COMP 206 (T4 - 2020)

Assignment 3

Instructions

Submit a single pdf containing all your answers.

Problems:

1. What is a binary search tree? What are the data structure invariants satisfied by it?
2. Create the decision tree for the sorted array

   $$1, 2, 3, 4, 5, 6, 7, 8, 9.$$

   Refer to the lecture on Binary Search Trees.
3. Convert the decision tree in the question 2 above to a binary search tree named T. Draw new decision trees after each of the following insert operations:
   - insert(T, 10)
   - insert(T, 12)
   - insert(T, 11)

4. Note that the entries in a sorted array do not play any role in determining the shape of a decision tree. The size of the sorted array completely determines the shape of the tree. What does the decision tree look like for arrays of following sizes:
   - 1
   - 3
   - 7
   - 15
   - $2^k - 1$, for any positive int k.

5. In question 2 above you converted a sorted array to a decision tree. Using the recursive structure of a tree we can print the entries of the tree in ascending order (`bst_print_ascending` function below). Discuss how you would print the entries in descending order by modifying the code below. Also write down the modified code.

```
//prints entries of the tree T
void bst_print_ascending(tree *T) {
    //base case: when the tree is empty do nothing
    if (T==NULL) {
        return;
    }
    //print entries of the left subtree
    bst_print_ascending(T->left);

    //print the root node
    printint(T->data); print("\n");

    //print entries of the right subtree
    bst_print_ascending(T->right);
}
```