Stack

Q1) stacking, taking the top element of the stack, determining whether the stack is empty, and displaying the elements of the stack

Program

```
class Stack:
    def __init__(self):
        self.stack =[]
    def push(self,value): # push method
        self.stack.append(value)
        return True
         def pop(self): #stack out method
                # Determine if the stack is empty
        if self.stack:
                         # Get the stack element and return
            item = self.stack.pop()
            return item
        else:
            return False
         def top(self): #View stack top element method
        if self.stack:
            return self.stack[-1]
        else:
            return False
         def length(self): #View stack length method
        return len(self.stack)

         def view(self): #View stack element method
        return ','.join(self.stack)
s = Stack()
s.push('1')
s.push('2')
 s.push('3') #Push three elements 1, 2, 3 on the stack
 item = s.pop() # pop an element from the stack
 print(s.top()) #View the top element of the stack
 print(s.length()) #View the stack length
 print(s.view()) #View stack elements
```

Output

```
2
2
1,2
```

Q2) Find maximum in stack in O(1) without using additional stack

Program

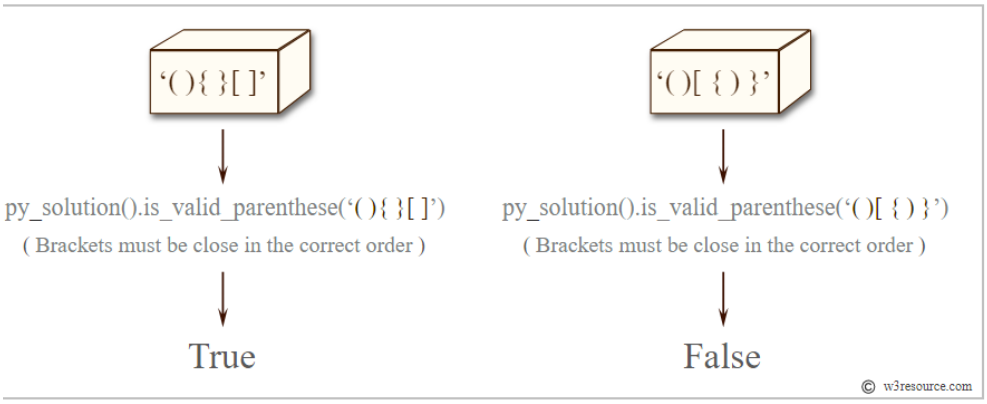
```
class Block:

    # A block has two elements
    # as components  (i.e. value and localMax)
    def __init__(self, value, localMax):
        self.value = value
        self.localMax = localMax

class Stack:
    def __init__(self, size):

        # Setting size of stack and
        # initial value of top
        self.stack = [None] * size
        self.size = size
        self.top = -1

    # Function to push an element
    # to the stack
    def push(self, value):

        # Don't allow pushing elements
        # if stack is full
        if self.top == self.size - 1:
            print("Stack is full")
        else:
            self.top += 1

            # If the inserted element is the first element
            # then it is the maximum element, since no other
            # elements is in the stack, so the localMax
            # of the first element is the element itself
            if self.top == 0:
                self.stack[self.top] = Block(value, value)

            else:

                # If the newly pushed element is less
                # than the localMax of element below it,
                # Then the over all maximum doesn't change
                # and hence, the localMax of the newly inserted
                # element is same as element below it
                if self.stack[self.top - 1].localMax > value:
                    self.stack[self.top] = Block(
                        value, self.stack[self.top - 1].localMax)

                # Newly inserted element is greater than
                # the localMax below it, hence the localMax
                # of new element is the element itself
                else:
                    self.stack
                    self.stack[self.top] = Block(value, value)

            print(value, "inserted in the stack")

    # Function to remove an element
    # from the top of the stack
    def pop(self):

        # If stack is empty
        if self.top == -1:
            print("Stack is empty")

        # Remove the element if the stack
        # is not empty
        else:
            self.top -= 1
            print("Element popped")

    # Function to find the maximum
    # element from the stack
    def max(self):

        # If stack is empty
        if self.top == -1:
            print("Stack is empty")
        else:

            # The overall maximum is the local maximum
            # of the top element
            print("Maximum value in the stack:",
                  self.stack[self.top].localMax)

# Driver code

# Create stack of size 5
stack = Stack(5)
stack.push(2)
stack.max()
stack.push(6)
stack.max()
stack.pop()
stack.max()
```

