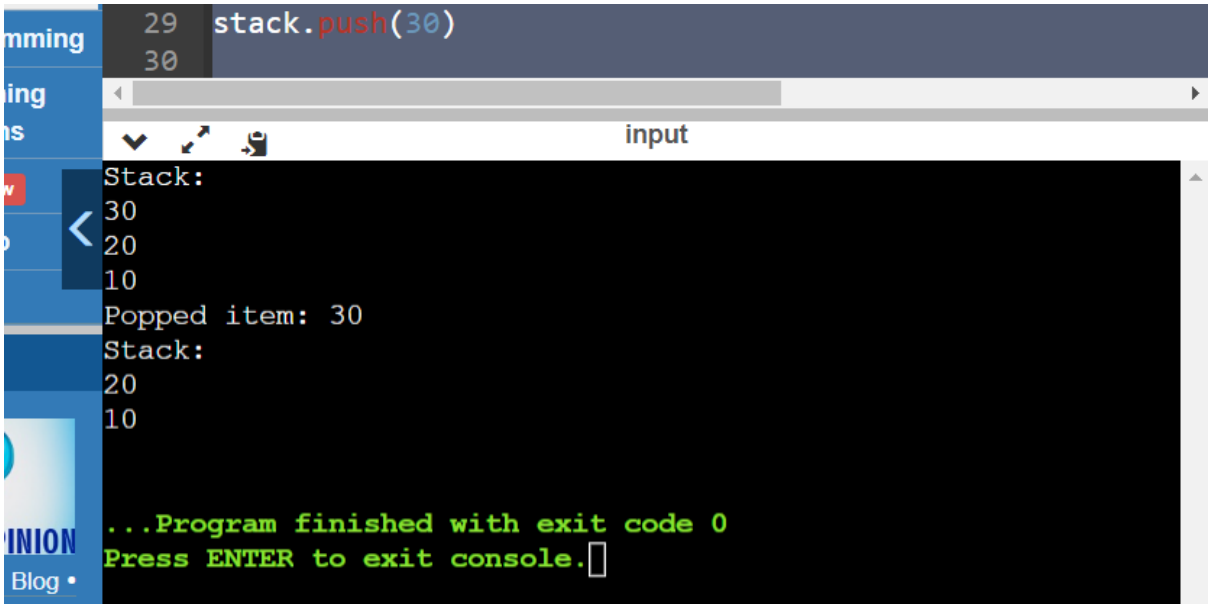
Day-13 : Stack & Queue

Problem statement: Implement a stack using an array.

```
class Stack:
    def __init__(self):
        self.stack = []

    def push(self, item):
        self.stack.append(item)

    def pop(self):
        if not self.is_empty():
            return self.stack.pop()
        else:
            return None

    def is_empty(self):
        return len(self.stack) == 0

    def print_stack(self):
        if not self.is_empty():
            print("Stack:")
            for item in reversed(self.stack):
                print(item)
        else:
            print("Stack is empty")

stack = Stack()

stack.push(10)
stack.push(20)
stack.push(30)
```

```
stack.print_stack()


popped_item = stack.pop()
if popped_item is not None:
    print("Popped item:", popped_item)

stack.print_stack()
```

