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Solve the following problems using Java, C or C++

Definitions

Linked list

A linked list is a data structure that contains the following fields:

- *value* - the data associated with the node
- *successor* - a pointer/reference to the successor of the current node

Binary tree

A binary tree is a data structure that contains the following fields: *value* - the data associated with the node

- *left* - a pointer/reference to the left subtree of the current node
- *right* - a pointer/reference to the right subtree of the current node

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Problem 1

Given a linked list, write a function that reverses the list. What is the big O complexity of the function?

```
List reverse(List list);
```

Problem 2

Given a binary tree, write a function that checks if it is a valid binary search tree (BST). A BST is a binary tree that:

- the left subtree of a node contains nodes with keys less than the node's key
- the right subtree of a node contains nodes with keys greater than the node's key
- both the left and right subtrees must also be binary search trees

```
   boolean isBST(BTree
tree);
```

Problem 3

Describe what happens when you run the following command:

```
 cat file.txt | grep
pattern
```

Problem 4

Given a binary tree and a sum, write a function that checks if the tree has a path from root to any leaf such that the sum of all values along the path equals the given sum.

```
 boolean hasPath(BTree tree, int sum);
```

For example, given the following tree and sum 6,

```
    1
   / \
2        4
 /      \
3        5
```

the function should return true, since the path 1 -> 2 -> 3 satisfies the condition.
