

# Expressions: Prefix, Infix, and Postfix

Course on C-Programming & Data Structures: GATE - 2024 & 2025

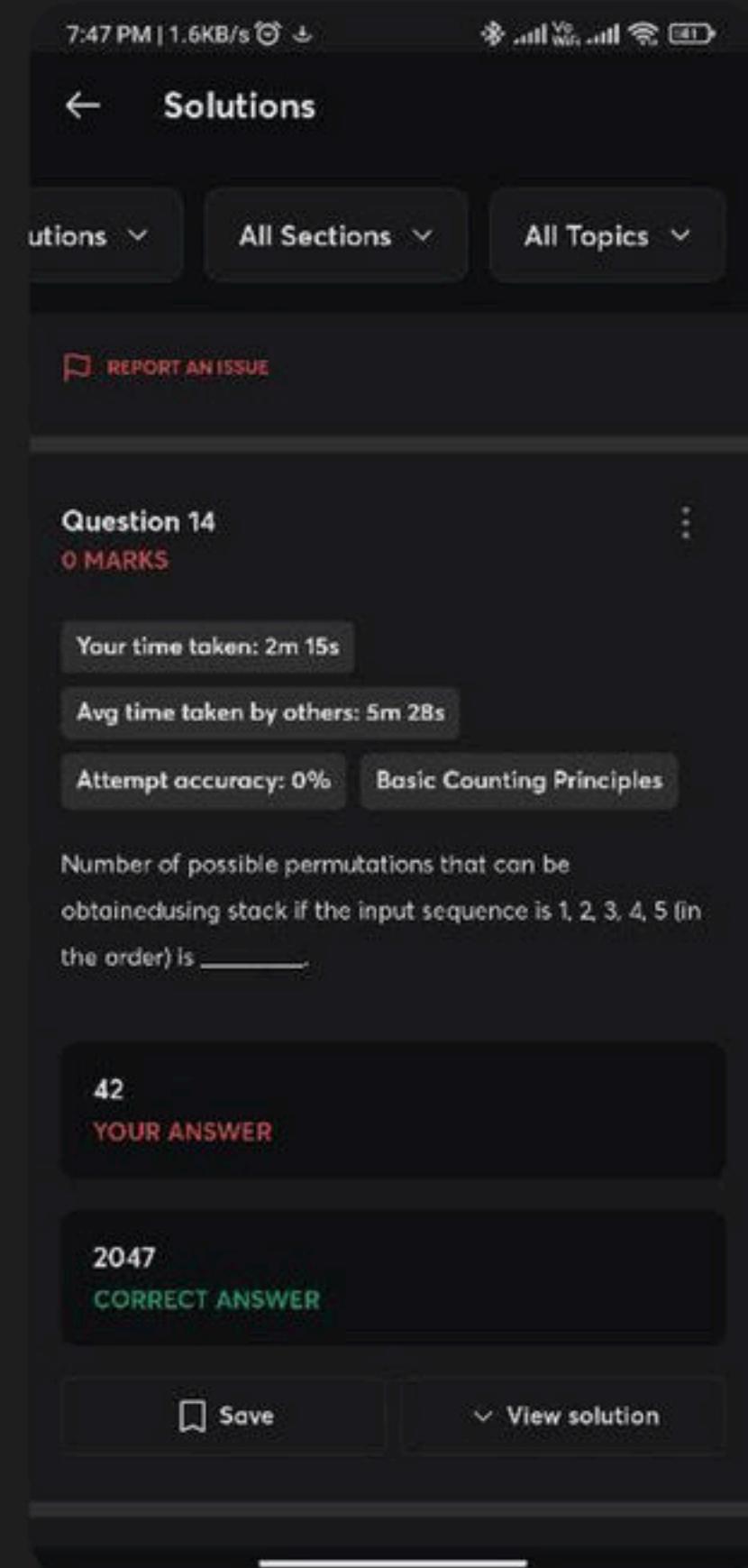
# Data Structure

## Stack: Expressions

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▲ 1 • Asked by Kanhaiya

Please help me with this doubt



The screenshot shows a mobile application interface for a math question. At the top, there's a header bar with the time "7:47 PM | 1.6KB/s" and signal strength indicators. Below the header, the word "Solutions" is displayed next to a back arrow. There are three buttons: "All Sections" and "All Topics" with dropdown arrows, and a "REPORT AN ISSUE" button with a red icon.