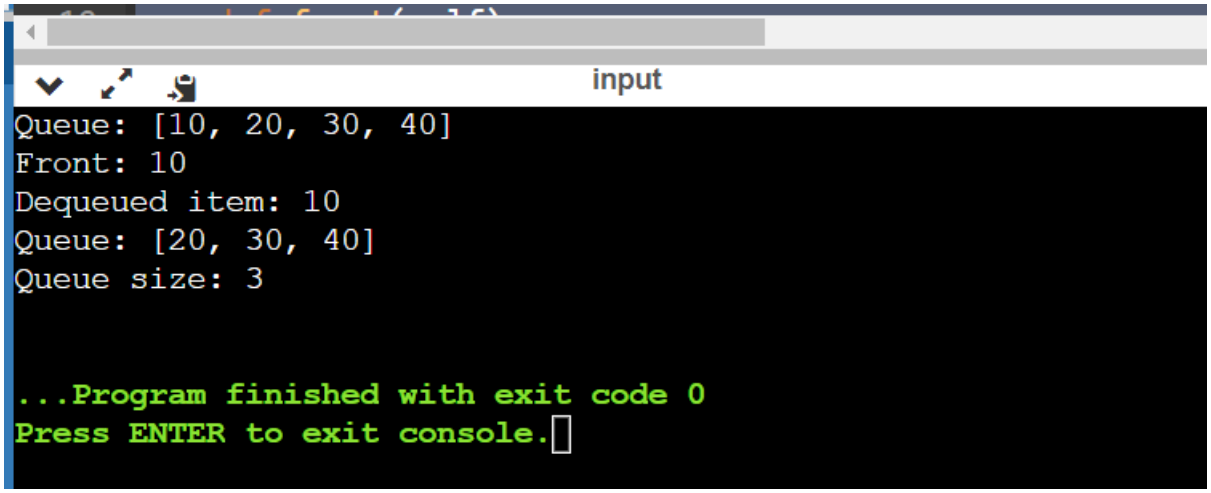


Problem Statement: Implement Queue Data Structure using Array with all functions like pop, push, top, size, etc.

```
class Queue:
    def __init__(self):
        self.queue = []

    def is_empty(self):
        return len(self.queue) == 0

    def size(self):
        return len(self.queue)
```

```
    def enqueue(self, item):
        self.queue.append(item)

    def dequeue(self):
        if self.is_empty():
            return None
        return self.queue.pop(0)

    def front(self):
        if self.is_empty():
            return None
        return self.queue[0]

    def print_queue(self):
        if self.is_empty():
            print("Queue is empty")
        else:
            print("Queue:", self.queue)

queue = Queue()
queue.enqueue(10)
queue.enqueue(20)
queue.enqueue(30)
queue.enqueue(40)

queue.print_queue()
print("Front:", queue.front())
print("Dequeued item:", queue.dequeue())
queue.print_queue()
```

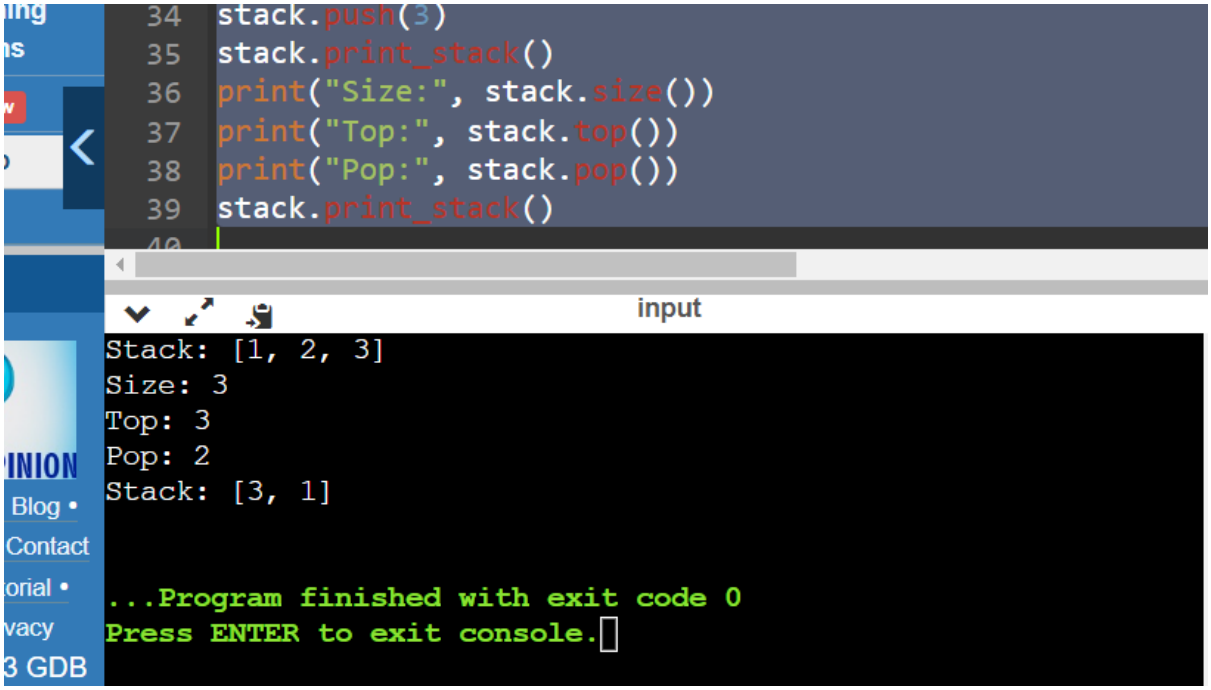
```
print("Queue size:", queue.size())
```



