Expression Trees:

Binary Trees can be used to represent algebraic expressions, as such representation facilitate the computer evaluation of expression.

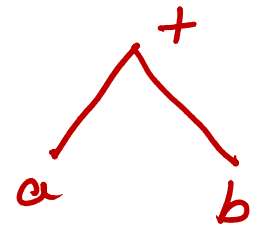
* the terminal vertices (leaves) are labeled with numbers or variables.
* the internal vertices are labeled with operation such as addition (+), subtraction (-) multiplication (*), division (/) and exponentiation (↑)

Prefix Notation : (Root, left, Right)

Infix Notation : (left, Root, Right)

Postfix Notation : (left, Right, Root)

ex)



Prefix : + ab

Infix : (a + b)

Postfix : a b +

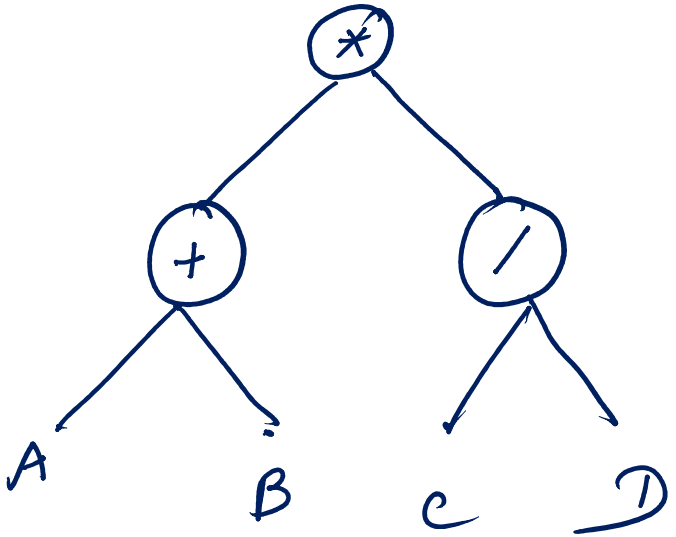
Note!

{ R x y ; R : operator

{ x R y ; x, y : numbers or Variables

{ x y R

Note: To avoid ambiguity in infix notation, we include a pair of parentheses.



Infix : ((A + B) * (C / D))

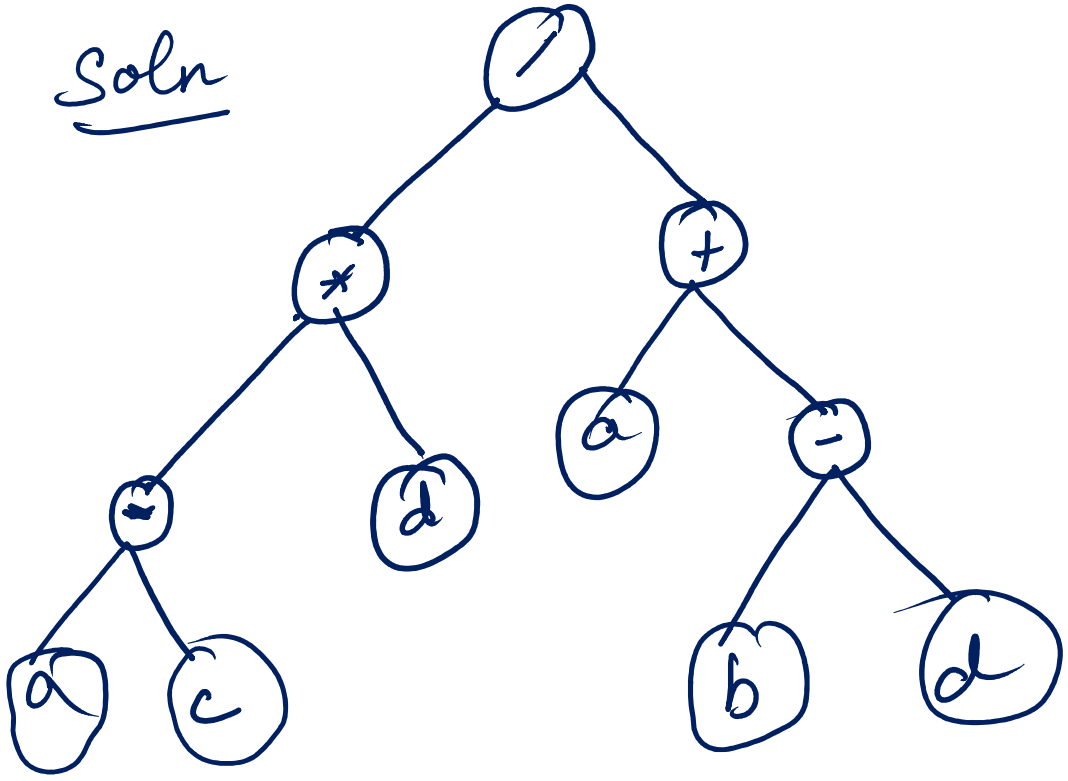
Prefix : * + A B / C D

Postfix : A B + C D / *

pbm: 1 Represent the expression $((a-c)*d)/(a+(b-d))$ as a binary tree and write Postfix and prefix notation.

