CS 143 Homework 6

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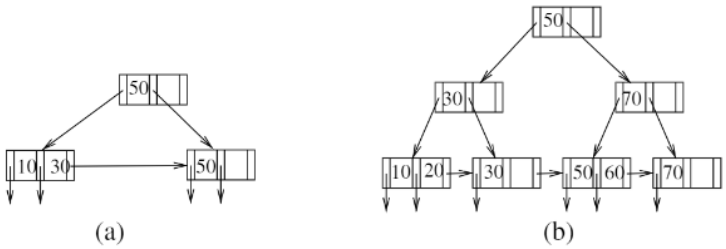
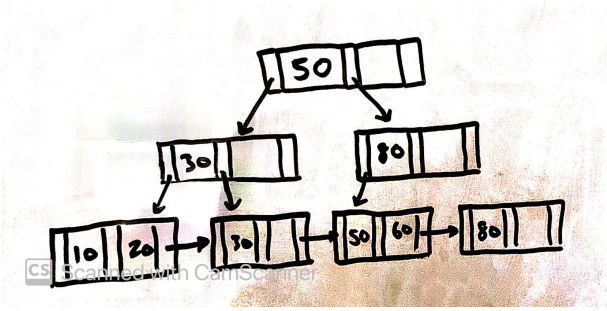
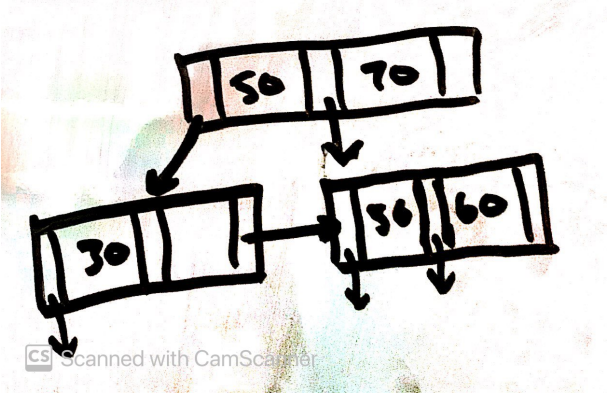
Problem 1



a) Show the final B+tree structure after we insert 60, 20, **and** 80 **into Figure (a)**



b) Show the final B+tree structure after we delete 20, 10, **and** 70 **into Figure (b)**



Problem 2

Consider a B+tree that indexes 300 records. Assume that $n = 5$ for this B+tree (i.e., each node has at most 5 pointers), what is the minimum and maximum height (depth) for this tree? (A tree with only the root node has a height of 1.)

Min:
4 records/node

$\frac{300 \text{ records}}{4 \text{ records/node}} = 75$ nodes

5 pointers/node

$5^{h_{\max}} \geq 75$

$h_{\max} = \lceil \log_5 75 \rceil$

$\boxed{h_{\max} = 3}$

Max:
$(\lceil \frac{n+1}{2} \rceil - 1) = 2$ records/node

$\frac{300 \text{ records}}{2 \text{ records/node}} = 150$ nodes

$(\lceil \frac{n}{2} \rceil) = 3$ pointers/node

$3^{h_{\min}} \geq 150$

$h_{\min} = \lceil \log_3 150 \rceil$

$\boxed{h_{\min} = 5}$

Problem 3

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106, 115, 916, 0, 96, 126, 16, 15, 31
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These keys are to be inserted in the above order into an (initially empty) extendible hash table. The hash function $h(n)$ for key n is $h(n) = n \mod 256$; that is, the hash value is the remainder when the key value is divided by 256 (2^8). Thus, the hash value is an 8-bit value. Each block can hold 3 data items. Draw the extendible hash table after all data items are inserted. Show the keys themselves in the buckets, not the hash value. The bucket numbers are drawn from the bits at the high order end of the hash value. Be sure to indicate i for the directory, the number of hash value bits used. Also indicate i for each bucket, the number of hash function bits that are used for that bucket.