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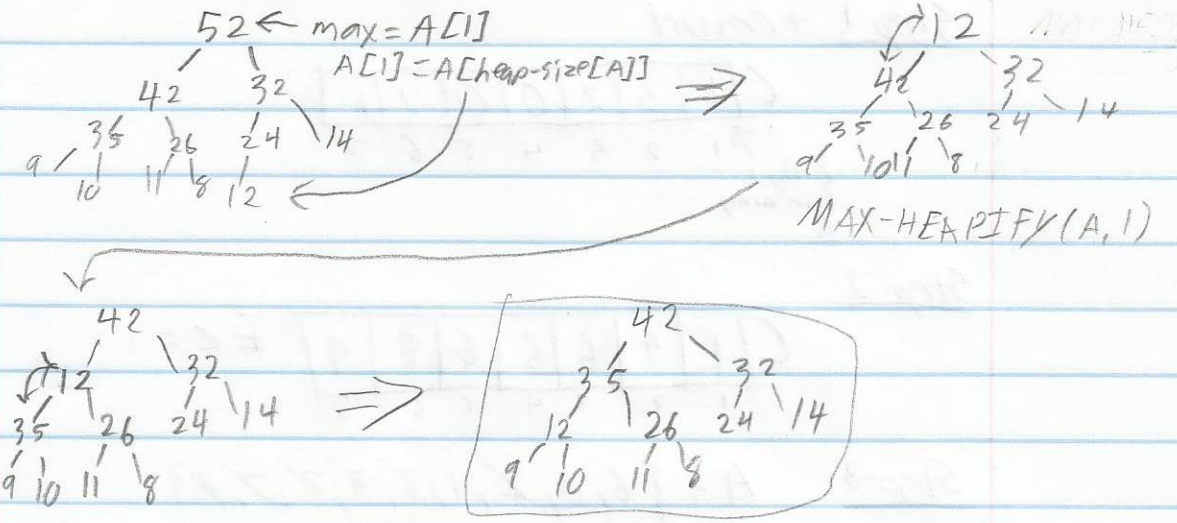
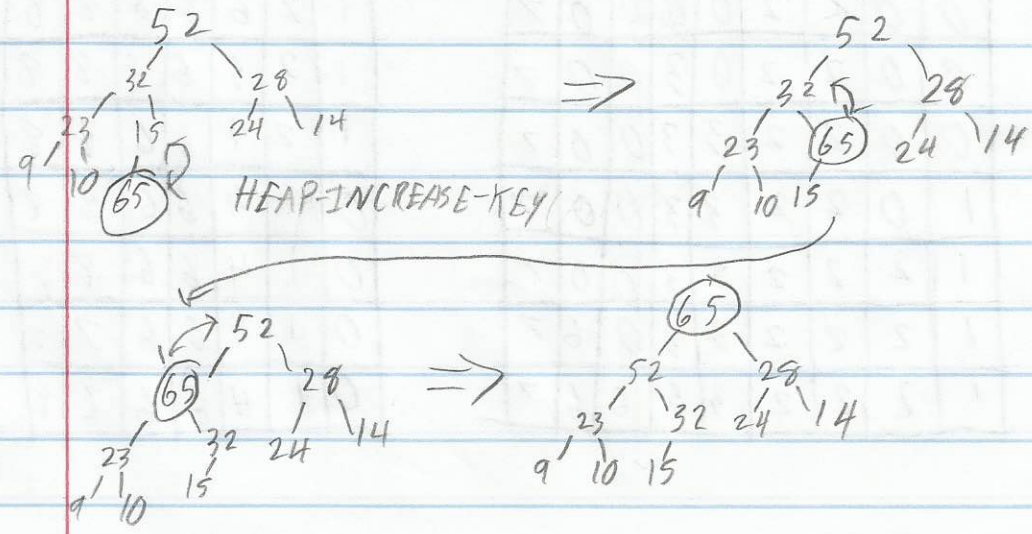
2/13/15

CSE 310 hw 4

1. Illustrate HEAP-EXTRACT-MAX on the heap $A = \{52, 42, 32, 35, 26, 24, 14, 9, 10, 11, 8, 12\}$



2. Illustrate MAX-HEAP-INSERT (A, 65) on the heap $A = \{52, 32, 28, 23, 15, 24, 14, 9, 10\}$



3. Illustrate COUNTING-SORT on the array $A = \{6, 6, 2, 1, 3, 3, 2, 7, 2\}$. Re-draw array C and B for each step and iteration

