CA320 Assignment

2-3 Trees

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Introduction

In this assignment we were asked to implement several functions for 2-3 Trees, more specifically add(X, T), member(X, T), height(T) and prettyPrint(T). My goal with this report is to cover some challenges and my approach to solve them.

Challenges

The hardest function to implement, in my opinion, was add(X, T). While reading the project description, I was confused on wether or not we can create a 3 node branch from the very start. In my initial drafts, I was passing a list to add (add([X], T)), to generate the 3 node. In the final draft, the 3 node branch can be created given that an already 2 node branch already exists, by adding a new element. The way I implemented add was by firstly splitting the tree into two parts, where elements greater than or equal to the new element go to the right subtree, and all elements less than the new element go to the left subtree. The split function recursively traverses the tree and splits it into two parts at the appropriate level. Then we create a new leaf node and and add it to the correct side of the tree based on its value. Finally I merge the two split parts back together (if the height of the 2 split parts are the same then the output will be a tree of the same height otherwise it will merge into the height it had prior to splitting). I was quite lucky since I have played around with trees in lab5 and lab6, many of the approaches and code was inspired from there.

Another challenge was implementing the prettyPrint(T) function. Though, I am not quite satisfied with the outcome, I believe I made a good attempt. The main struggle was properly formatting the output, as a tree in the terminal. I did not manage to create correct branches, but I did manage to indent the nodes that are different and nest them at a certain extent. My approach was creating a helper function (formatTree), to recursively traverse the tree, and generate the output (string) as we go along, based on the depth of the tree.

The rest of the functions weren't difficult to implement. "Contains" and "Delete" were solved by recursively looking for the given element in a preexisting tree. "Height" came as a bonus with implementing the add function and I am just pattern matching to determine the height of the tree based on the structure of the tree. It checks if the tree is a Leaf, Node, or Node2, and returns the height accordingly.

Conclusion

In conclusion, the implementation of 2-3 Trees in this assignment was a rewarding experience, despite the challenges encountered. The add(X, T) function was a significant challenge, requiring careful handling of different tree structures. However, the contains and delete functions were straightforward to implement, and the height(T) function was straightforward to implement as well. The prettyPrint(T) function was complex, but it was a valuable learning experience. Despite the incomplete implementation, I am satisfied with the progress made

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