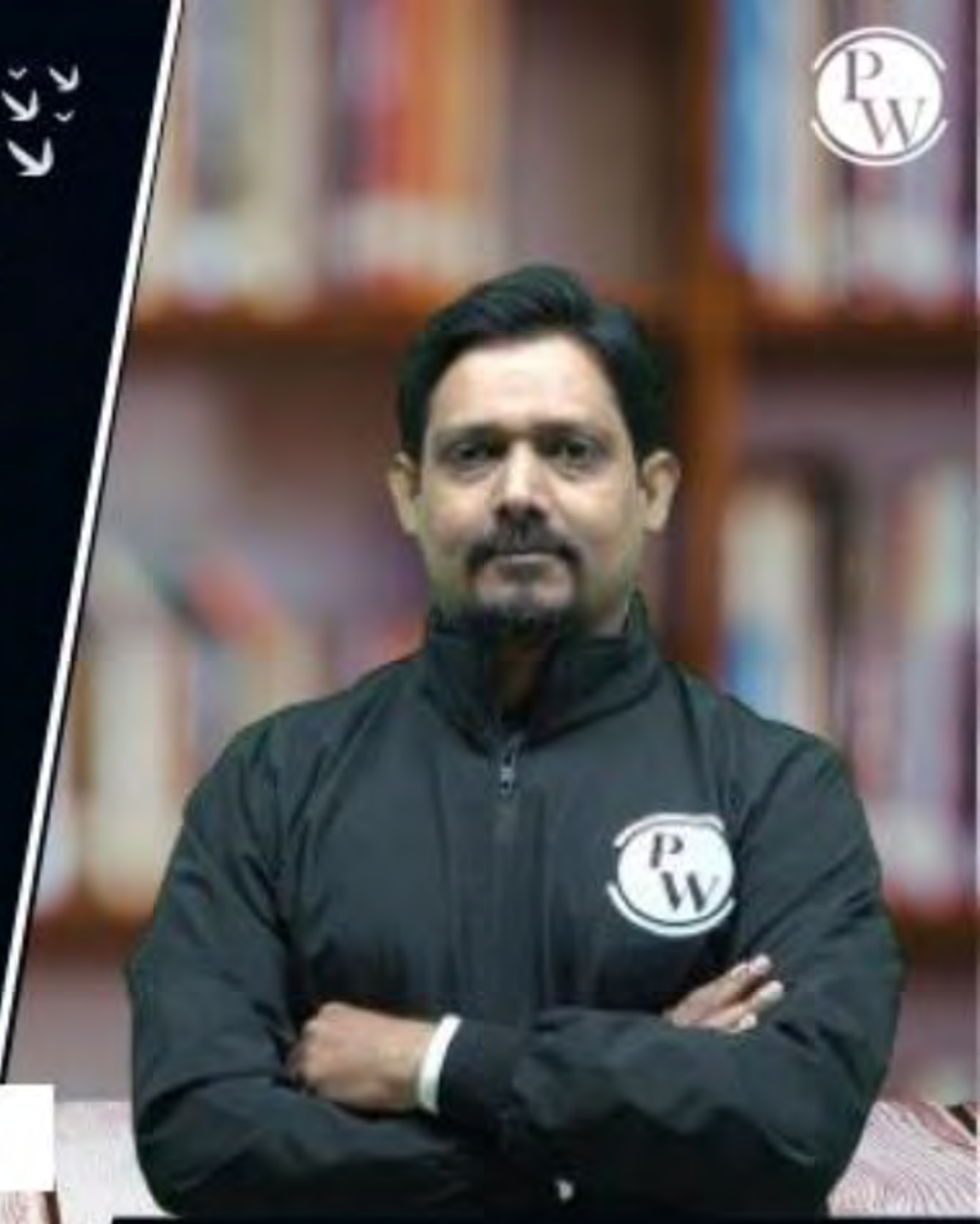
Computer Science & IT

Data Structure & Programming

Stack

Lecture No. 04



By- Abhishek Sir

Recap of Previous Lecture

- Topic
- Topic
- Topic
- Topic
- Topic

Expression using stack

Slide

Topics to be Covered

- Topic
- Topic
- Topic
- Topic
- Topic

Evaluation of postfix

Evaluation of prefix

Slide

Topic : Question

Let s be a stack of size $n \geq 1$. Starting with the empty stack, suppose we push the first n natural numbers in sequence, and then perform n pop operations. Assume that *Push* and *Pop* operations take X seconds each, and Y seconds elapse between the end of one such stack operation and the start of the next operation. For $m \geq 1$, define the stack-life of m as the time elapsed from the end of Push (m) to the start of the pop operation that removes m form S. The average stack life of an element of this stack is

(A) $n(X + Y)$

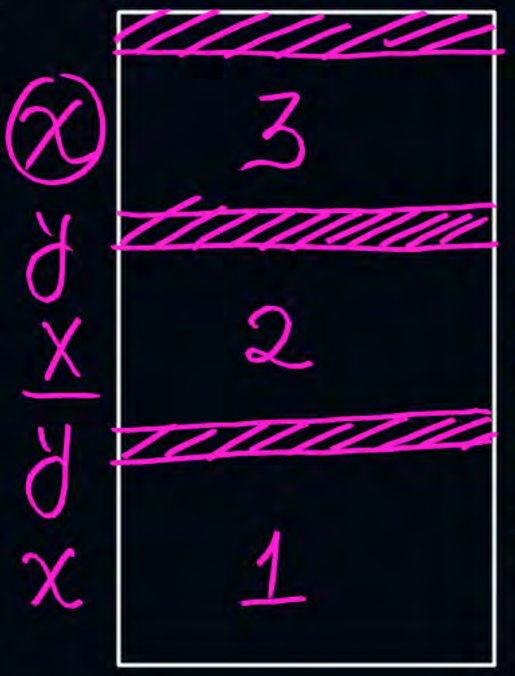
(B) $3Y + 2X$

(C) $n(X + Y) - X$

(D) $Y + 2X$

Topic : Question

Let s be a stack of size n ≥ 1. Starting with the empty stack, suppose we push the first n natural numbers in sequence, and then perform n pop operations. Assume that *Push* and *Pop* operations take X seconds each, and Y seconds elapse