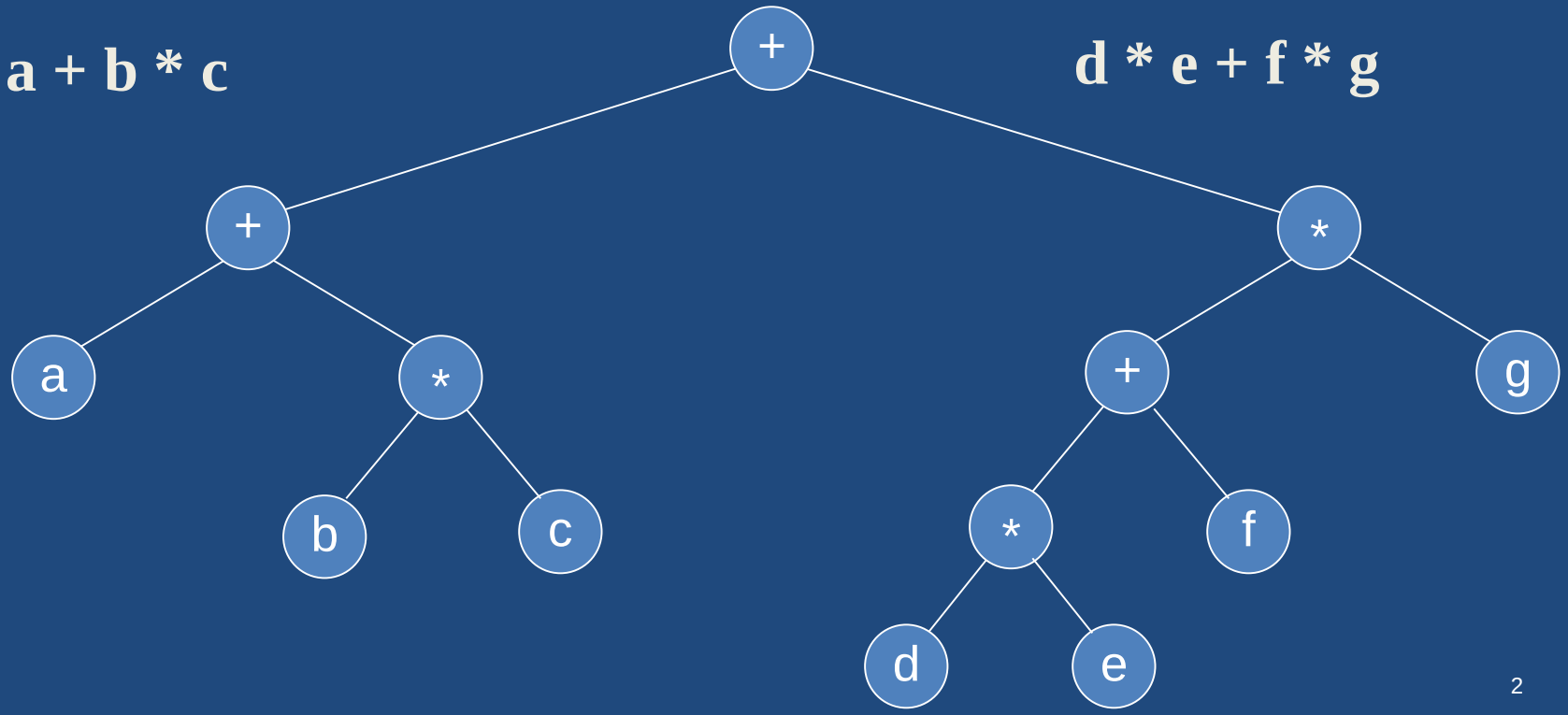
Application of Binary Tree

Expression Tree

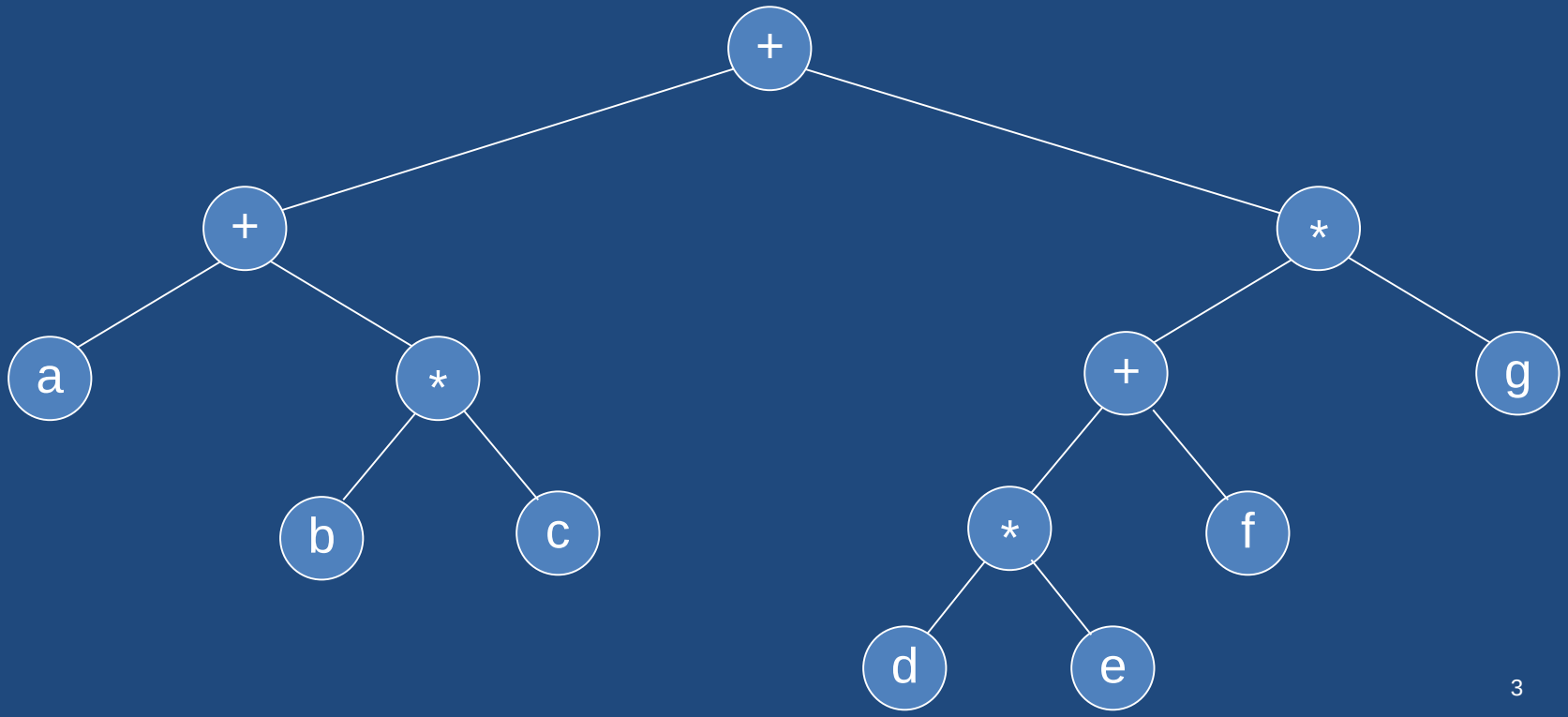
Expression Tree

- The inner nodes contain operators while leaf nodes contain operands.



