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TOPIC

Data Structure and Algorithms

College

Walchand Institute of Technology

Assignment 2: Stack

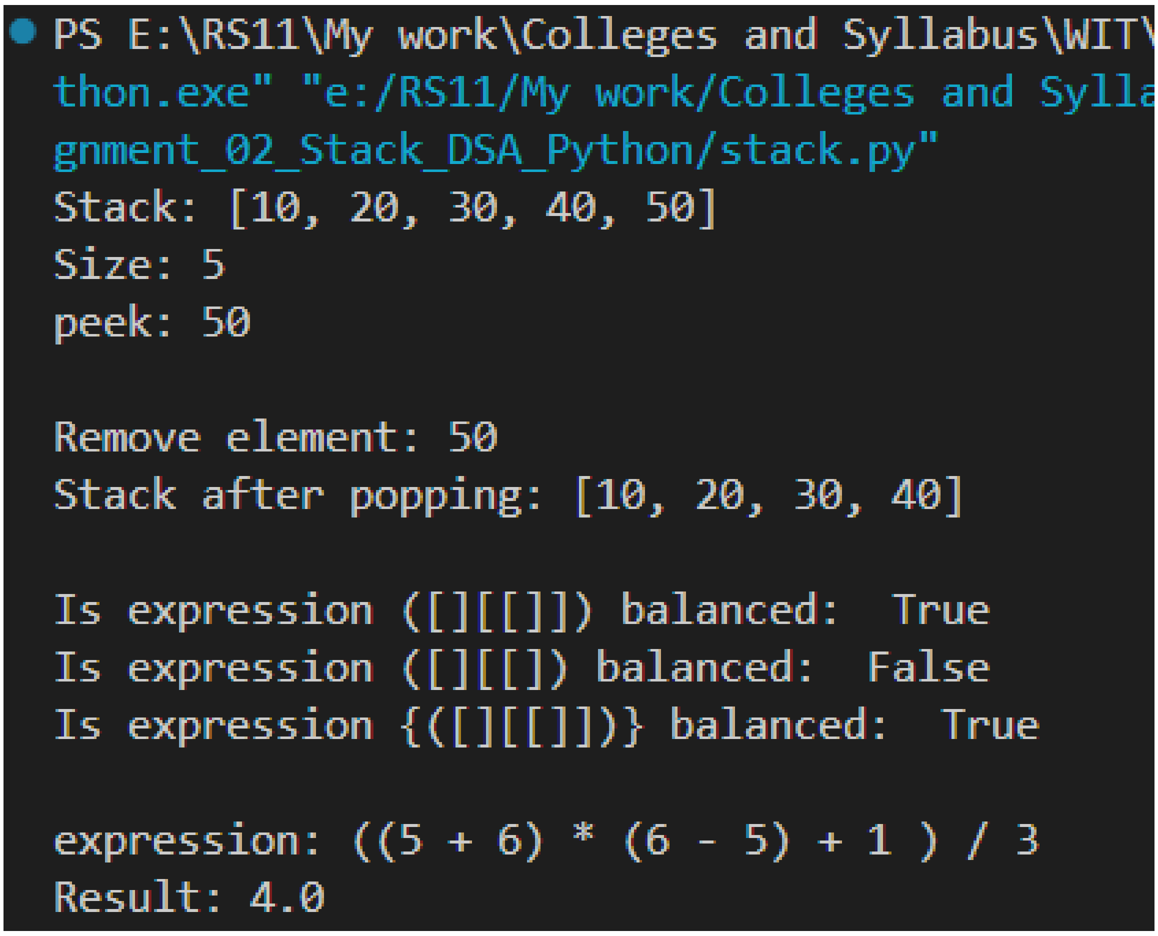
Implementation of Stack Data Structure using Python.