between the end of one such stack operation and the start of the next operation. For m ≥ 1, define the stack-life of m as the time elapsed from the end of Push (m) to the start of the pop operation that removes m form S. The average stack life of an element of this stack is



1

3 - stack life

y + x + y + x + y

2x + 3y

2 stack Life

1. stack Life

total $\frac{6x+9y}{3} = 2x+3y$

$4x+5y$

Bloom Taxonomy

Learning outcome

1. Recall
2. Application
3. Comprehension
4. Analysis / Synthesis

Infix : $a+b*d\uparrow e-f$

$= a+b*(d\uparrow e)-f$ ①

$= a+(b*(d\uparrow e))-f$

$= (a+(b*(d\uparrow e)))-f$

$= ((a+(b*(d\uparrow e)))-f)$

repeated Scanning required

Topic : Evaluation of Postfix Expression

Single scan evaluates the expression

6 2 3 + − 3 8 2 / + * 2 ↑ 3 +

6	2	3	+	−	3	8	2	/	+	*	2	↑	3	+
							2							
		3				8	8	8/2 = 4						
	2	2	2+3 = 5		3	3	3	3	3+4 = 7		2		3	
6	6	6	6	6-5 = 1	1	1	1	1	1	1*7 = 7	7	7↑2 = 49	49	49+3 = 52

Stack (operand stack)

top = $operand_2$

top - 1 = $operand_1$

Ans = 52

Slide

Topic : Evaluation of Postfix Expression

23 * 422 * / + 35 + -

Single digit No

2	3	*	4	2	2	*	/	+	3	5	+	-	
					2								
				2	2	2*2 = 4				5			
	3		4	4	4	4	4/4 = 1		3	3	8		
2	2	2*3 = 6	6	6	6	6	6	6+1 = 7	7	7	7	7-8 = -1	

