

**HW 4: Extracredit 2**

(15 points)

Due: 11pm April 30, 2020

**No partial credit will be given. Credit is all or nothing. Upload answers in a pdf file to appropriate gradescope submission link**

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1. Determine the running time of mergesort for (6 points)

- a. Sorted input
- b. Reverse-ordered input
- c. Random input

Explain your answer for each.

2. For the quicksort implementation in this book, what is the running time when all keys are equal? Explain (3 points)

3. Show the tree that results of the following sequence (6 points)

union(1,2), union(3,4), union(3,5), union(1,7), union(3,6), union(8,9), union(1,8),  
union(3,10), union(3,11), union(3,12), union(3,13), union(14,15), union(16,0),  
union(14,16), union(1,3), union (1,14) when the unions are

- a. Performed arbitrarily
- b. Performed by height
- c. Performed by size

Note unions are operated on the roots of the trees containing the arguments.