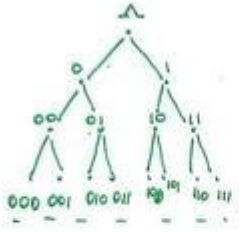
LEC 36 11/29/99

TREE TRAVERSAL

LABELING VERTICES IN AN ORDERED ROOTED TREE



SET OF BINARY STRINGS

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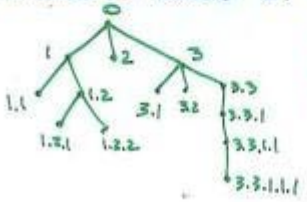
BINARY ORDERED ROOTED TREE + ORDERING OF CHILDREN

UNIVERSAL ADDRESS SYSTEM: ROOT IS LABELED 0 AND ITS CHILDREN AT LEVEL 1 WITH 1, 2, ..., k_v. FOR EACH VERTEX AT LEVEL $n \geq 1$ WITH LABEL A ITS CHILDREN GET LABELS A.1 A.2 ... $A.n_v$



CAN BE TOTALLY ORDERED LEXICOGRAPHICALLY

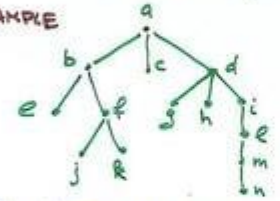
TRAVERSING TREES: PREORDER, INORDER, POSTORDER TRAVERSALS ALL DEFINED RECURSIVELY

IN ALL DEFINITIONS BELOW T IS AN ORDERED ROOTED TREE WITH ROOT r; $T_1 \ldots T_n$ - SUBTREES AT r

DEF. 1. PREORDER TRAVERSAL OF T $P_rT(T)$

$P_rT(T) = r, P_rT(T_1), \ldots, P_rT(T_n)$

EXAMPLE



$P_rT(T) = a, b, e, f, j, k, c, d, g, h, i, e, m, n.$

DEF. 2. INORDER TRAVERSAL $I_nT(T)$

$I_nT(T) = I_nT(T_1), r, I_nT(T_2), \ldots, I_nT(T_n)$

EXAMPLE: $I_nT(T) = e, b, j, f, k, a, c, g, d, h, i, e, m, n$

DEF. 3 POSTORDER TRAVERSAL $P_oT(T)$

$P_oT(T) = P_oT(T_1), \ldots, P_oT(T_n), r$

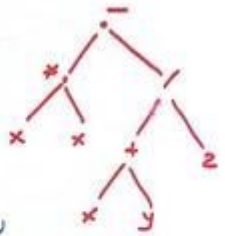
EXAMPLE: $P_oT(T) = e, j, k, f, b, c, g, h, i, m, e, d, a$

TERM NOTATIONS

TERM = LABELED TREE

$$x^2 - \frac{x+y}{2} =$$

$$= (x * x) - [(x+y)/2]$$



DEF. PREFIX FORM OF AN EXPRESSION = PREORDER TRAVERSAL = POLISH NOTATION

EXAMPLE: PREFIX FORM OF $x^2 - \frac{x+y}{2} = - * x x / + x y 2$

UNAMBIGUOUS!

DEF. POSTFIX FORM = = POSTORDER TRAVERSAL = = REVERSE POLISH NOTATION

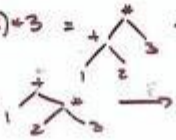
POSTFIX FORM OF $x^2 - \frac{x+y}{2}$ = $x x * x y + 2 / -$

DEF. INFIX FORM = $x * x - x + y / 2$

= INORDER TRAVERSAL + FULL PARENTHESING!

OTHERWISE AMBIGUOUS

EXAMPLE: $(1+2)*3 =$



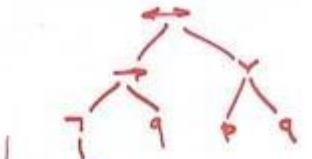
$\longrightarrow 1 + 2 * 3$

$1 + (2 * 3) =$

$\longrightarrow 1 + 2 * 3$

EXAMPLE $(\neg p \to q) \leftrightarrow (p \vee q)$

ROOTED TREE FORM

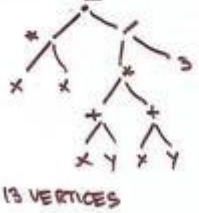


PREFIX FORM

POSTFIX FORM

INFIX FORM $(p \neg q) \leftrightarrow (p \vee q)$

DAG FORM = DIRECTED ACYCLIC GRAPHS = CAN GIVE AN EXPONENTIAL SPEED UP! EACH SUBTREE IS STORED ONLY ONCE. EXAMPLE $x^2 - \frac{(x+y)^2}{3}$



13 VERTICES

8 VERTICES