Ans = -1

Slide

Topic : Question

#Q. The following postfix expression with single digit operands is evaluated using a stack:

823^ / 23 * + 51 * −

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

(A) 6, 1

(B) 5, 7

(C) 3, 2

(D) 1, 5

3			3		
2	2^3 = 8		2	2*3 = 6	
8	8	8/8 = 1	1	1	

Slide

Topic : Question

Consider two binary operators '↑' and '↓' with the precedence of operator ↓ being lower than that of the operator ↑. Operator ↑ is right associative while operator ↓, is left asociative.

↑ is exponentiation operator, $a \uparrow b = a^b$

↓ is logarithmic operator $a \downarrow b = \log_b a$

The value of the expression $(65536 \downarrow 2 \uparrow 4 \uparrow 2 \downarrow 2)$ is _____.

$2^{16} \downarrow 2 \uparrow 4 \uparrow 2 \downarrow 2$

$= 2^{16} \downarrow 2 \uparrow 16 \downarrow 2$

$= 2^{16} \downarrow 2^{16} \downarrow 2$

$a \quad b$

$\log_{2^{16}} 2^{16} = 1$

$= 1 \downarrow 2$

$a \quad b$

$\log_2 1 = 0$

0 ←

↑ > ↓

↑ right

↓ left

Slide

Topic : Question

Q Which of the following expressions evaluates to the largest number?

(A) The postfix expression 2 3 + 5 * 7 – = 18

(B) The prefix expression + * – 2 3 5 7

(C) The infix expression (2 + 3) * (5 - 7) = 5 * - 2 = -10

(D) The infix expression 2 + (3 * 5) – 7

2 + 15 - 7 = 10

	+		*	–
3		5		7
2	5	5	25	25

25 - 7 = 18

A

Slide

Topic : Question

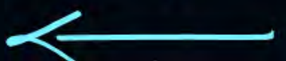
Q Which of the following expressions evaluates to the largest number?

(A) The postfix expression 2 3 + 5 * 7 –

(B) The prefix expression + * – 2 3 5 7

(C) The infix expression (2 + 3) * (5 - 7)

