

Julia Nelson

Homework 4

11/1/19

"I pledge my honor that I have abided by the Stevens Honor System." J. Nelson

①

The only change I would make would be to change one line

to "copy list L1 to L2 in reverse order"

"copy list L1 to L2 in the same order"

This keeps the same structure and remains recursive, but generates the binary ~~tree~~ INORDER.

②

Figure 4.11b

<u>n</u>	<u>m</u>
----------	----------

50	65
25	130
12	260 (+130)
6	520
3	1040
1	2080 (+1040)
	2080 + (130 + 1040) =
	3250



Russian Peasant 72 * 93

<u>n</u>	<u>m</u>
----------	----------

72	93
36	186
18	372
9	744 → 744
4	1488
2	2976
1	5952 → 5952
	<div style="border: 1px solid black; padding: 2px; display: inline-block;">= 6696</div>

③

a) Inputs that cause quicksort w/ LomutoPart to perform Worst-Case:

- when Lomuto outputs $n-1$ elements (when $n=1$ it's $1-1=0$)

b)

$$T(1) = \Theta(1)$$

$$T(n) = T(n-1) + \Theta(n)$$

$$= \sum_{k=1}^n (\Theta(k)) = \Theta(n^2)$$

④

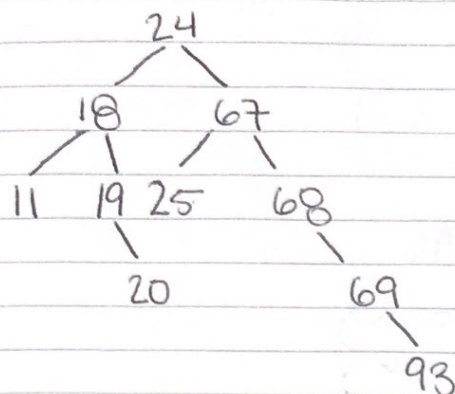
~~5.1.22~~

~~2/2~~

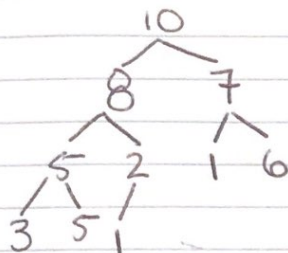
~~1/2~~

5

key = 24 18 67 68 69 25 19 20 11 93



6 Given Tree:



d) Internal Nodes: 5, 2, 8, 7, 10 = 5

e) Number Leaves: 3, 5, 1, 1, 6 = 5

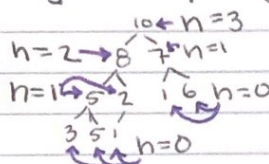
f) Max Width = 4

a) PreOrder: 10, 8, 5, 3, 5, 2, 1, 7, 1, 6

b) InOrder: 3, 5, 5, 8, 1, 2, 10, 1, 7, 6

c) PostOrder: 3, 5, 5, 1, 2, 8, 1, 6, 7, 10

g) height = 3



7

a) $T(n) = 2T(n/4) + 1$

$a=2$ $a \geq 1 \checkmark$

$b=4$ $b > 1 \checkmark$

$d=0$ $d \geq 0 \checkmark$

$2 > 4^0$

$T(n) \in \Theta(n^{\log_4 2})$

$\in \Theta(n^{1/2})$

$= T(n) \in \boxed{\Theta(n^{1/2})}$

Master Theorem

$T(n) \in \Theta(n^d)$ if $a < b^d$

$T(n) \in \Theta(n^d \log n)$ if $a = b^d$

$T(n) \in \Theta(n^{\log_b a})$ if $a > b^d$

c) $T(n) = 2T(n/4) + n$

$a=2$ $b=4$ $d=1$

$2 \leq 4^1$ $T(n) \in \Theta(n^1)$

$T(n) \in \boxed{\Theta(n)}$

b) $T(n) = 2T(n/4) + \sqrt{n}$

$a=2$ $b=4$ $d=1/2$

$2 < 4^{1/2}$

$2 = 2$ so $T(n) \in \Theta(n^{1/2} \log n)$

$T(n) \in \boxed{\Theta(\sqrt{n} \log n)}$

d) $T(n) = 2T(n/4) + n^2$

$a=2$ $b=4$ $d=2$ $2 < 4^2$

$T(n) \in \boxed{\Theta(n^2)}$

e) $T(n) = 2T(n/4) + n^3$

$a=2$ $b=4$ $d=3$

$2 < 4^3$ $T(n) \in \boxed{\Theta(n^3)}$

8

a) $T(n) = \Theta(1) + \Theta(1) + 6T(n/3) + \Theta(n\sqrt{n})$

$$T(n) = 6T(n/3) + \Theta(n\sqrt{n})$$

$$T(n) = 6T(n/3) + n^{3/2}$$

b) $6T(n/3) + n^{3/2}$

$$a = 6$$

$$b = 3$$

$$d = 3/2$$

$$6 - 3^{3/2}$$

$$6 > 5.196$$

$$T(n) \in \Theta(n^{\log_b a})$$

$$\in \Theta(n^{\log_3 6})$$

$$T(n) \in \Theta(n^{1.6309})$$

$$\in \Theta(n^{1.63})$$