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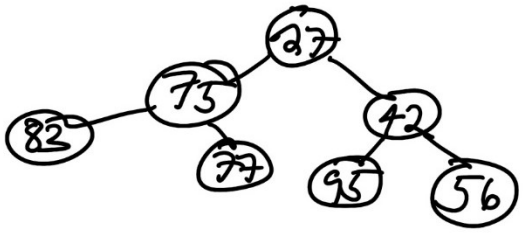
METCS 526

Module 4 Homework (Problems 1 through 5)

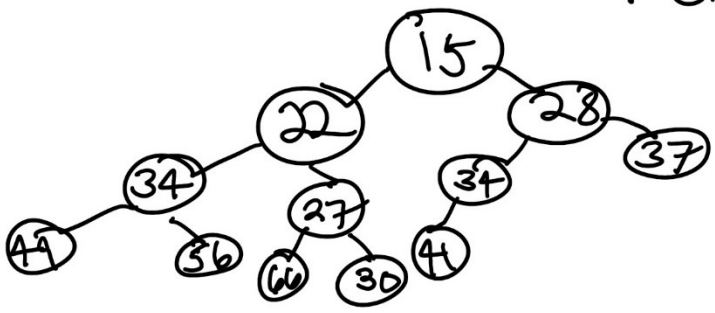
Problem 1 (10 points)

① This is a min heap because our root node is the smallest key value. Since the new addition is smaller than the current root, it will replace it as the root. It is first placed as the right child of the 56 node, which it then swaps with since 56>27, then it swaps with the root b/c 42>27, which leads to the following tree:

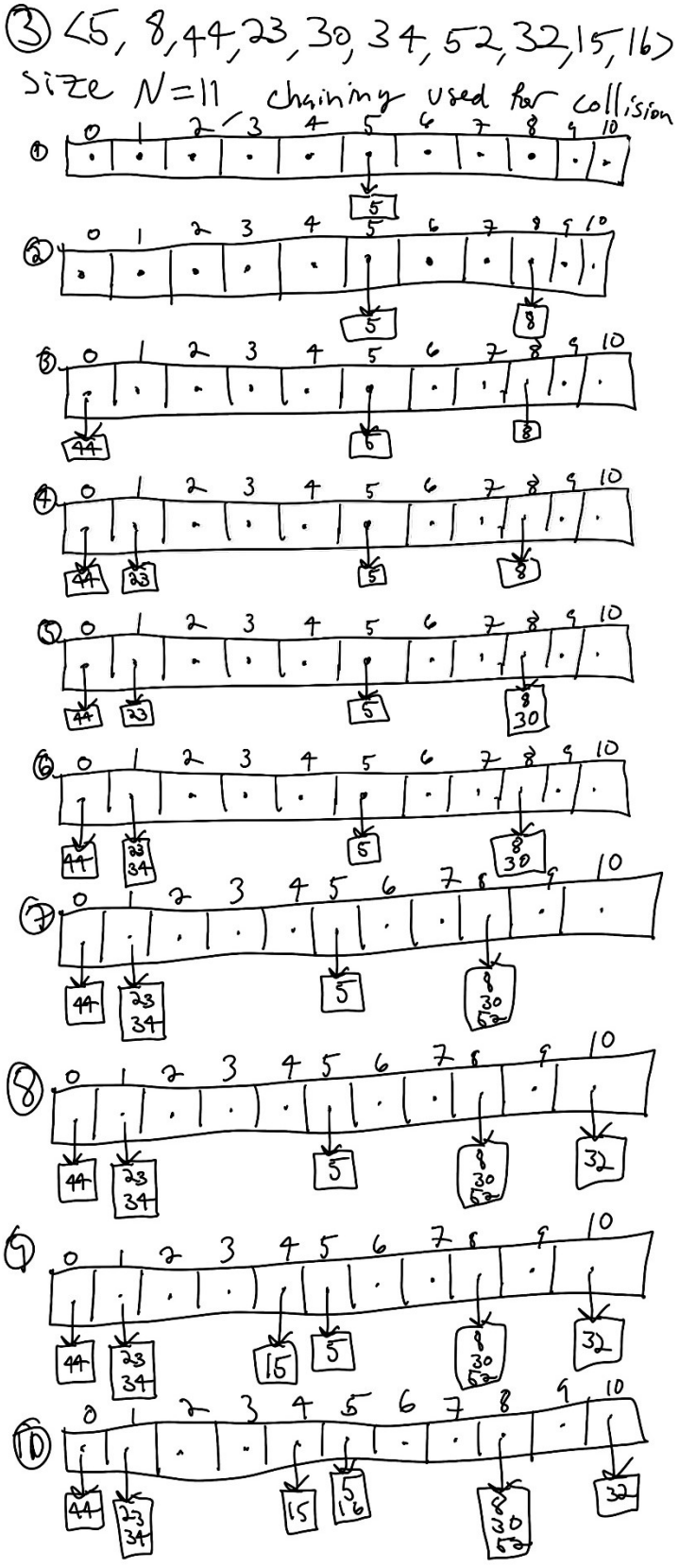


Problem 2 (10 points).