(D) The infix expression 2 + 3 * 5 – 7



– * +

2					
3	2-3 = -1				
5	5	-1*5 = -5			
7	7	7	-5+7 = ②		

operand$_1$ op operand$_2$

top = operand$_1$

top-1 operand

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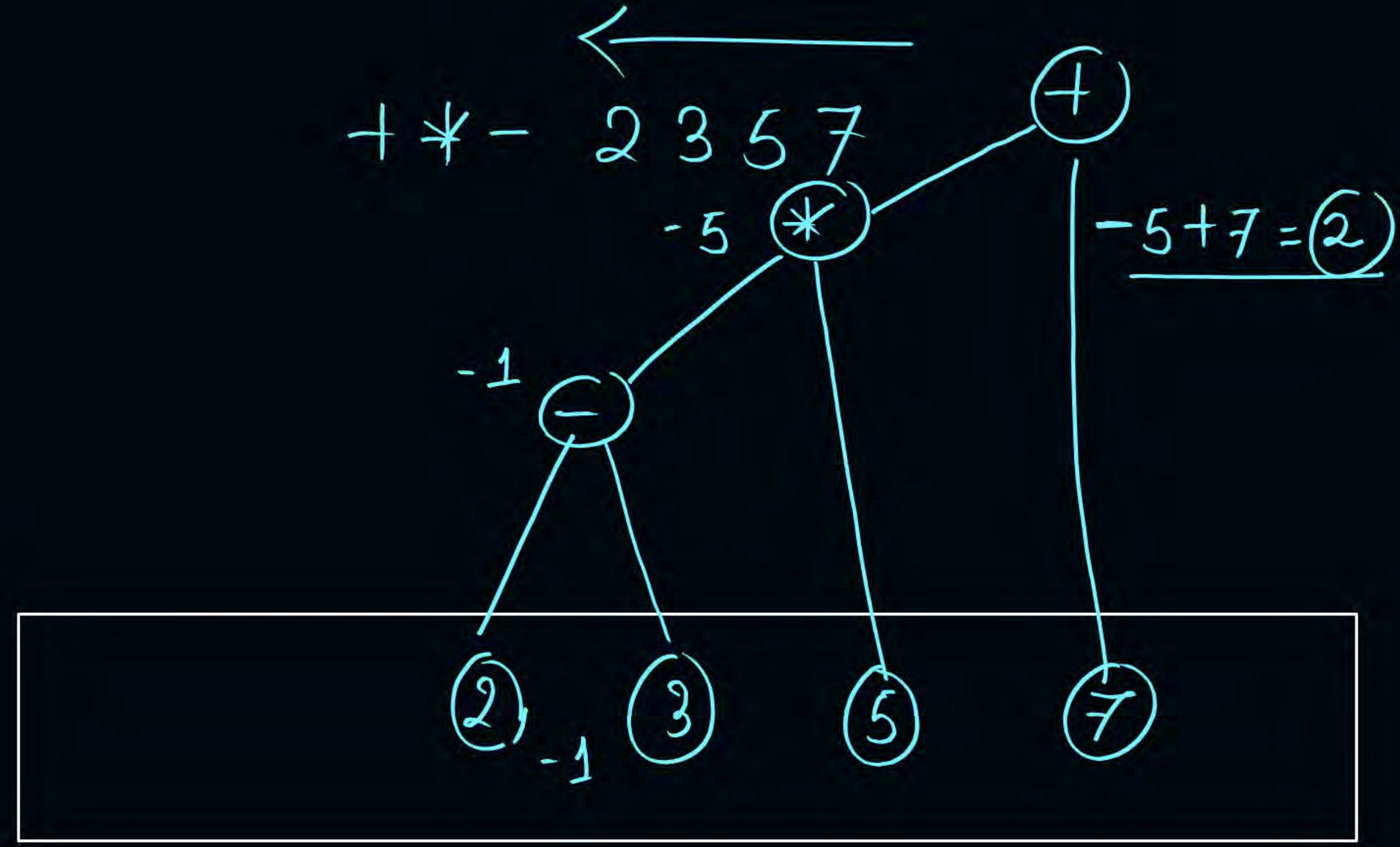

+ * - 2 3 5 7
+
-5
*
-5+7=2
-1
-
2
-1
3
5
7

Infix → prefix

a+b*c

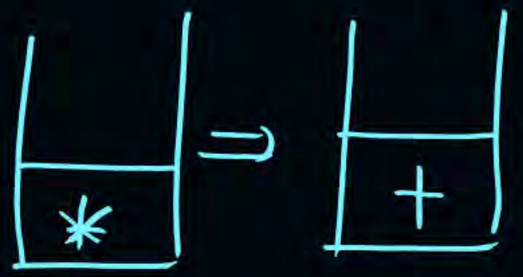
a+ *bc

+a*bc

c*b+a

1. Reverse order
2. postfix convert
3. Reverse the expression

cb*a



cb*a+

+a*bc

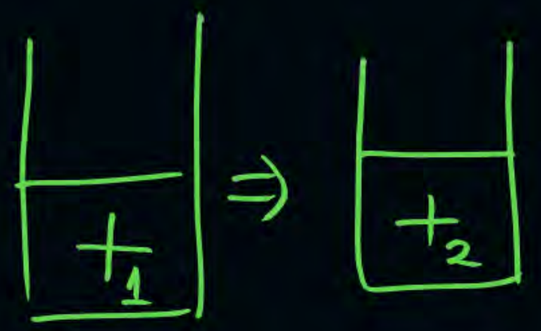
Same precedenc ans is wrong

a+b+c

cb+$_1$a

Reverse – c+$_1$b+$_2$a

++abc



Convert to postfix :

cb+$_1$a+$_2$

Reverse – + a+b c ← Is this correct

↑ wrong.

