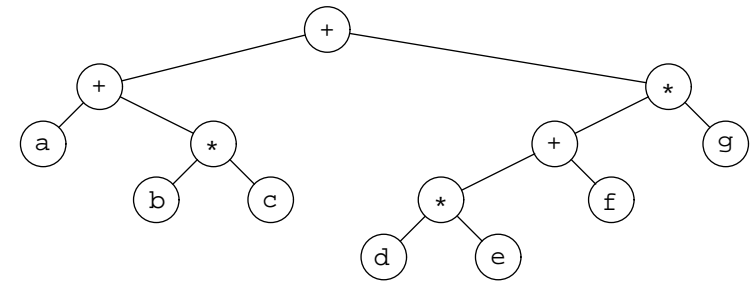


Binary Trees

Section 4.2

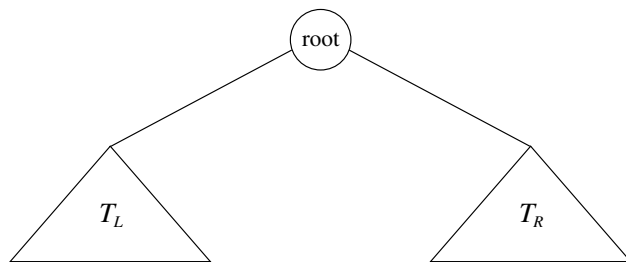
Ali Erkan
Ithaca College

Binary Trees: A Special Case



- ▶ **Inorder** traversal: $\textcircled{A} a + b \times c + d \times e + f \times g$
- ▶ **Inorder** traversal with parans? $\textcircled{A} (a + (b \times c)) + (((d \times e) + f) \times g)$
- ▶ **Preorder** traversal? $\textcircled{A} + + a \times b c \times + \times d e f g$.
This is the prefix expression
- ▶ **Postorder** traversal? $\textcircled{A} a b c \times + d e \times f + g \times +$.
This is the postfix expression

Binary Trees: A Special Case



- ▶ Node structure in general

```
class TreeNode {
    Object element;
    TreeNode firstChild;
    TreeNode nextSibling;
}
```

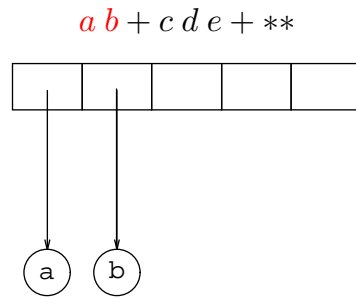
- ▶ Node structure in particular

```
class BinaryTreeNode {
    Object element;
    BinaryTreeNode left;
    BinaryTreeNode right;
}
```

Postfix Expression to Binary Evaluation Tree

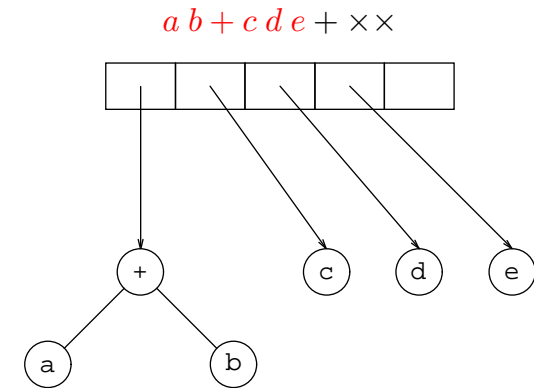
$a b + c d e + **$

Postfix Expression to Binary Evaluation Tree



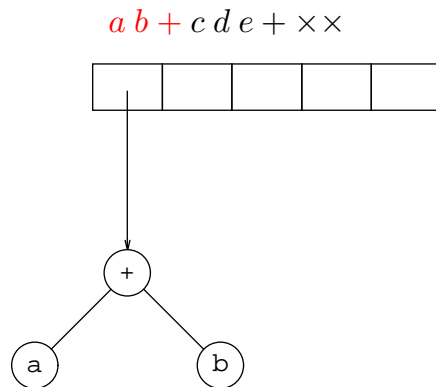
Next $+$ will be processed.
What will the tree(s) look like?

Postfix Expression to Binary Evaluation Tree



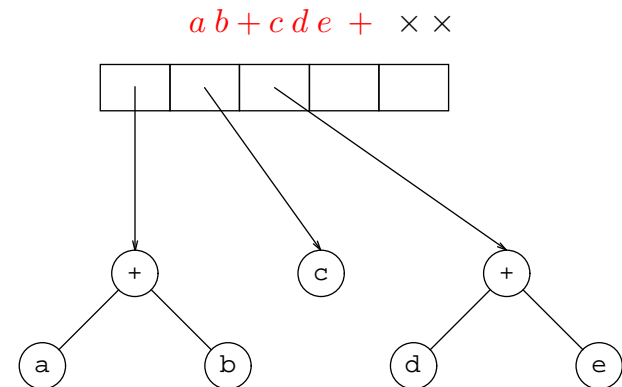
Next $+$ will be processed.
What will the tree(s) look like?

