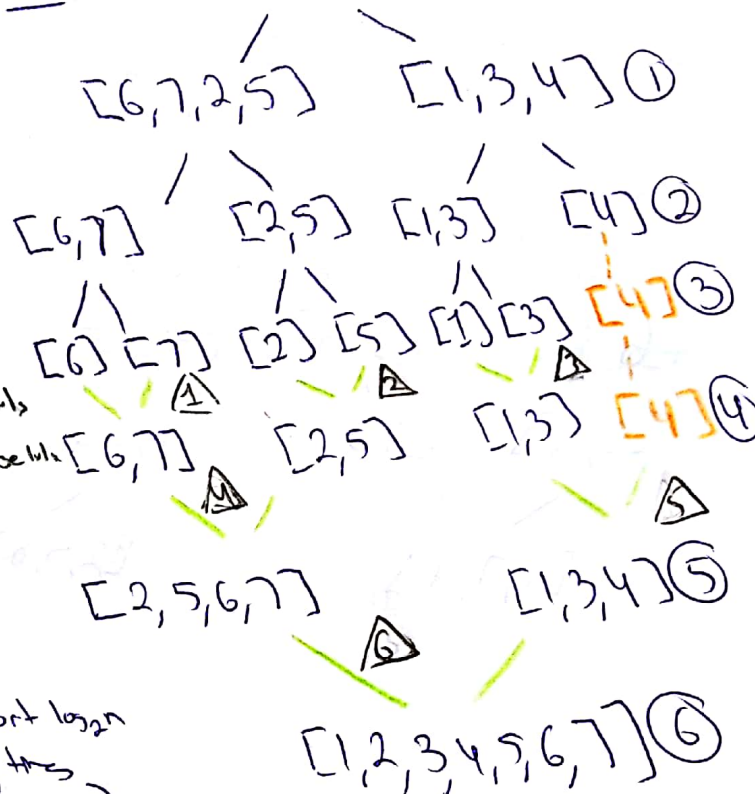
Daniel Gelfand
APCS2 p32

HW#06 -- How Fast Are Your Turtles?
2018-02-12

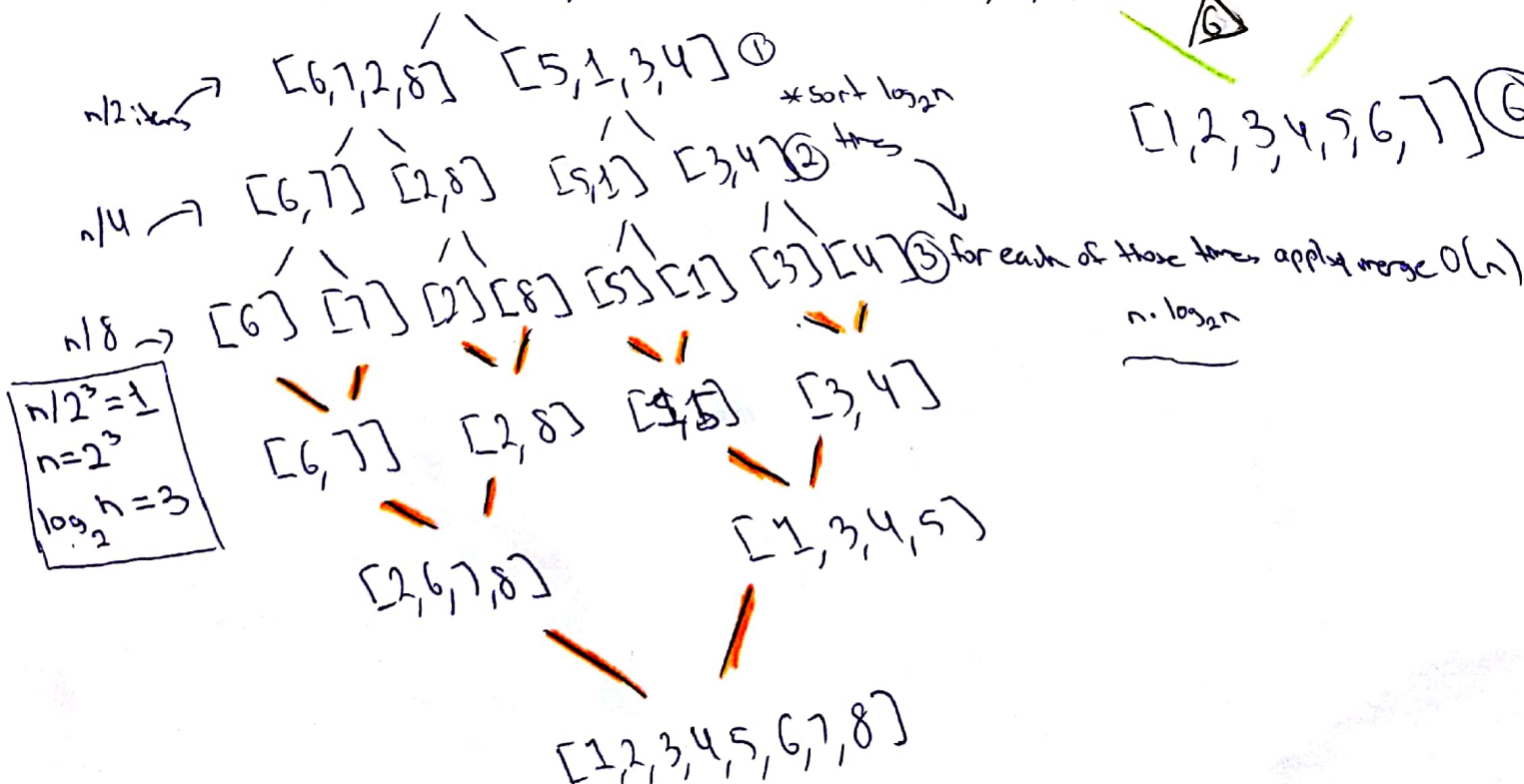
Win: [2, 1, 3] n=3 * Took 4 lvs. for sorted array