Scan the input Right to Left

$a + b + c$ —

print Right to Left

a b c

Rest is HPU

LPoPu-S

$t_2\ t_1\ a\ b\ c$

Topic : Question

Q Consider the following expression

(5 2 * 3 3 2 + * +) – (+ * 5 2 * + 3 4 * 5 2)

What will the result after evaluating the expression Where the sub expression in post fix and prefix form and all numbers are single digit numbers

(A) 250 (B) -55 (C) 80 (D) 1000

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for evaluating postfix expression

2015

Non linear pipeline

Scan input Right to left

top = operand$_1$

top-1 = operand$_2$

Topic : Question

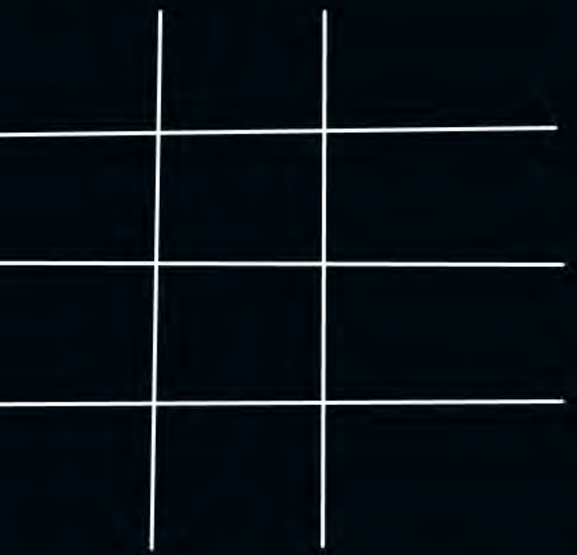
#	postfix		Value
P	2 3 * 4 2 2 * / + 3 5 + -	A	80
Q	6 2 3 + - 3 8 2 / + * 2 $ 3 +	B	-1
R	5 2 * 3 4 + 5 2 * * +	C	52
S	8 2 3 ^ / 2 3 * + 5 1 * -	D	25
R	5 2 * 3 3 2 + * +	E	2
U	10 5 + 60 6 / * 8 –	F	142

