Practice Quiz Out of 33 Marks

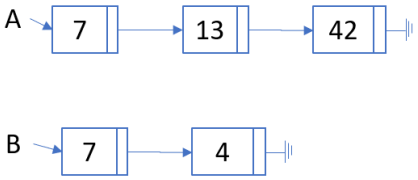
Linked Lists

Suppose head pointer `A` points to the first node of a singly-linked list, and header pointer `B` points to the first node of a different singly-linked list. If a list is empty, then its head pointer is `nullptr`.

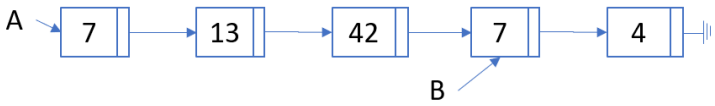
Nodes have this type:

```
struct Node {
   int data;
   Node* next;
};
```

Part A. (4 marks) Assuming `A` and `B` are both initially `nullptr`, write C++ code that makes lists `A` and `B` like this:



Part B. (6 marks) Write C++ code that starts with the lists above and appends `B` to the end of `A` so it looks like this:



Note that no nodes are added or removed. **Important**: Your code should work for *any* lists `A` and `B`, not just the particular ones in this question.

Part C. (4 marks) Write C++ code that correctly de-allocates all the nodes so there are no memory leaks or other problems.

Binary Trees

(8 marks) Write a function that returns the number of leaf (external) nodes in a binary tree. Use detailed C++-like pseudocode.

Assume `T` points to the root node, and if the tree is empty then `T` is `nullptr`. Nodes are based on this struct:

```
struct Node {
   int data;
   Node* left;
   Node* right;
};
```

Binary Search Trees

Part A. (3 marks) Give the definition of a **binary search tree** (**BST**). Assume unique keys.

Part B. (4 marks) Give the definition of an **AVL tree**. Assume unique keys.

Part C. (4 marks) *Prove* or *dis-prove* the following:

> Suppose r is the root node of an AVL tree. If the left sub-tree of r is non-empty, then that sub-tree is also an AVL tree.

Write your answer in clear, readable English that would make your math teacher proud.