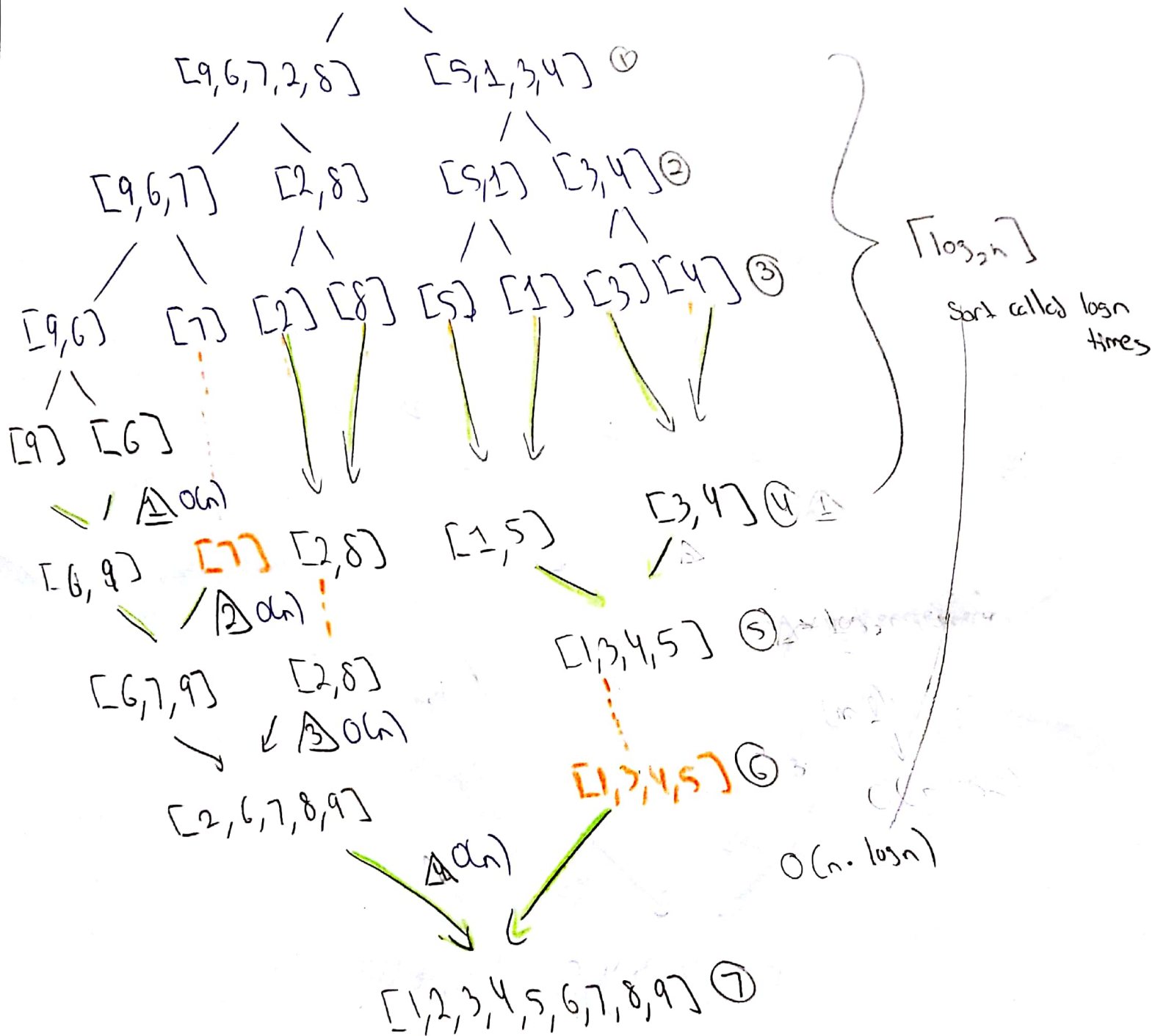
Timi: [6, 7, 2, 5, 1, 3, 4] n=7



Jeremy: [6, 7, 2, 8, 5, 1, 3, 4] n=8



Réine: [9, 6, 7, 2, 8, 5, 1, 3, 4]



* Merging n one-item arrays

Richard: [0,6,7,2,8,5,1,9,3,4] $n=10$

[0,6,7,2,8] [5,1,9,3,4] ①

[0,6,7] [2,8] [5,1,9] [3,4] ②

[0,6] [7] [2] [8] [5,1] [9] [3] [4] ③

[0] [6] [2] [8] [5] [1] [3] [4] ④

[0,6] [7] [2,8] [1,5] [9] [3,4] ⑤

[0,6,7] [2,8] [1,5,9] [3,4] ⑥

[0,2,6,7,8] [1,3,4,5,9] ⑦

[0,1,2,3,4,5,6,7,8,9] ⑧

[3] [4] ④ = $\lceil \log_2 10 \rceil$

$\lceil \log_2 10 \rceil$ merges
 $\times n-1$ merges

William: [12, 9, 15, 10, 6, 16, 7, 2, 8, 13, 5, 1, 14, 3, 4, 11] $n=16$

$\log_2 16 = 4$
 $\log_2 n$ subarray steps

[12, 9, 15, 10, 6, 16, 7, 2] [8, 13, 5, 1, 14, 3, 4, 11] ①

[12, 9, 15, 10] [6, 16, 7, 2] [8, 13, 5, 1] [14, 3, 4, 11] ②

[12, 9] [5, 10] [6, 16] [7, 2] [8, 13] [5, 1] [14, 3] [4, 11] ③

[12] [9] [5] [10] [6] [16] [7] [2] [8] [13] [5] [1] [14] [3] [4] [11] ④

[9, 12] [5, 10] [6, 16] [2, 7] [8, 13] [1, 5] [3] [14] [4] [11] ⑤

[5, 9, 10, 12] [2, 6, 7, 16] [1, 5, 8, 13] [3, 4, 11, 14] ⑥

[2, 5, 6, 7, 9, 10, 12, 16] [1, 3, 5, 8, 11, 13, 14] ⑦

[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16] ⑧

15 merges
 $n-1$ merges
 11 merges, 16 subarrays

Explanation: From the traces it can be seen that the max possible divisions before reaching all sorted arrays is $\lceil \log_2 n \rceil$. Merge will be called $n-1$ times to merge n elements. Sorting runs in $O(\log n)$ and merging in $O(n)$. Since, one is working during the other, merge sort is $O(n \log n)$.