Postfix Expression to Binary Evaluation Tree



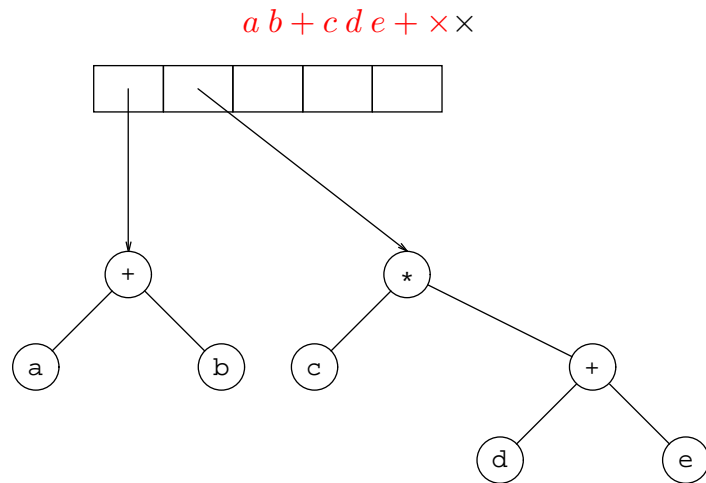
Next $\times d e$ will be processed.
What will the tree(s) look like?

Postfix Expression to Binary Evaluation Tree

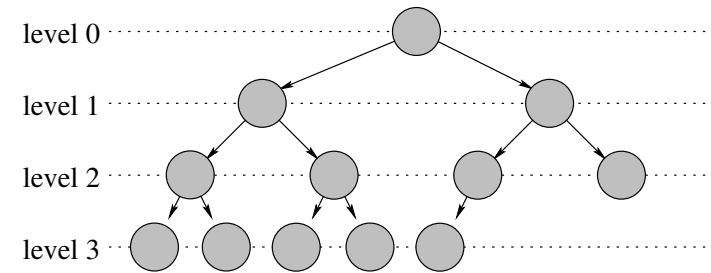


Next \times will be processed.
What will the tree(s) look like?

Postfix Expression to Binary Evaluation Tree

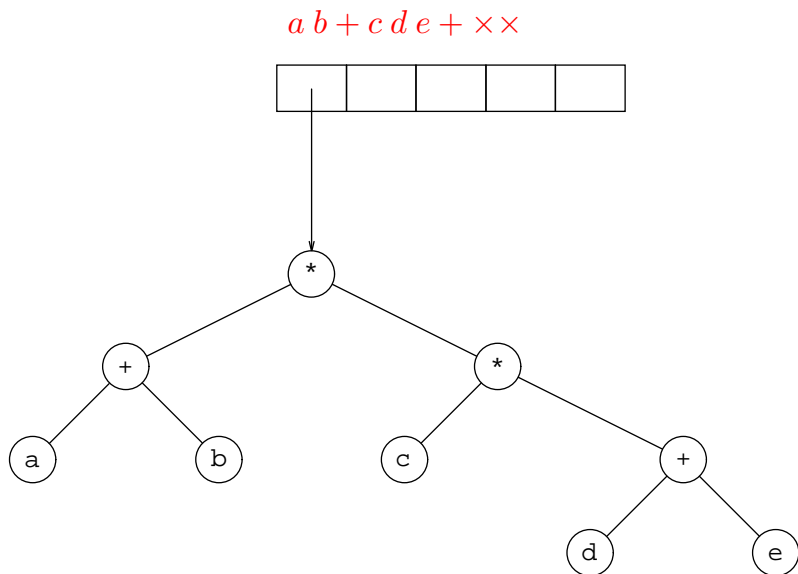


A Balanced Binary Tree

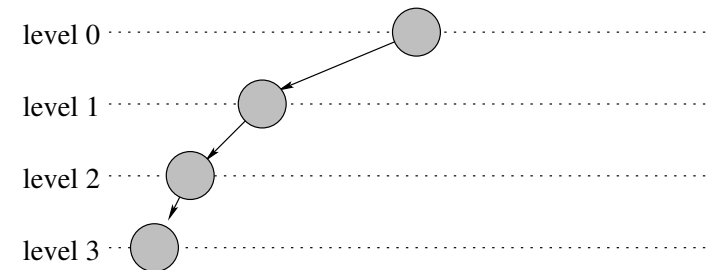


- A binary tree of N nodes such that the path length from the root to any leaf is “usually” around $\textcircled{A} \log_2 N$ steps.

Postfix Expression to Binary Evaluation Tree



A Degenerate Binary Tree



- If a tree grows only in one direction, it degenerates into a \textcircled{A} linked list .