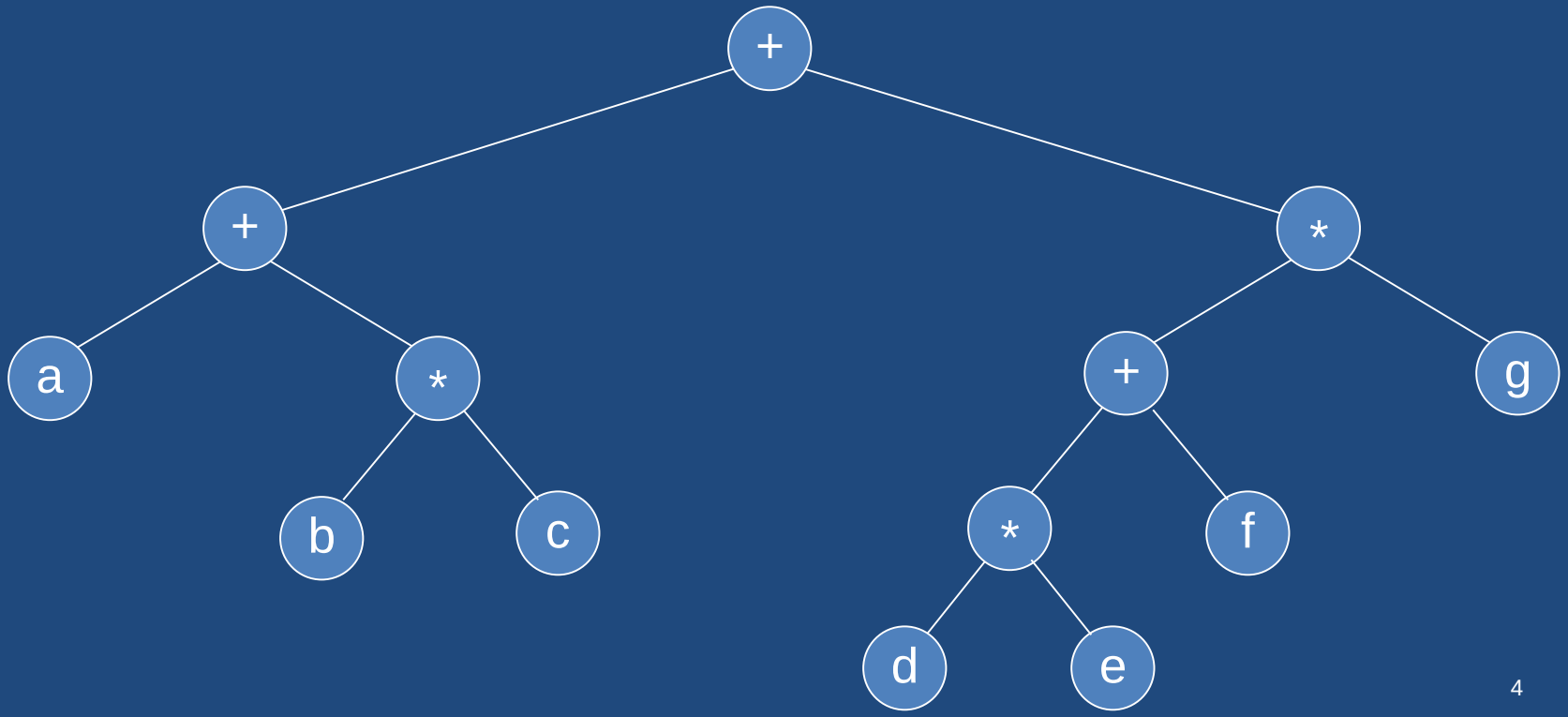
Expression Tree

- The tree is binary because the operators are binary.



