

Every opening parenthesis should have a closing parenthesis

No any parenthesis should start with closing parenthesis

Parenthesis matching problems → Applications of Stack

Paranthesis Matching

3	*	2	-	(8	+	1)	/	10
0	1	2	3	4	5	6	7	8	9	

exp = $3 * 2 - (8 + 1)$

(? → NO → if yes push into the stack
)? → No → if yes pop out of the stack

pop

Stack

$(3 * 2) - 1(8 - 2)$ ✓
 $a = 1 - 3) * 4(8 ;$

The screenshot shows a presentation slide titled "Paranthesis Matching". It features an array of characters: 3, *, 2, -, (, 8, +, 1,), /, 10, with indices 0 through 9 below them. Handwritten notes show the expression "exp = 3 * 2 - (8 + 1)" with arrows indicating the sequence of operations. Below the array, there are two conditional rules for matching parentheses: "(? → NO → if yes push into the stack" and ") ? → No → if yes pop out of the stack". To the right, a stack diagram is shown with a vertical line and a circle at the bottom labeled "Stack", with an arrow pointing up labeled "pop". Further right, there are handwritten mathematical expressions: "(3 * 2) - 1(8 - 2)" with a checkmark, and "a = 1 - 3) * 4(8 ;". The slide is part of a presentation titled "Algorithms & Data Structures > Paranthesis Matching".

Paranthesis Matching

Algorithms & Data Structures > Paranthesis Matching

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Stack

$(3 * 2) - 1(8 - 2)$ ✓
 $a = 1 - 3) * 4(8 ;$

Condition for a balanced Exp

- ① While popping Stack should not underflow \Rightarrow if it happens \rightarrow unbalanced expression
- ② At EOE, the stack must be Empty \Rightarrow " "

EOE – End Of Expression

Paranthesis Matching

Algorithms & Data Structures > Paranthesis Matching

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(? → NO → if yes push into the stack
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Stack

$(3 * 2) - 1(8 - 2)$ ✓
 $a = 1 - 3) * 4(8 ; \rightarrow$ unbalanced

Condition for a balanced Exp

- ① While popping Stack should not underflow \Rightarrow if it happens \rightarrow unbalanced expression
- ② At EOE, the stack must be Empty \Rightarrow " "

Paranthesis Matching

Exp = $3 * 2 - (8 + 1) / 10$

Condition for a balanced Exp

- ① While popping Stack should not underflow \Rightarrow if it happens \rightarrow unbalanced Expression
- ② At EOE, the stack must be Empty \Rightarrow " " " "

Stack

Algorithms & Data Structures > Parenthesis Matching

$(3 * 2) - 1(8 - 2)$ ✓
 $a = 1 - 3) * 4(8 ; \rightarrow$ unbalanced by ①
 $(1 * (8 - 3(7) \rightarrow$ unbalanced by ②
 $(7 * 8) - 3(7) \rightarrow$ unbalanced by ①

in above screenshot we are talking about condition 1 and 2

Paranthesis Matching

Exp = $3 * 2 - (8 + 1) / 10$

Condition for a balanced Exp

- ① While popping Stack should not underflow \Rightarrow if it happens \rightarrow unbalanced Expression
- ② At EOE, the stack must be Empty \Rightarrow " " " "

HW \Rightarrow ① $7 - (8(3 * 4) + 11 + 12) - 8)$
 a \rightarrow How many push pop operations?
 b \rightarrow Time complexity? WC? BC?
 n is the size of the exp!

Stack

Algorithms & Data Structures > Parenthesis Matching

$(3 * 2) - 1(8 - 2)$ ✓
 $a = 1 - 3) * 4(8 ; \rightarrow$ unbalanced by ①
 $(1 * (8 - 3(7) \rightarrow$ unbalanced by ②
 $(7 * 8) - 3(7) \rightarrow$ unbalanced by ①

Time Complexity

- Best Case: $O(1)$
- Worst Case: $O(n)$