

Written Problems

Question 1

The maximum possible height for a binary tree = $\frac{N}{2}$

This can be achieved by lining up all the nodes to one side of the tree.

The minimum possible height for a binary tree = $\text{ceil}(\log(N + 1)) - 1$

This can be achieved by ensuring that the binary tree is filled at every level until it moves onto the next level. The ceil method is used to ensure that any partially filled level is taken into consideration.

Question 2

The maximum possible height for a tree = N

This can be achieved by lining up all the nodes to one side of the tree.

The minimum possible height for a tree = 1

This can be done by making one of the nodes the root, and every other node the child of this root node. Since this is a case where any type of tree is considered, a node can have any number of children.

Question 5

1. The first example is not a good one because there will be a large number of collisions. There may be different strings but the hash function evaluates the length of the string, which different strings may have in common, thus defeating the purpose of creating a unique key.
2. When generating a hash key, it needs to be unique, and every time the hash function is called, it needs to be able to produce that same key corresponding to that respective data. But having a function generate a key randomly doesn't ensure that the same key will be produced again leading to discrepancies.