10 5 + 60 6 / * 8 -

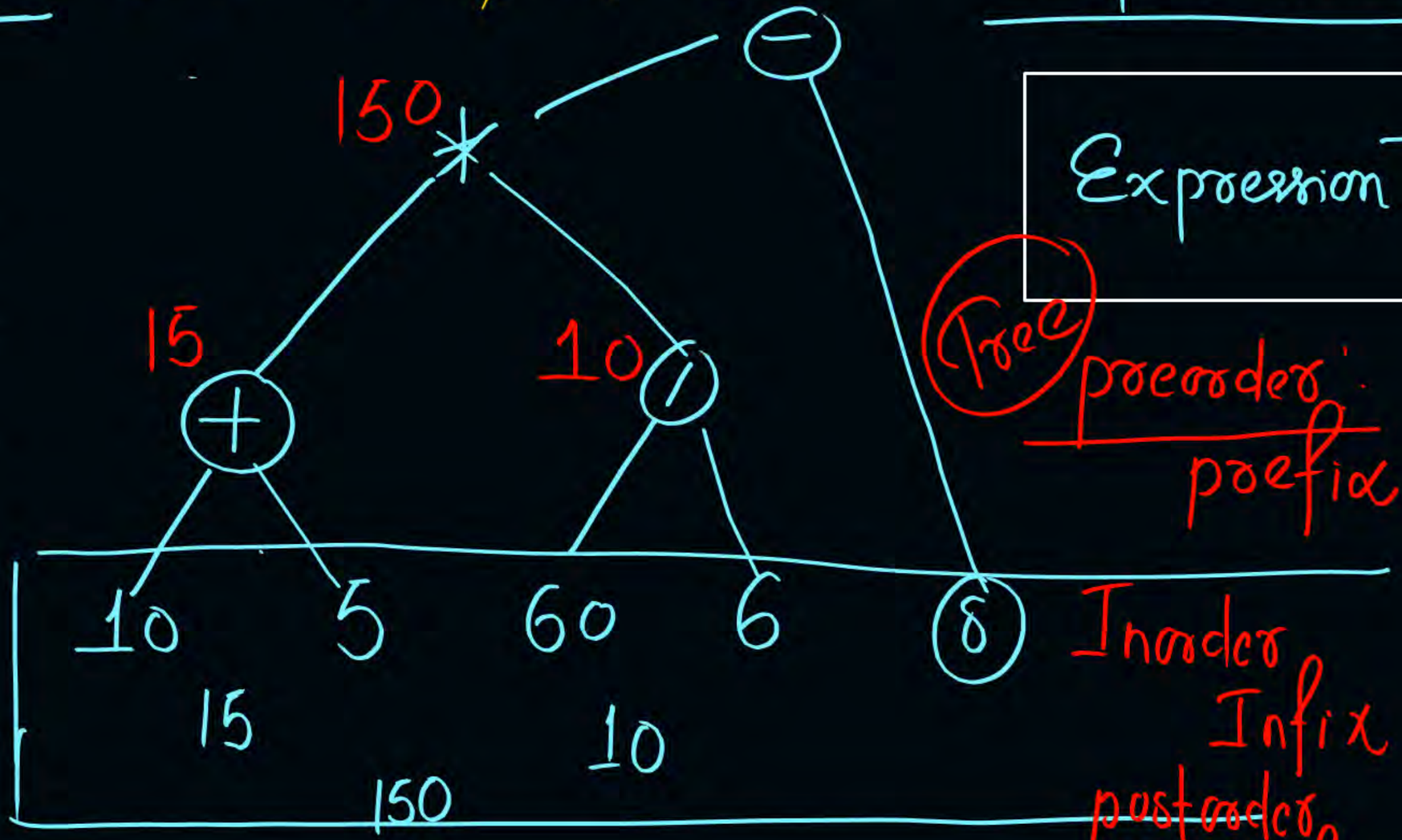
+		/	*		-
		6			
5		60	60/6 = 10		8	
10	10+5 = 15	15	15	15*10 = 150	150	150-8 = 142

10 5 + 60 6 / * 8 −

Expression Tree



Stack



Expression Tree

Tree

preorder:
prefix

Inorder
Infix

postorder
postfix

Topic : Question

Match the following

#	postfix		Value
P	2 3 * 4 2 2 * / + 3 5 + -	A	80
Q	6 2 3 + - 3 8 2 / + * 2 $ 3 +	B	-1
R	5 2 * 3 4 + 5 2 * * +	C	52
S	8 2 3 ^ / 2 3 * + 5 1 * -	D	25
R	5 2 * 3 3 2 + * +	E	2
U	10 5 + 60 6 / * 8 –	F	142

P-B, Q-C, R-A, S-E, T-D, U-F

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Topic : Question

#Q.

Compute the post fix equivalent of the following expression $3 \times \log (x + 1) - a / 2$

Topic : Question

HW

A function f defined on stacks of integers satisfies the following properties. $f(\phi) = 0$ and f(push (S,i)) = max (f(s), 0) +I for all stacks S and integers i.

If a stack S contains the integers 2, –3, 2, –1, 2 in order from bottom to top, what is f(S)?

(A) 6

(B) 4

(C) 3

(D) 2

2 mins Summary

Topic

Topic

Topic

Topic

Topic

Evaluation of postfix & prefix

problems

Slide

THANK - YOU

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