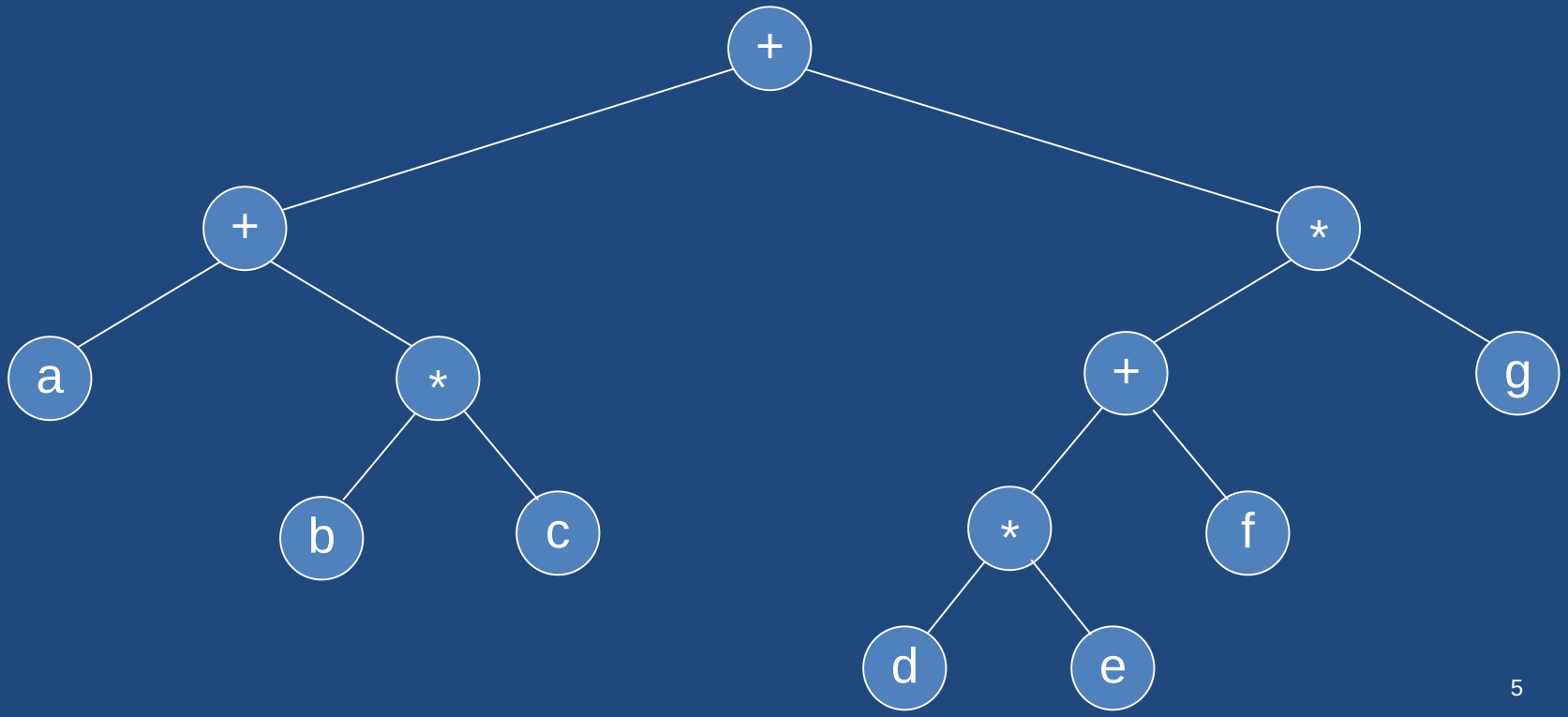
Expression Tree

- This is not necessary. A unary operator (!, e.g.) will have only one subtree.



