

Conversion of Infix Expressions to Prefix and Postfix Notations

Part I: Converting Infix Expressions

Expression (a)

Infix Expression:

$$A + \frac{B}{C} \times (D - A)^{F^H}$$

Step 1: Identify the Main Operator

- The main operator is the addition (+) which splits the expression into:

$$A \quad \text{and} \quad \frac{B}{C} \times (D - A)^{F^H}.$$

Step 2: Parse the Right Part

- In the subexpression $\frac{B}{C} \times (D - A)^{F^H}$, division (/) has higher precedence than multiplication.
 - First, compute B/C .
- Next, consider $(D - A)^{F^H}$:
 - Compute $D - A$ within the parentheses.
 - Since exponentiation (\wedge) is right-associative, compute F^H first.
 - Then compute $(D - A)^{(F^H)}$.

Thus, the overall structure is:

$$A + \left[\left(\frac{B}{C} \right) \times ((D - A)^{(F^H)}) \right]$$

Step 3: Conversion to Prefix Notation

- The main operator (+) is written first.
- The left operand is A .
- The right operand is the multiplication operator:
 - Left operand: division $/BC$
 - Right operand: exponentiation, where the base is $(D - A)$ and the exponent is F^H

The resulting prefix expression is:

$$+A * /BC \wedge -DA \wedge FH$$

Step 4: Conversion to Postfix Notation

- B/C converts to postfix as: $BC /$
- $D - A$ converts to postfix as: $DA -$
- F^H converts to postfix as: $FH \wedge$
- Then, $(D - A)^{F^H}$ converts to: $DA - FH \wedge \wedge$
- The multiplication becomes: $BC / DA - FH \wedge \wedge *$
- Finally, adding A gives:

$$ABC / DA - FH \wedge \wedge * +$$

Expression (b)

Infix Expression:

$$\left((P + R) \times Q \right)^{\frac{X}{(Y+Z)}}$$

Step 1: Identify the Main Operator

- The main operator is the exponentiation (\wedge) operator with:
 - Left operand: $((P + R) \times Q)$
 - Right operand: $\frac{X}{(Y+Z)}$

Step 2: Break Down Each Part

- **Left Side:**
 - Evaluate $P + R$ inside the parentheses.
 - Multiply the result by Q .
- **Right Side:**
 - Evaluate $Y + Z$ within the parentheses.
 - Divide X by the result.

Step 3: Conversion to Prefix Notation

- For the left part:
 - $P + R$ in prefix is: $+ P R$
 - Multiplying by Q gives: $* + P R Q$
- For the right part:
 - $Y + Z$ in prefix is: $+ Y Z$
 - Then $X/(Y + Z)$ becomes: $/ X + Y Z$
- The overall prefix expression is:

$$\wedge * + P R Q / X + Y Z$$

Step 4: Conversion to Postfix Notation

- For the left part:
 - $P + R$ in postfix is: $P R +$
 - Multiplying by Q gives: $P R + Q *$
- For the right part:
 - $Y + Z$ in postfix is: $Y Z +$
 - Then $X/(Y + Z)$ becomes: $X Y Z + /$
- The overall postfix expression is:

$$P R + Q * X Y Z + / \wedge$$