

(十五) 离散数学: 复习 (Review)

魏恒峰

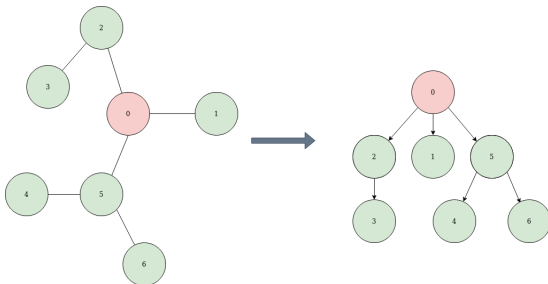
hfwei@nju.edu.cn

2021 年 06 月 17 日



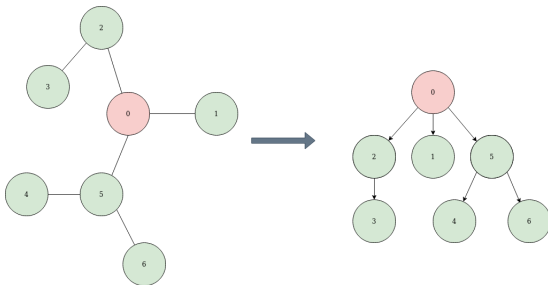
Definition (Rooted Tree (有根树))

A **rooted tree** is a **tree** where one vertex has been **designated the root**.



Definition (Rooted Tree (有根树))

A **rooted tree** is a **tree** where one vertex has been **designated the root**.



Definition (Directed Rooted Tree (有向有根树))

A **directed rooted tree** is a **rooted tree** where all edges directed **away from** or **towards** the root.

Definition

Parent, Child; Sibling; Ancestor, Descendant

Definition

Parent, Child; Sibling; Ancestor, Descendant

Definition (k -ary Trees (k -叉树))

A k -ary tree is a rooted tree in which each vertex has $\leq k$ children.

2-ary trees are often called binary trees.

Definition

Parent, Child; Sibling; Ancestor, Descendant

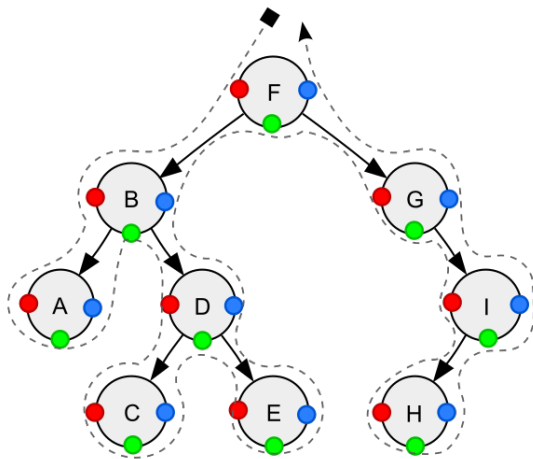
Definition (k -ary Trees (k -叉树))

A k -ary tree is a rooted tree in which each vertex has $\leq k$ children.

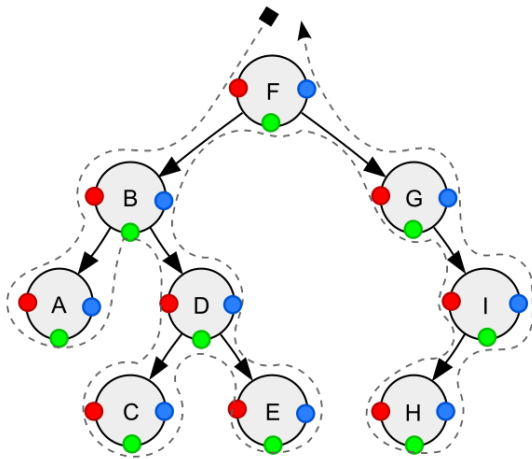
2-ary trees are often called **binary trees**.

Definition (Complete k -Tree (完全 k -叉树))

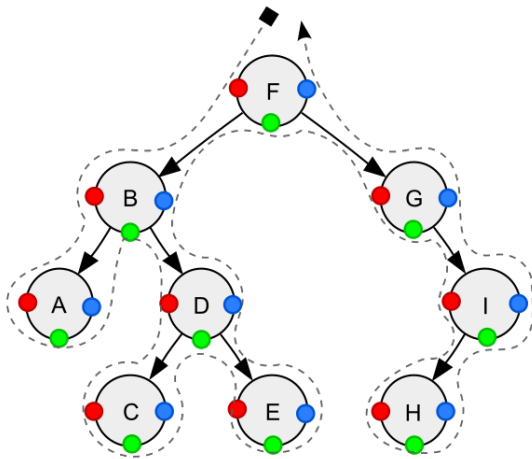
A **complete k -tree** is a k -ary tree in which each vertex, other than leaves, has $= k$ children.