Expression Tree

- Inorder traversal yields: a+b*c+d*e+f*g

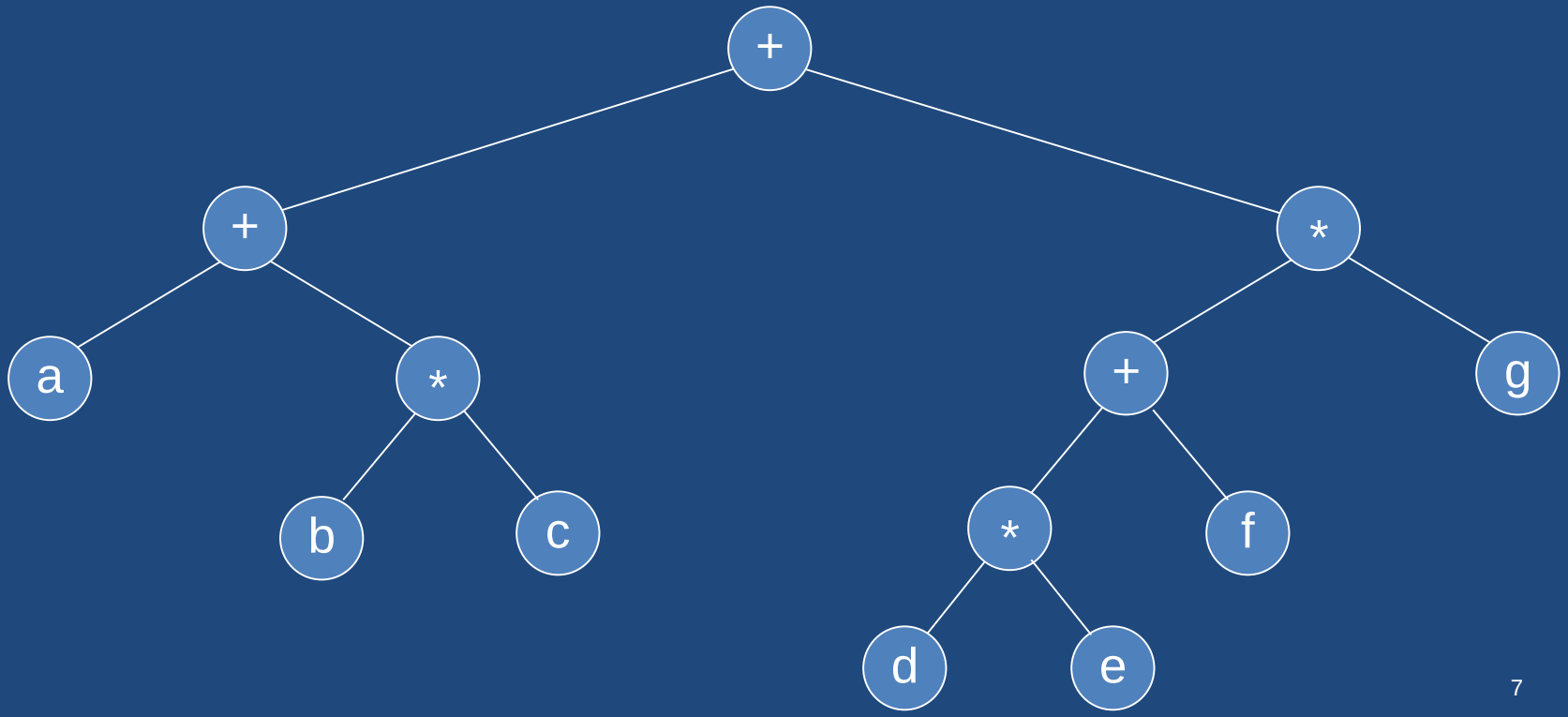


Enforcing Parenthesis

```
void inorder(TreeNode<int>* treeNode)
{
     if( treeNode != NULL ){
      cout << "(";
      inorder(treeNode->getLeft());
      cout << ")";
      cout << *(treeNode->getInfo());
      cout << "(";
      inorder(treeNode->getRight());
      cout << ")";
     }
}
```

