

빅 데이터 혁신 공유 대학

파이썬으로 배우는 데이터 구조

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Data Structures in Python

Chapter 3 - 1

- Stack Concept and ADT
- **Stack Example - Matching**
- Stack Example - Postfix

Agenda

- Example Applications
- Checking for Balanced Braces
- Bracket Matching

Checking for Balanced Braces

- Algorithm
 - Initialize the stack to empty.
 - For every char read
 - If it is a non-bracket character, skip it.
 - If it is an open bracket, then push onto stack.
 - If it is a close bracket,
 - If the stack is empty, return ERROR.
 - Else, pop an element out from the stack.
 - If the stack is NON-EMPTY, ERROR.

Checking for Balanced Braces

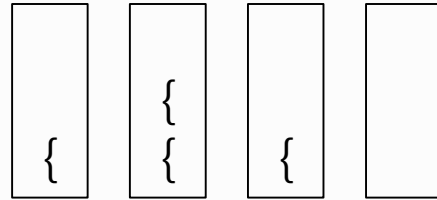
■ Examples

Input Strings

Stack as algorithm executes

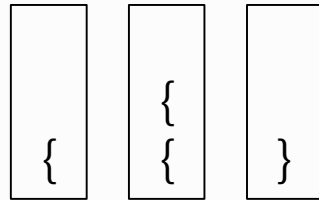
1 2 3 4

{a {b} c}



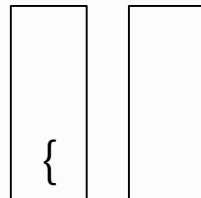
1. push "{"
2. push "{"
3. pop
4. pop
Stack empty → balanced

{a {bc}



1. push "{"
2. push "{"
3. pop
Stack not empty → unbalanced

{ab} c}



1. push "{"
2. pop
3. pop
Stack empty when last "}" encountered
→ unbalanced

Checking for Balanced Braces

- Coding

```
def bracesBalanced(expr):  
    st = Stack()  
    for i in range(len(expr)):  
        if token[i] == '{':           #open bracket  
            st.push(token[i])  
        elif token[i] == '}':        #close bracket  
            if st.is_empty():  
                return False  
            else:  
                st.pop()              #pop an item  
    return st.is_empty()
```

Expressions to test

{a{b}c}
{a{bc}
{ab}c}

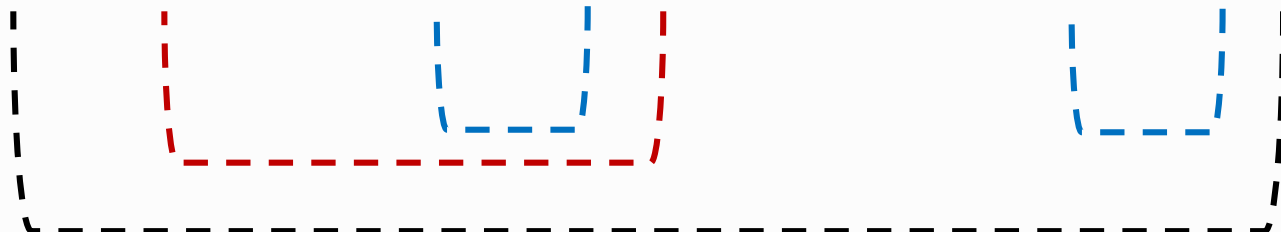
Result:

{a{b}c}: True
{a{bc}: False
{ab}c}: False

Bracket Matching

- Ensure that pairs of brackets are properly matched
 - Examples:

`{ a, (b + f[4]) * 3, d + f[5] }`



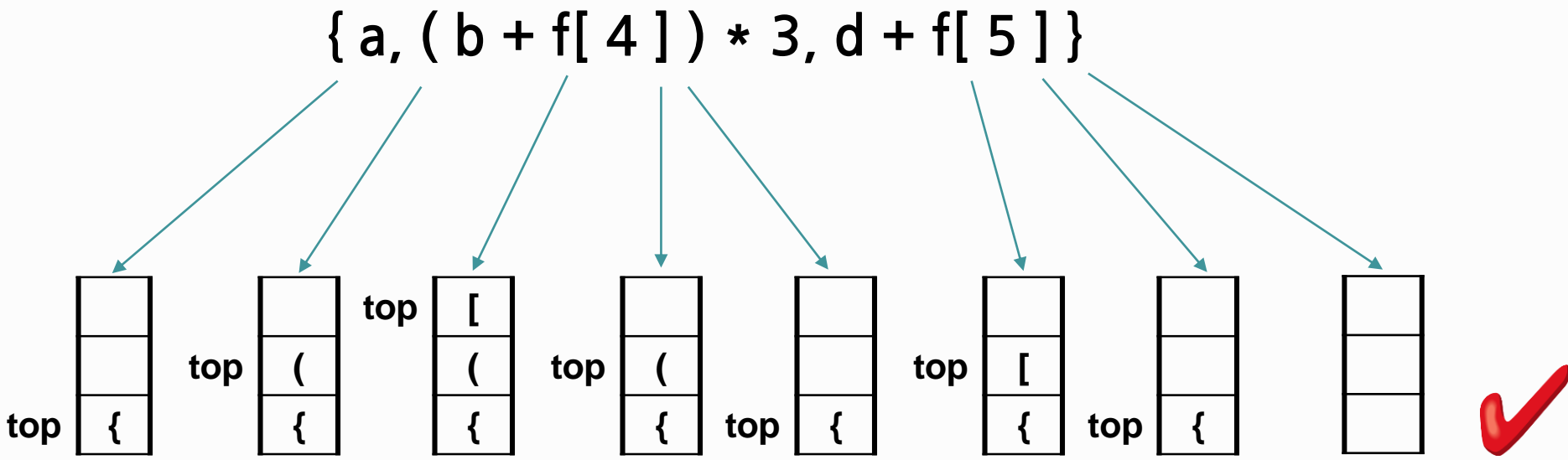
<code>(...) ...)</code>	<code>// too many closing brackets</code>
<code>(... (...)</code>	<code>// too many open brackets</code>
<code>[... (...] ...)</code>	<code>// mismatch brackets</code>