{ root : /
left — (a-c)*d
Rgt — a+(b-d)

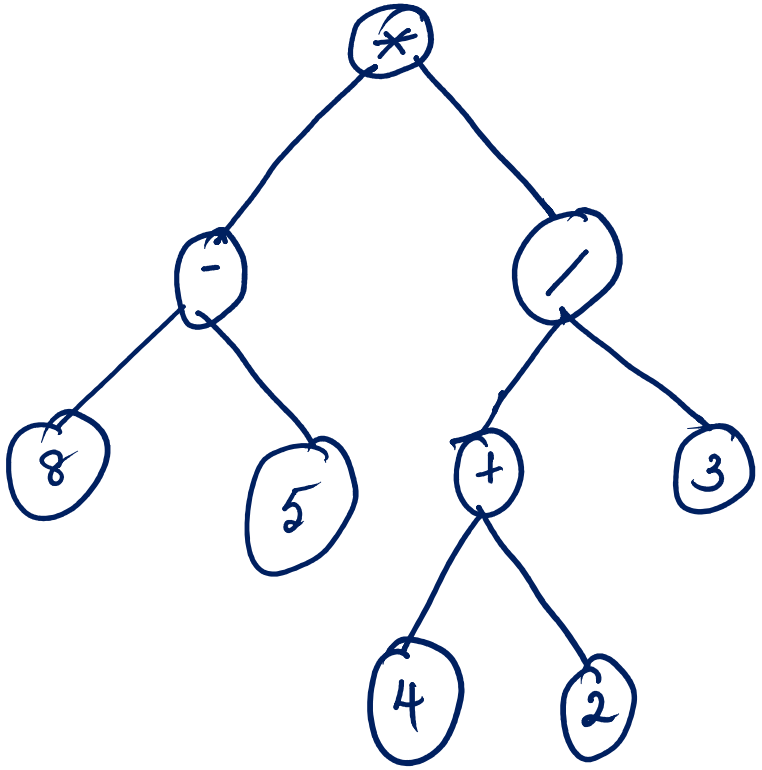
Soln



Prefix: / * - a c d + a - b d

Postfix: a c - d * a b d - + /

2) Write Prefix, Infix, Postfix expressions and evaluate the expressions



Ans:

Prefix : * - 8 5 / + 4 2 3

Infix ((8 - 5) * ((4 + 2) / 3))

Postfix: 8 5 - 4 2 + 3 / *

evaluate:

Prefix: * - 8 5 / + 4 2 3

{ Rxy, from right

* - 8 5 / 6 3

* - 8 5 2 = * 3 2

Ans: 6

Post fix 8 5 - 4 2 + 3 / *

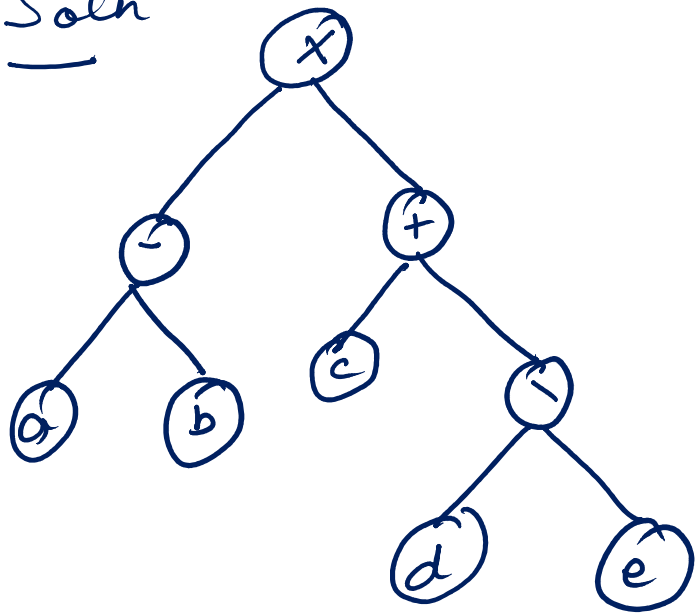
{ xy R, from left

= 3 4 2 + 3 / *

= 3 6 3 / * = 3 2 * = 6

3) Construct the tree of algebraic expression $((a-b) \times (c + (d/e)))$. write prefix, postfix forms. evaluate when $a=6, b=4$) $c=5, d=2, e=2$

Soln



Prefix: $x - a\ b + c \setminus d\ e$

Postfix: $a\ b - c\ d\ e \setminus + x$

evaluation :

Prefix: $x - ab + c / de$ $\{a=6, b=4, c=5, d=2, e=2$

$= x - 6\ 4 + 5\ /\ 2\ 2$

$= x - 6\ 4\ +\ 5\ 1$

$= x\ 6\ 4\ 6$

$= x\ 2\ 6$

$= 12$

{ Rxy, from right

Post fix $a\ b - c\ d\ e\ /\ +\ x = 6\ 4 - 5\ 2\ 2\ /\ +\ x$ { xyR, from left

$= 2\ 5\ 2\ 2\ /\ +\ x = 2\ 5\ 1\ +\ x = 26x$

$= 12$

4) Evaluate + - ↑ 3 2 ↑ 2 3 / 8 - 4 2 in Prefix

{ Exy from right

= + - ↑ 3 2 ↑ 2 3 / 8 2

= + - ↑ 3 2 ↑ 1 2 3 4

= + - ↑ 1 3 2 8 4

= + - 9 8 4

= + 1 4

= 5

5) Evaluate in Postfix :

{ xyR from left

(7 2 −) 3 + 2 3 2 + − 1 3 − * /

= (5 3 +) 2 3 2 + − 1 3 − * /

= 8 2 (3 2 +) − 1 3 − * /

= 8 (2 5 −) 1 3 − * /

= 8 (−3) (1 3 −) * /

= 8 (−3) (−2) * /

= 8 6 / = $\frac{8}{6} = \frac{4}{3}$.

b) Evaluate (i) + − * 2 3 5 / ↑ 2 3 8

ii) 7 2 3 * 4 + 9 3 / − +

iii) 3 2 * 2 ↑ 5 3 − 8 4 / * −