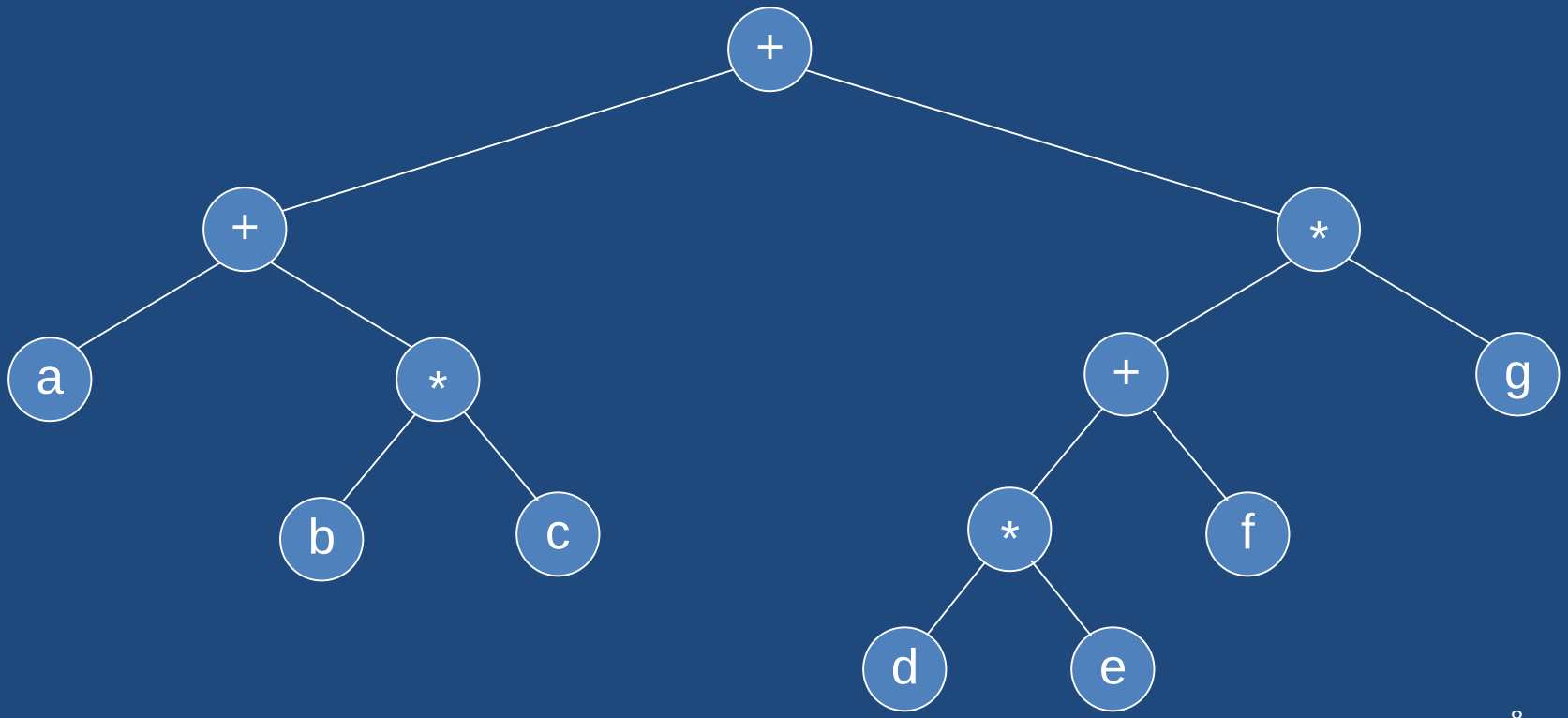
Expression Tree

- Inorder : (a+(b*c))+(((d*e)+f)*g)



Expression Tree

- Postorder traversal: a b c * + d e * f + g * +
  which is the postfix form.



Constructing Expression Tree

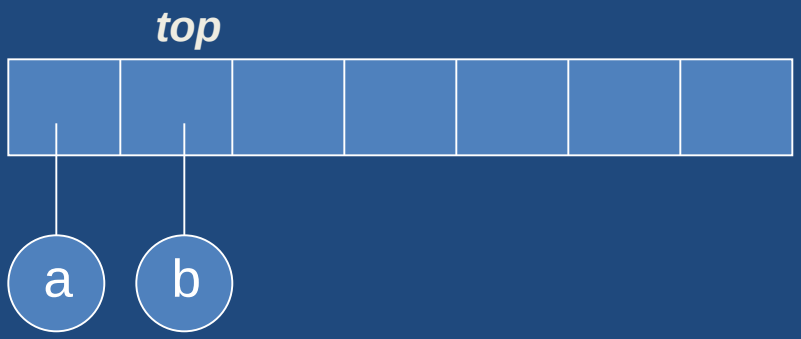
- Algorithm to convert postfix expression into an expression tree.
- We already have an expression to convert an infix expression to postfix.
- Read a symbol from the postfix expression.
- If symbol is an operand, put it in a one node tree and push it on a stack.
- If symbol is an operator, pop two trees from the stack, form a new tree with operator as the root and T_1 and T_2 as left and right subtrees and push this tree on the stack.

Constructing Expression Tree

- a b + c d e + * *

Constructing Expression Tree

- a b + c d e + * *

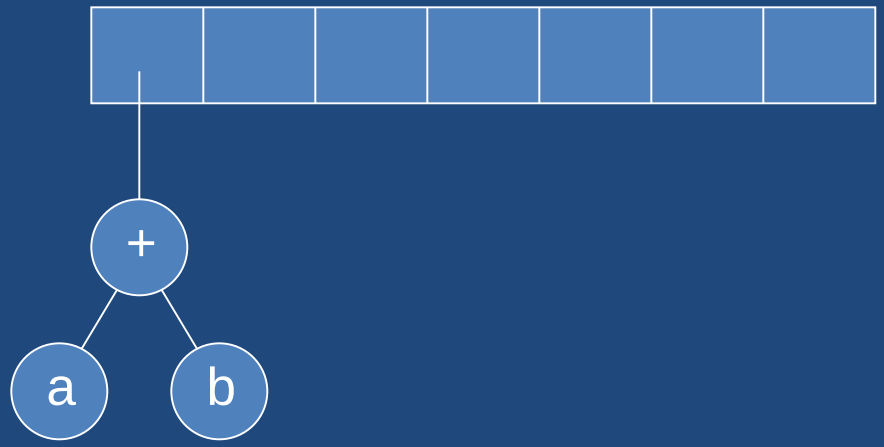


If symbol is an operand, put it in a one node tree and push it on a stack.