Bracket Matching

- Algorithm:
 - Initialize the stack to empty.
 - For every char read
 - if it is a non-bracket, skip the character
 - if it is an open bracket then push onto stack
 - if it is a close bracket, then
 - If the stack is empty, return ERROR
 - pop from the stack
 - if they don't match then return ERROR
 - If the stack is **NON-EMPTY, ERROR.**

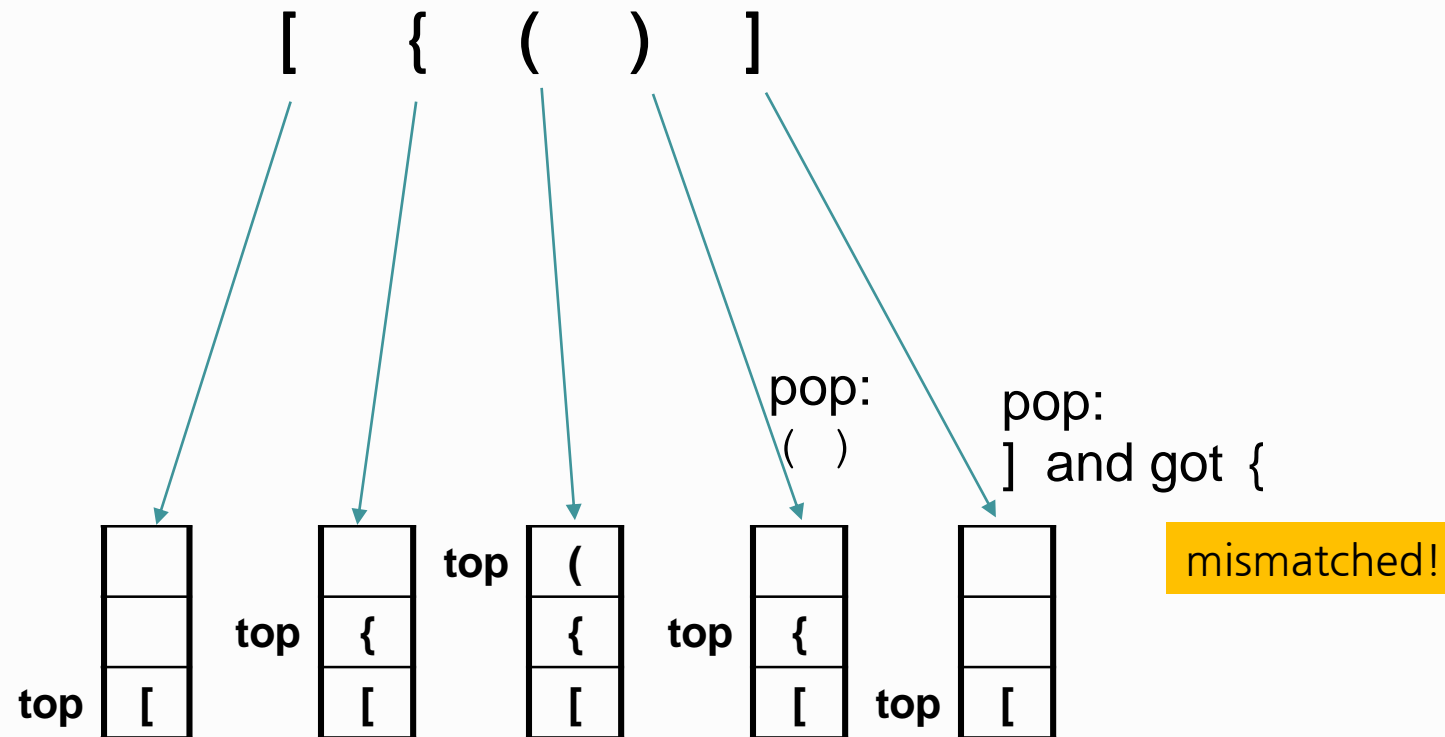
Bracket Matching

■ Example 1:



Bracket Matching - Algorithm

- Example 2:



Bracket Matching

■ Coding

```
def bracketsMatched(expr):  
    st = Stack()  
    balanced = True  
    index = 0  
    while index < len(expr) and balanced:  
        token = expr[index]  
        if token in "([{":  
            st.push(token)  
        elif token in ")]}":  
            if st.is_empty():  
                balanced = False  
            else:  
                top = st.pop()  
                if not matches(top, token):  
                    balanced = False  
        index = index + 1  
    if balanced and st.is_empty():  
        return True  
    return False
```

Expressions to test:

```
[{()}]  
[{()}]  
[{()}]}
```

Results:

```
[{()]: False  
[{()}] : True  
[{()}] } : False
```

a function to check whether
the brackets are matched

Bracket Matching - Exercise 1

- Complete the function `matches(a, b)`
 - It is a function to check whether the brackets are matched
 - Examples:
 - `matches('(', ')')` returns `True`
 - `matches('(', '(')` returns `False`

```
def bracketsMatched(expr):  
    ...  
        ...  
        if not matches(top, token):  
            balanced = False  
    index = index + 1  
    ...
```

Summary

- Stacks are used in applications that manage data items in LIFO manner, such as:
 - Checking for Balanced Braces
 - Matching brackets in expressions
 - Evaluating postfix expressions
 - Conversion from Infix to Postfix

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