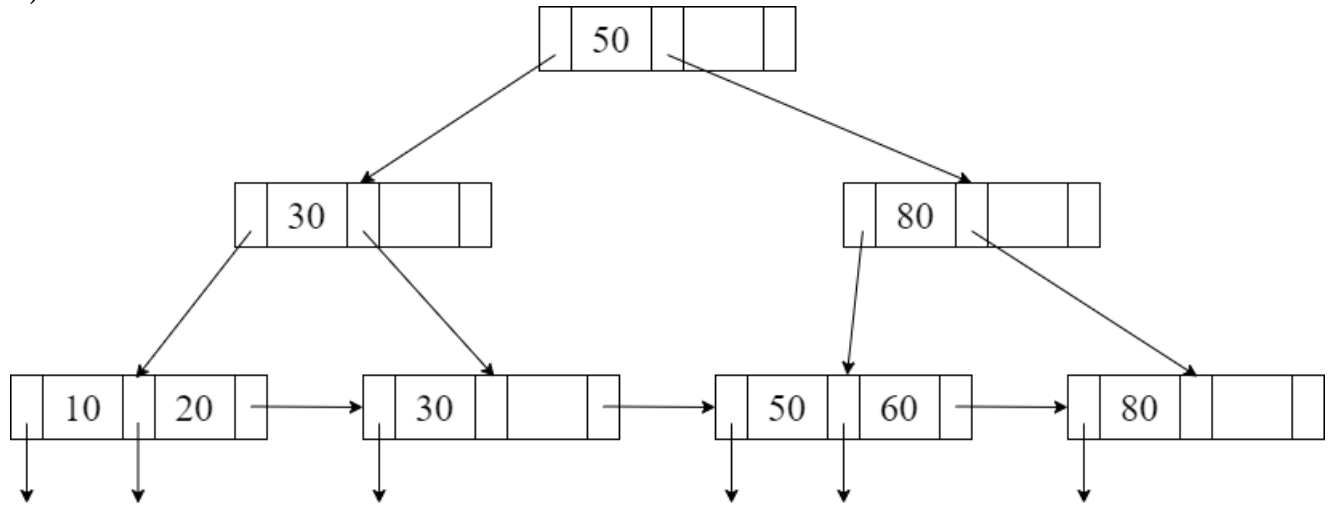
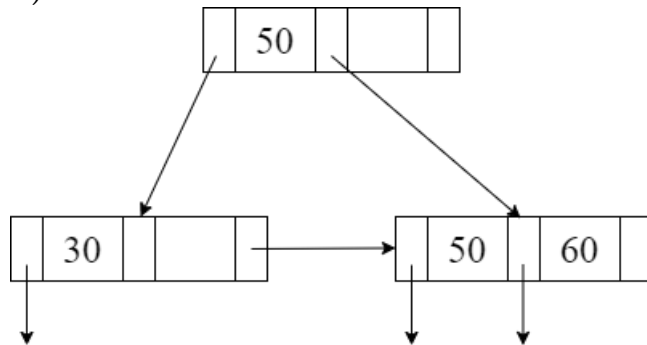


1 Problem 1

a)



b)



2 Problem 2

The minimum and maximum height (depth) of the tree are 3 and 5 respectively.

Work:

Given the tree has 300 records and is $n = 5$:

Leaf nodes:

Pointers: $\lceil (n + 1)/2 \rceil = 3$

Keys: $\lceil (n + 1)/2 \rceil - 1 = 2$

Non-leaf nodes:

Pointers: $\lceil n/2 \rceil = 3$

Keys: $\lceil n/2 \rceil - 1 = 2$

Root node:

Pointers: 2

Keys: 1

Maximum:

First, we take all leaf nodes as having minimum keys: $300 / 2 = 150$ leaf nodes.

Then, we take all non-leaf nodes to have minimum number of pointers: 3 pointers per non-leaf nodes i.e. 3 children. So, we have $150 / 3 = 50$, $50 / 3 \approx 17$, $17 / 3 \approx 6$, $6 / 3 = 2$, root. This is a height of 5.

Minimum:

First, we take all leaf nodes as having maximum keys: $300 / 4 = 75$ leaf nodes.

Then, we take all non-leaf nodes to have maximum number of pointers: 5 pointers per non-leaf nodes i.e. 5 children. So, we have $75 / 5 = 15$, $15 / 5 = 3$, root. This is a height of 3.

3 Problem 3

Original	106	115	916	0	96	126	16	15	31
Hash	01101010	01110011	10010100	00000000	01100000	01111110	00010000	00001111	00011111