Step 1 → count

C	1	3	2	0	0	2	1
	1	2	3	4	5	6	7

only 1 1 in array A

Step 2

C	1	4	6	6	6	8	9
	1	2	3	4	5	6	7

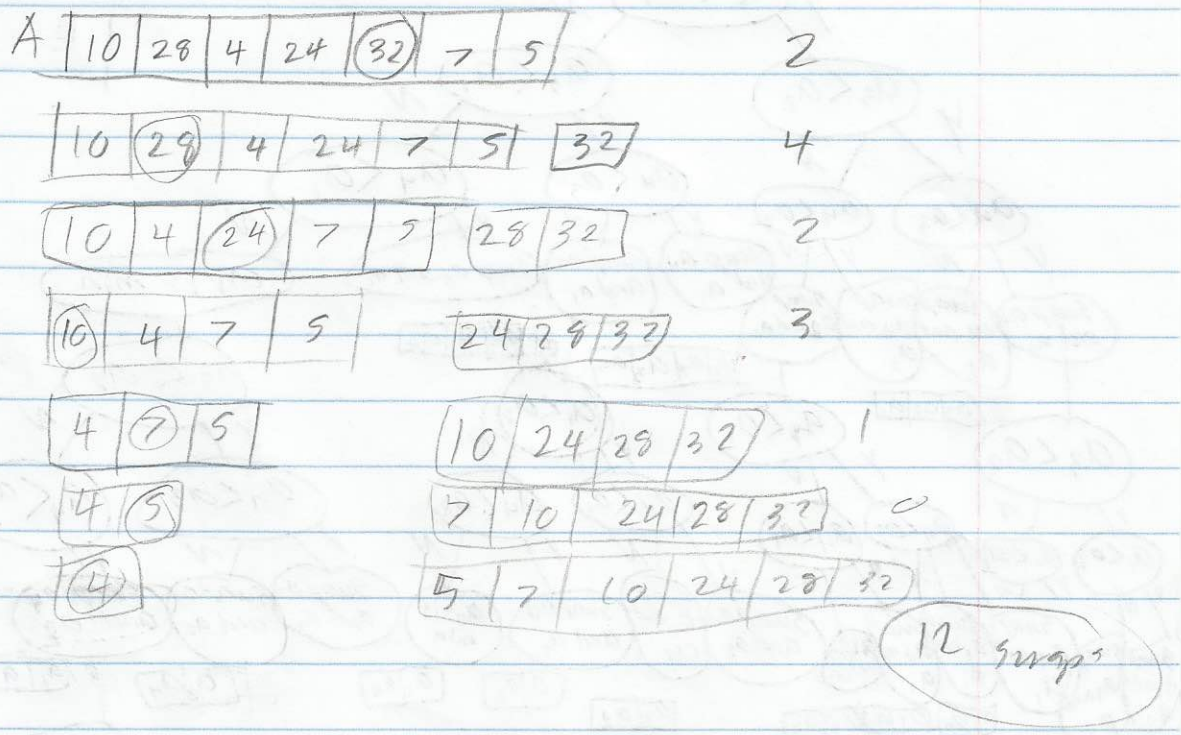
<= i

Step 3 $A = \{6, 6, 2, 1, 3, 3, 2, 7, 2\}$

B	1	2	3	4	5	6	7	8	9
	0	0	0	2	0	0	0	0	0
	0	0	0	2	0	0	0	0	7
	0	0	2	2	0	0	0	0	7
	0	0	2	2	0	3	0	0	7
	0	0	2	2	3	3	0	0	7
	1	0	2	2	3	3	0	0	7
	1	2	2	2	3	3	0	0	7
	1	2	2	2	3	3	0	6	7
	1	2	2	2	3	3	6	6	7

C	1	2	3	4	5	6	7
	1	3	6	6	6	8	9
	1	3	6	6	6	8	8
	1	2	6	6	6	8	8
	1	2	5	6	6	8	8
	1	2	4	6	6	8	8
	0	2	4	6	6	8	8
	0	1	4	6	6	8	8
	0	1	4	6	6	7	8
	0	1	4	6	6	6	8

4. Suppose we use RANDOMIZED-SELECT to select the minimum element of the array $A = \{10, 28, 4, 24, 32, 7, 5\}$. Describe a sequence of partitions that results in the worst-case performance. Re draw the array every time 2 elements are swapped including exchanges in RANDOMIZED-PARTITION and PARTITION



CSE 310 cont.

5. In the algorithm SELECT, the input elements are divided into groups of 5. Will the algorithm work in linear time ($O(n)$) if they are divided into groups of 15?

$$8\left(\left\lceil \tfrac{1}{2} \cdot \left\lceil \tfrac{n}{15} \right\rceil \right\rceil - 2\right) \geq \frac{2n}{15} - 16$$

$T(n/15) + T(8n/15 + 16) + O(n)$

$T(n) \leq c\lceil n/15 \rceil + c(8n/15 + 16) + an$

$\leq cn/15 + 8cn/15 + 16c + an$

$= 9cn/15 + 16c + an$

$= cn + (-cn/15 + 16c + an)$

$\leq cn$

$= O(n)$

6. Build a decision tree for the following sort algorithm, operating on 4 elements a_1, a_2, a_3, and a_4 ($A = \{a_1, a_2, a_3, a_4\}$). Each non-leaf node should compare 2 elements and the leaves should contain all permutations of the four elements

a_1	a_2	a_3	a_4