Stack is growing left to right

Constructing Expression Tree

- a b + c d e + * *

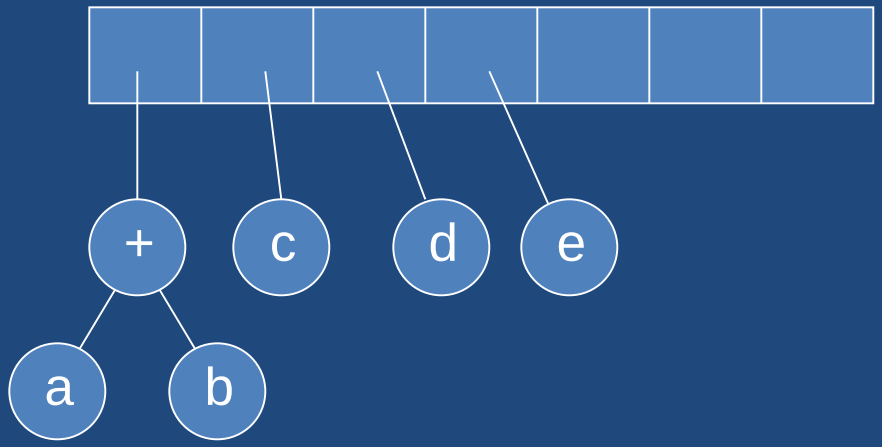


If symbol is an operator, pop two trees from the stack, form a new tree with operator as the root and T_1 and T_2 as left and right subtrees and push this tree on the stack.

Stack is growing left to right

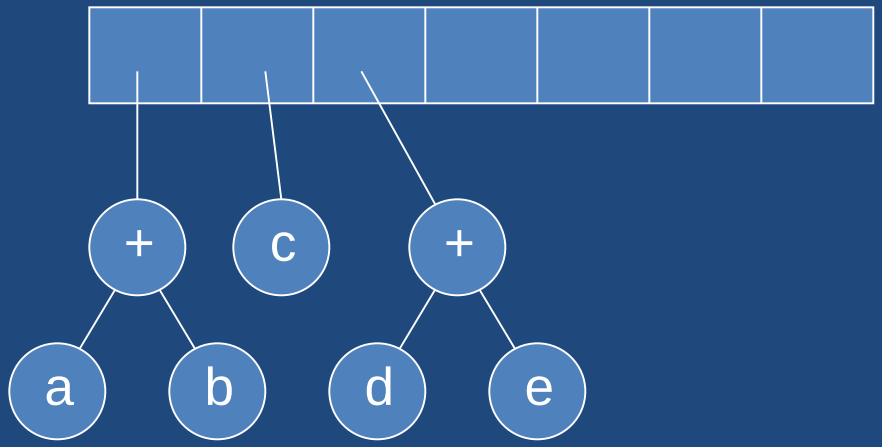
Constructing Expression Tree

- a b + c d e + * *



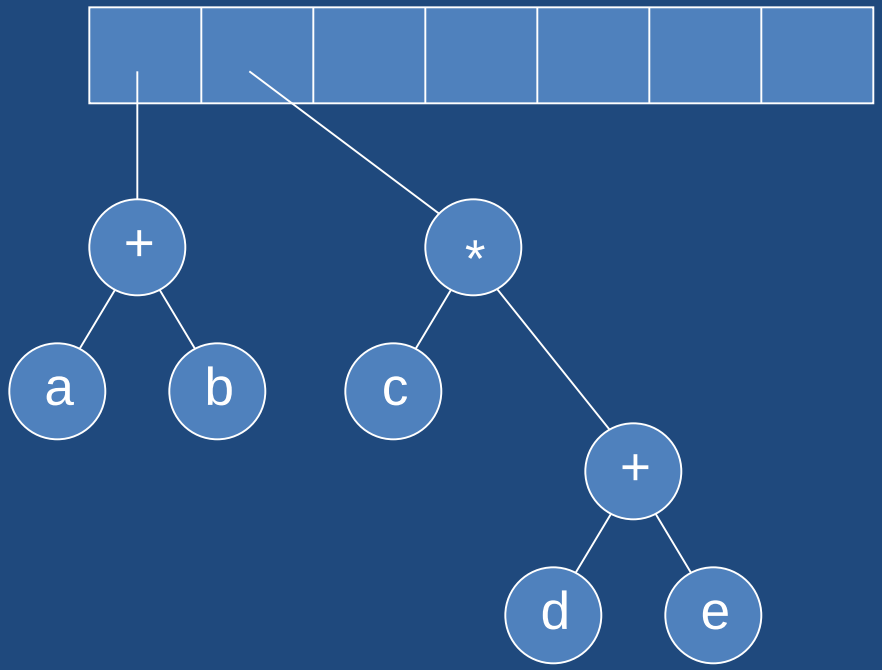
Constructing Expression Tree

- a b + c d e + * *



Constructing Expression Tree

- a b + c d e + * *



Constructing Expression Tree

- a b + c d e + * *