(2) This is a min-heap again, so we will be removing the root & down heap bubbling. The furthest down elem., 34, goes and replaces the 5. Then 34 swaps with the right child (15) since it has the smaller key. Then it swaps with its left child as 34 is smaller than its right child but larger than its left child. This is the resulting tree:



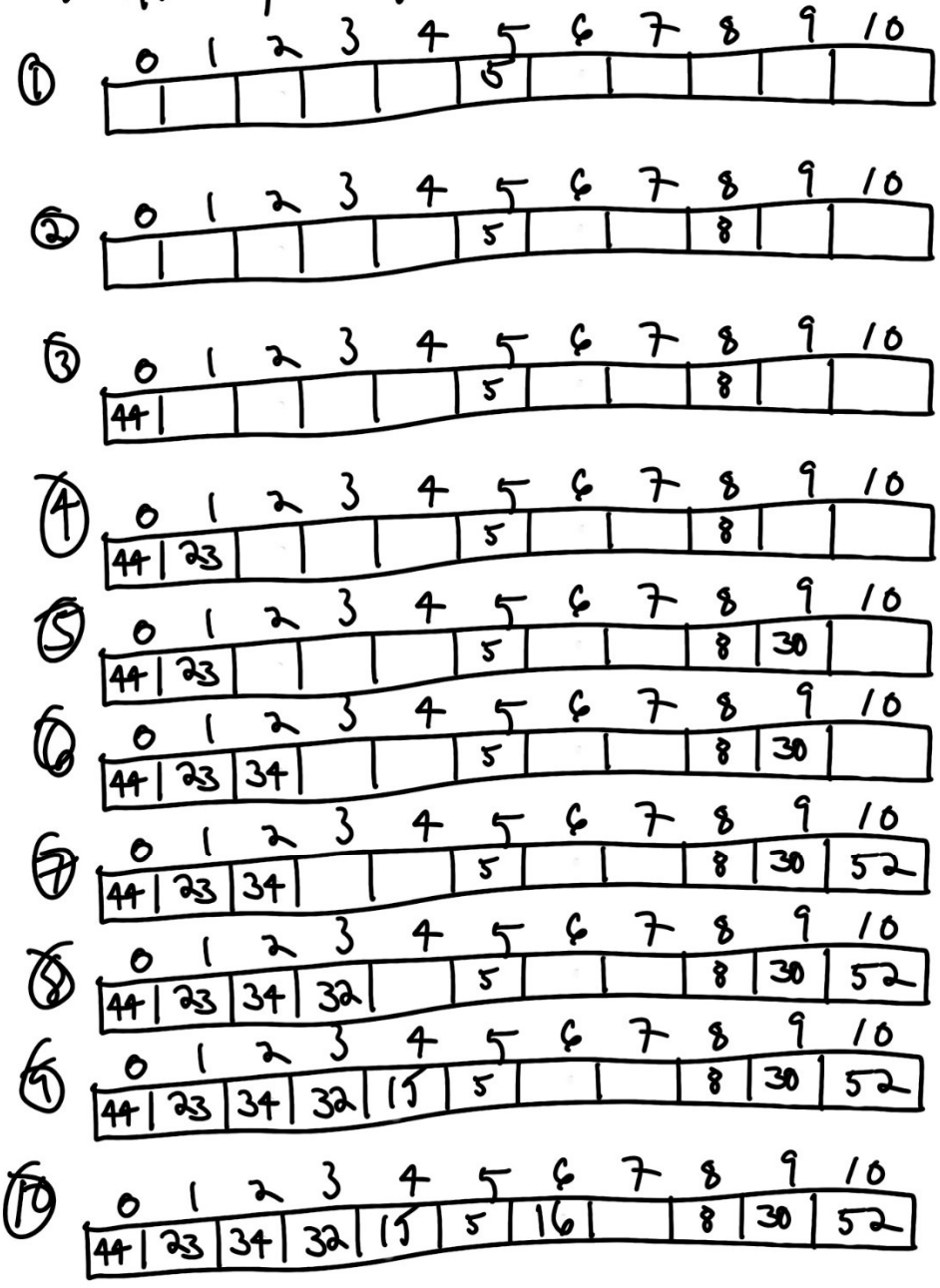
Problems 3 (10 points each).



Problem 4 (10 points).

④ <5, 8, 44, 23, 30, 34, 52, 32, 15, 16>

N=11, linear probing used



Problem 5 (10 points).

(5) $h(15) = 15 \% 13 = 2$, occupied

$h'(15) = (15 \% 11) + 1 = 4 + 1 = 5$

$h(15,1) = (2+5) \% 13 = 7$, occupied

$h(15,2) = (2 + 2 \cdot 5) \% 13 = 12$, occupied

$h(15,3) = (2 + 3 \cdot 5) \% 13 = 4$, empty, so

$K = 15$ is stored at **index 4**

In this process, we check the index using the regular hash function, then since there was a collision, it uses the $h(k,i)$ function, or $(h(k) + i \cdot h'(k)) \bmod N$, until we find an empty cell, which is true for $i = 3$.