**Question 14**  
0 MARKS

Your time taken: 2m 15s  
Avg time taken by others: 5m 28s  
Attempt accuracy: 0% Basic Counting Principles

Number of possible permutations that can be obtained using stack if the input sequence is 1, 2, 3, 4, 5 (in the order) is \_\_\_\_\_.

**42**  
**YOUR ANSWER**

**2047**  
**CORRECT ANSWER**

Save

# Applications of Stack

- ◆ Expression Evaluation ✓
- ◆ Recursion ✓

Expression :-

How to express operations

Operator  $\Rightarrow$  denotes operat'n

Operands  $\Rightarrow$  data or value

reverse polish notation



polish notation



# Expressions

- ◆ **Prefix Notation:** When operator is placed before both of operands  $+ a b$
- ◆ **Infix Notation:** When operator is placed between both of operands  $a + b$
- ◆ **Postfix Notation:** When operator is placed after both of operands  $a b +$

$+ + a$  prefix

$a + +$  postfix

$\Rightarrow$  There is no "any parenthesis  
in prefix or postfix notation"

# Precidence and Associativity

## ◆ **Precedences:** High to Low

1. Parenthesis	:	( )	left to right
2. Exponent	:	$\uparrow$	right to left
3. Multiplication & Division	:	* & /	left to right
4. Addition & Subtraction	:	+ & -	left to right

$$3 - 5 - 1 \Rightarrow -2 - 1$$

$$\begin{matrix} 3 - 4 \\ -1 \end{matrix}$$

- 3

$$\begin{matrix} 2 \textcircled{3^2} \\ \Rightarrow 2^9 \Rightarrow 512 \end{matrix}$$

$$\begin{matrix} 2 \uparrow 3 \uparrow 2 \\ = 219 \\ = 512 \end{matrix}$$

# Infix to Prefix & Postfix

$$2 + 3 * 5$$

$$\Rightarrow 2 + 15$$

Prefix :-

$$\Rightarrow 17$$

$$2 + \boxed{* 35}$$

$$+ 2 * 35$$

Postfix :-

$$2 + \underline{35 *}$$

$$235 * +$$

# Infix to Prefix & Postfix

$$2 + 5 * \underline{3} \uparrow 2 + 9$$

infix :-

$$2 + 5 * \underline{\uparrow 3} \underline{2} + 9$$

$$2 + \underline{* 5 \uparrow 3} \underline{2} + 9$$

$$\underline{+ 2 * 5 \uparrow 3} \underline{2} + 9$$

$$+ \underline{\uparrow 2 * 5 \uparrow 3} \underline{2} \underline{9}$$

Postfix :-

$$2 + 5 * \underline{3} \underline{2} \uparrow + 9$$

$$2 + \underline{5} \underline{3} \underline{2} \uparrow \underline{*} + 9$$

$$\underline{2} \underline{5} \underline{3} \underline{2} \uparrow \underline{*} + + 9$$

$$2 \underline{5} \underline{3} \underline{2} \uparrow \underline{*} + 9 +$$

# Infix to Prefix & Postfix

$$2 - 5 * 1 / 6 \uparrow \underline{3 \uparrow 2} + 9$$

Pre:-

$$2 - 5 * 1 / 6 \uparrow \underline{\uparrow 32} + 9$$

$$2 - 5 + 1 / \underline{\uparrow 6 \uparrow 32} + 9$$

$$2 - \underline{* 5 1} / \underline{\uparrow 6 \uparrow 32} + 9$$

$$2 - \underline{/ * 5 1 \uparrow 6 \uparrow 32} + 9$$

$$= \underline{2 / * 5 1 \uparrow 6 \uparrow 32} + 9$$

Post:-

$$2 - 5 * 1 / 6 \uparrow \underline{3 2 \uparrow} + 9$$

$$2 - 5 + 1 / \underline{6 3 2 \uparrow \uparrow} + 9$$

$$2 - \underline{5 1 *} / \underline{6 3 2 \uparrow \uparrow} + 9$$

$$2 - \underline{5 1 * 6 3 2 \uparrow \uparrow} / + 9$$

$$\underline{2 5 1 *} \underline{6 3 2 \uparrow \uparrow} / - + 9$$

+ -2/\*51↑6↑329

251\*632↑↑)-9+

Ques) Convert following expression into prefix and postfix :-

$$(a+b)* (c-d) / e + f * g - h * i$$

Prefix :-

$$- + / * + a b - c d e * f g * h i$$

Postfix :-

$$ab+cd-*e/fg*+hi*-$$

# Infix to Prefix & Postfix

	Prefix	Postfix
$-b$	$- b$	$b -$
$\log x$	$\log x$	$x \log$
$x!$	$! x$	$x!$
$\log x!$	$\log ! x$	$x! \log$