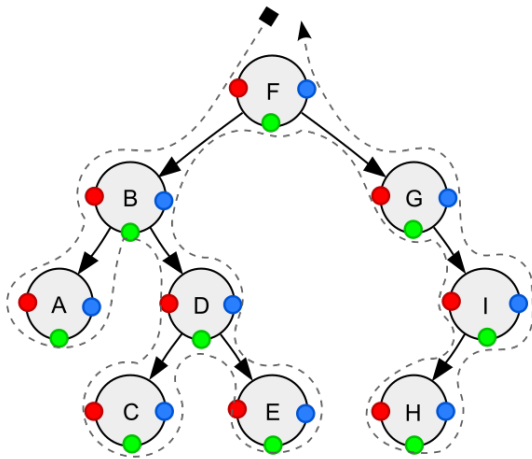
Depth-First Search (DFS)



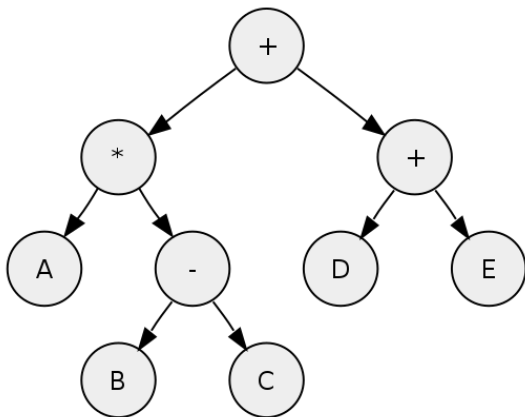
Pre-order (前序) Traversal: $F, B, A, D, C, E, G, I, H$



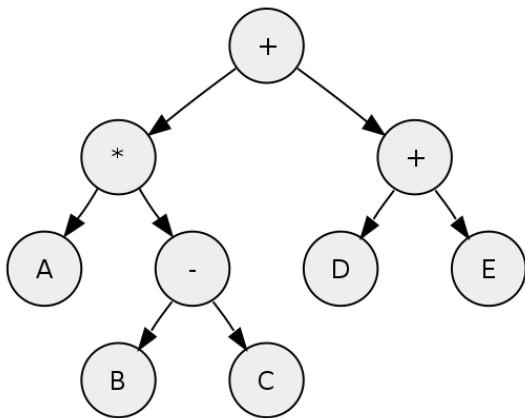
In-order (中序) Traversal: $A, B, C, D, E, F, G, H, I$



Post-order (后序) Traversal: $A, C, E, D, B, H, I, G, F$

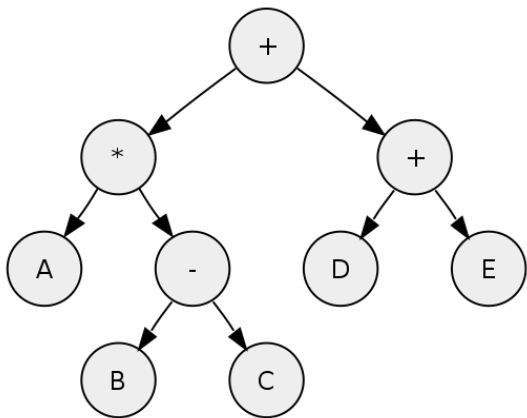


Prefix Expression (前缀表达式): $+ * A - BC + DE$



Prefix Expression (前缀表达式): $+ * A - BC + DE$

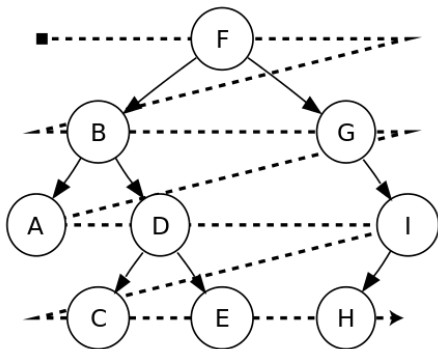
Infix Expression (中缀表达式): $A * (B - C) + (D + E)$



Prefix Expression (前缀表达式): $+ * A - BC + DE$

Infix Expression (中缀表达式): $A * (B - C) + (D + E)$

Postfix Expression (后缀表达式): $ABC - * DE + +$



Breadth-First Search (BFS): $F, B, G, A, D, I, C, E, H$



David A. Huffman (1925 ~ 1999)

$C[1 \dots n]$	a	b	c	d	e	f
$F[1 \dots n]$	45	13	12	16	9	5
Fixed Length Code	000	001	010	011	100	101
Variable Length Code	0	101	100	111	1101	1100

Prefix code (前缀码): No code is a **prefix** of some other code

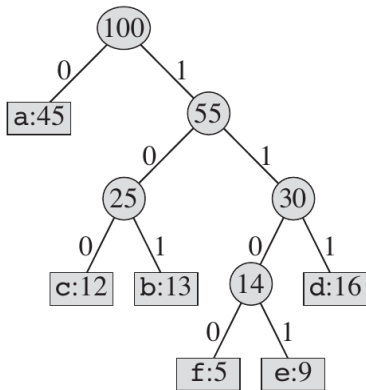
The Encoding Problem

To find the **optimal** binary prefix code for C and F .

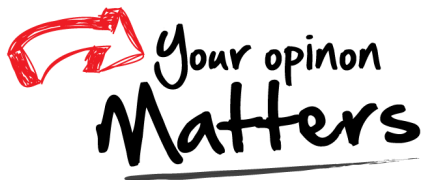
Let E be a binary prefix code for C and F . The length $L(E)$ is

$$L(E) = \sum_{c \in C} f_c \cdot l_E(c)$$

$C[1 \dots n]$	a	b	c	d	e	f
$F[1 \dots n]$	45	13	12	16	9	5



Thank
You!



Office 302

Mailbox: H016

hfwei@nju.edu.cn