Output

```
2 inserted in stack
Maximum value in the stack: 2
6 inserted in stack
Maximum value in the stack: 6
Element popped
Maximum value in the stack: 2
```

Q3) Write a Python class to find validity of a string of parentheses, '(', ')', '{', '}', '[' and ']. These brackets must be close in the correct order,
for example "()" and "()[]{}" are valid but "[)", "({[)]" and "{{{" are invalid.

torial Presentation:


‘(){}[]’
py_solution().is_valid_parenthese(‘(){}[]’)
(Brackets must be close in the correct order)
True
‘()[{)}’
py_solution().is_valid_parenthese(‘()[{)}’)
(Brackets must be close in the correct order)
False
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Program

```
class py_solution:
  def is_valid_parenthese(self, str1):
    stack, pchar = [], {"(": ")", "{": "}", "[": "]"}
    for parenthese in str1:
      if parenthese in pchar:
        stack.append(parenthese)
      elif len(stack) == 0 or pchar[stack.pop()] != parenthese:
        return False
    return len(stack) == 0

print(py_solution().is_valid_parenthese("(){}[]"))
print(py_solution().is_valid_parenthese("()[{)}"))
print(py_solution().is_valid_parenthese("()"))
```

Output

```
True
False
True
```

Q4) Sort a stack using a temporary stack

Program

```
# This function return the sorted stack
def sortStack ( stack ):
    tmpStack = createStack()
    while(isEmpty(stack) == False):

        # pop out the first element
        tmp = top(stack)
        pop(stack)

        # while temporary stack is not
        # empty and top of stack is
        # greater than temp
        while(isEmpty(tmpStack) == False and
             int(top(tmpStack)) > int(tmp)):

            # pop from temporary stack and
            # push it to the input stack
            push(stack,top(tmpStack))
            pop(tmpStack)

        # push temp in tempory of stack
        push(tmpStack,tmp)

    return tmpStack

# Below is a complete running
# program for testing above
# function.

# Function to create a stack.
# It initializes size of stack
# as 0
def createStack():
    stack = []
    return stack

# Function to check if
# the stack is empty
def isEmpty( stack ):
    return len(stack) == 0
# Function to push an
# item to stack
def push( stack, item ):
    stack.append( item )
# Function to get top
# item of stack
def top( stack ):
    p = len(stack)
    return stack[p-1]
# Function to pop an
# item from stack
def pop( stack ):

    # If stack is empty
    # then error
    if(isEmpty( stack )):
        print("Stack Underflow ")
        exit(1)

    return stack.pop()
# Function to print the stack
def prints(stack):
    for i in range(len(stack)-1, -1, -1):
        print(stack[i], end = ' ')
    print()
# Driver Code
stack = createStack()
push( stack, str(34) )
push( stack, str(3) )
push( stack, str(31) )
push( stack, str(98) )
push( stack, str(92) )
push( stack, str(23) )
print("Sorted numbers are: ")
sortedst = sortStack ( stack )
prints(sortedst)
```

Output

```
Sorted numbers are:
98 92 34 31 23 3
```

Q5) Reverse a string using stack

Program

```
# Python program to reverse a string using stack
 # Function to create an empty stack.
# It initializes size of stack as 0
def createStack():
    stack=[]
    return stack

# Function to determine the size of the stack
def size(stack):
    return len(stack)

# Stack is empty if the size is 0
def isEmpty(stack):
    if size(stack) == 0:
        return true

# Function to add an item to stack .
# It increases size by 1
def push(stack,item):
    stack.append(item)

#Function to remove an item from stack.
# It decreases size by 1
def pop(stack):
    if isEmpty(stack): return
    return stack.pop()

# A stack based function to reverse a string
def reverse(string):
    n = len(string)

    # Create a empty stack
    stack = createStack()
    # Push all characters of string to stack
    for i in range(0,n,1):
        push(stack,string[i])

    # Making the string empty since all
    #characters are saved in stack
    string=""

    # Pop all characters of string and
    # put them back to string
    for i in range(0,n,1):
        string+=pop(stack)

    return string

# Driver program to test above functions
string="GeeksQuiz"
string = reverse(string)
print("Reversed string is " + string)
```

Output

```
Reversed string is ziuQskeeG
```