$$x = 5 * 3 + \log(2 + 5) - 9$$

Prefix:-

$$= x - + * 5 3 \log + 2 5 9$$

Postfix:-

$$53 * 25 + \log + 9 - =$$

## Postfix to Infix

$a b * c +$

$(a * b) c +$

$\{a * b\} + c$

$a * b + c$

→ Scan L to R

→ solve first operator

②

$a b c + *$

$a (b + c) *$

$a * (b + c)$

Ques

$$ab * c + d *$$

$$(a * b) c + d *$$

$$( (a * b) + c ) \quad d *$$

$$(a * b + c) \quad d *$$

$$(a * b + c) * d$$

Ques

$$ab + cd - *$$

$$(a + b) cd - *$$

$$(a + b) (c - d) *$$

$$(a + b) * (c - d)$$

# Postfix to Infix

2 5 3 2 ↑ \* + 9 +

# Prefix to Infix

- + 9 / 4 ↑ 2 3 8

# Question

a b c \* + d e / f \* -

+ - 6 ↑ 2 \* 3 7 9

# Evaluation of Postfix Notation Using Stack

2 5 3 2 ↑ \* + 9 +

# Evaluation of Postfix Notation Using Stack

1. Add right parenthesis ) at the end of  $P$
2. Scan  $P$  from left to right until ) is encountered:
  - I. If an Operand is encountered, PUSH it onto stack
  - II. If an operator is encountered:
    - A. POP first two elements from stack , a is top element and b is next to top element
    - B. Evaluate  $b \text{ op } a$  & push the result onto stack
3. Set the result = top of stack

# Evaluation of Prefix Notation Using Stack

1. Add right parenthesis ( at the start of  $P$
2. Scan  $P$  from right to left until ( is encountered:
  - I. If an Operand is encountered, PUSH it onto stack
  - II. If an operator is encountered:
    - A. POP first two elements from stack , a is top element and b is next to top element
    - B. Evaluate  $a \text{ op } b$  & push the result onto stack
3. Set the result = top of stack

# Question GATE-2007

The following postfix expression with single digit operand is evaluated using a stack

8 2 3 ^ / 2 3 \* + 5 1 \*

Note that  $^$  is the exponentiation operator. The top elements of the stack after the first  $*$  is evaluated are

- |          |          |
|----------|----------|
| (A) 6, 1 | (C) 3, 2 |
| (B) 5, 7 | (D) 1, 5 |

# Question GATE-2015

The result evaluating the postfix expression 10, 5, +, 60, 6, /, \*, 8, – is



*DPP*

# Question 1

Convert following infix notations into prefix and postfix:

1.  $(A + B) * (C - D) / F - X * Y / Z$
2.  $a + b * c - d ^ e ^ f$
3.  $A+B*(C+D)/F+D*E$
4.  $3*log(x+1)-a/2$
5.  $a = - b * c \uparrow d \uparrow e + f * g / h - i * j$

# Question 2

Convert following notations into Infix:

$A \ B \ C \ D \ - \ * \ + \ E \ /$

$A \ B \ C \ * \ D \ / \ + \ E \ -$

$A \ B \ * \ C \ - \ D \ +$

$A \ B \ C \ + \ * \ D \ -$

# Question 3

Evaluate Following Expressions using stack:

$$1. + 6 * - 3 6 7$$

$$2. / 3 * 9 + 4 + 5 3$$

$$3. 4 5 6 + - 2 5 * -$$

$$4. 4 3 * 2 / 1 8 9 \uparrow \uparrow + 2 - 3 +$$

$$5. + + - + 2 3 1 \uparrow 1 \uparrow 3 6 / * 6 3 2$$

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# Happy Learning



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