Code:

```
# Assignment 2: STACK implementation by RAUNAK SHAH using PYTHON
class Stack:
    def __init__(self):
        self.items = []

    def isEmpty(self):
        return len(self.items) < 1

    def push(self, element):
        self.items.append(element)

    def pop(self):
        if not self.isEmpty():
            return self.items.pop()
        else:
            raise IndexError("Pop method cannot be done when stack is empty.
No Element to pop.")

    def peek(self):
        if not self.isEmpty():
            return self.items[-1]
        else:
            raise IndexError("No Element to peek in the stack.")

    def size(self):
        return len(self.items)


    # More Features of Stack
    def is_balanced(self, expression) -> bool:
        opening_brackets = "[({"
        closing_brackets = "])}"

        stack = Stack()

        for char in expression:
            if char in opening_brackets:
                stack.push(char)
            elif char in closing_brackets:
                if stack.isEmpty():
                    return False

                top = stack.peek()
                if opening_brackets.index(top) != closing_brackets.index(char)
or top == None :
                    return False
```

```python
                stack.pop()

        return stack.isEmpty()

    def evaluate_infix(self,expression):
        expression = "(" + expression + ")"
        def precedence(operator):
            if operator == '+' or operator == '-':
                return 0
            elif operator == '*' or operator == '/':
                return 1
            else:
                return 2

        def apply_operator(operators, values):
            operator = operators.pop()
            right = values.pop()
            left = values.pop()

            if operator == '+':
                values.push(left + right)
            elif operator == '-':
                values.push(left - right)
            elif operator == '*':
                values.push(left * right)
            elif operator == '/':
                values.push(left / right)

        operators = Stack()
        values = Stack()

        i = 0
        while i < len(expression):
            if expression[i].isdigit():
                j = i
                while j < len(expression) and (expression[j].isdigit() or
expression[j] == '.'):
                    j += 1
                values.push(float(expression[i:j]))
                i = j
            elif expression[i] in "+-*/":
                while (not operators.isEmpty() and operators.peek() in "+-*/"
and precedence(expression[i]) <= precedence(operators.peek())):
                    apply_operator(operators, values)
                operators.push(expression[i])
                i += 1
            elif expression[i] == "(":
                operators.push(expression[i])
                i += 1
            elif expression[i] == ")":
                while (not operators.isEmpty() and operators.peek() != '('):
                    apply_operator(operators, values)
                operators.pop()
                i += 1
            else:
                i += 1

        while not operators.isEmpty():
            apply_operator(operators, values)

        # return the remaining element in values i.e the final answer
        return values.pop()

new_stack = Stack()

# Inserting elements
new_stack.push(10)
new_stack.push(20)
new_stack.push(30)
new_stack.push(40)
new_stack.push(50)
print(f"Stack: {new_stack.items}")
print(f"Size: {new_stack.size()}")
print(f"peek: {new_stack.peek()}")

print(f"\nRemove element: {new_stack.pop()}")
print(f"Stack after popping: {new_stack.items}")

# Testing Exptra features of stack

# Checking for expression balance
print("\nIs expression ([][[]]) balanced: ",new_stack.is_balanced("([][[]])"))
print("Is expression ([][[]) balanced: ",new_stack.is_balanced("([][[])"))
print("Is expression {([][[]])} balanced: ",new_stack.is_balanced("{([[]])}"))

# Evaluating an expression
expression = "((5 + 6) * (6 - 5) + 1 ) / 3"
print(f"\nexpression: {expression}")
print(f"Result: {new_stack.evaluate_infix(expression)}")
```

Output:



```
PS E:\RS11\My work\Colleges and Syllabus\WIT\
thon.exe" "e:/RS11/My work/Colleges and Sylla
gnment_02_Stack_DSA_Python/stack.py"
Stack: [10, 20, 30, 40, 50]
Size: 5
peek: 50

Remove element: 50
Stack after popping: [10, 20, 30, 40]

Is expression ([][[]]) balanced:  True
Is expression ([][[]) balanced:  False
Is expression {([][[]])} balanced:  True

expression: ((5 + 6) * (6 - 5) + 1 ) / 3
Result: 4.0
```