Problem Statement: Implement a **Stack** using a single **Queue**.

```
class Stack:
    def __init__(self):
        self.queue = []

    def push(self, value):
        self.queue.append(value)

    def pop(self):
        if not self.is_empty():
            size = len(self.queue)
            for _ in range(size - 1):
                self.queue.append(self.queue.pop(0))
            return self.queue.pop(0)

    def top(self):
        if not self.is_empty():
            size = len(self.queue)
            for _ in range(size - 1):
                self.queue.append(self.queue.pop(0))
```

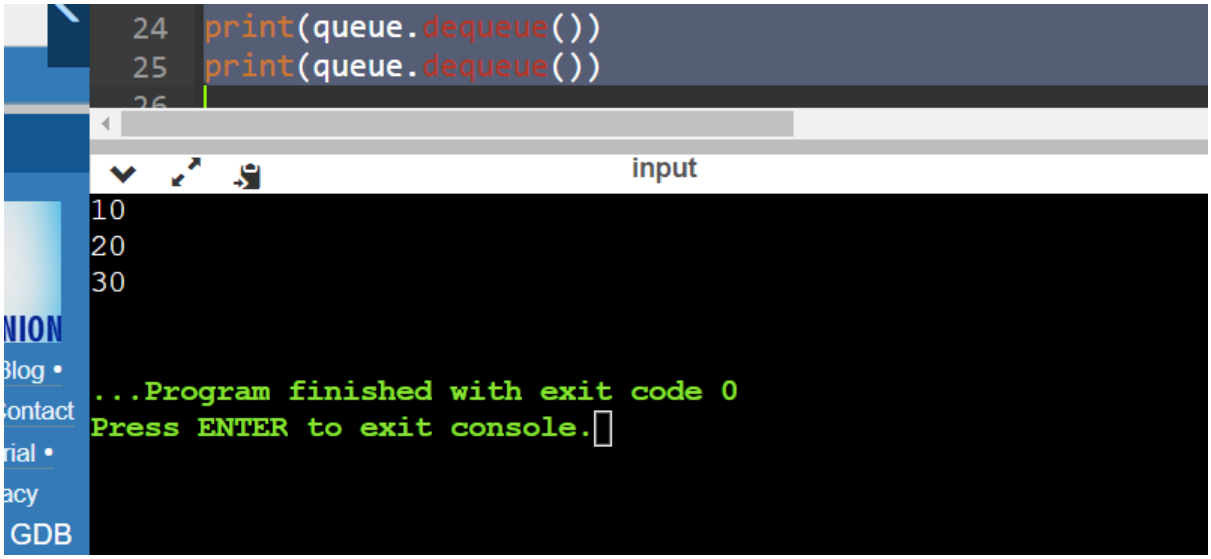
```
            return self.queue[0]

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

    def is_empty(self):
        return len(self.queue) == 0

    def print_stack(self):
        print("Stack:", self.queue)

stack = Stack()
stack.push(1)
stack.push(2)
stack.push(3)
stack.print_stack()
print("Size:", stack.size())
print("Top:", stack.top())
print("Pop:", stack.pop())
stack.print_stack()
```



Problem Statement: Given a Stack having some elements stored in it. Can you implement a Queue using the given Stack?**Using two Stacks where push operation is O(N).**

```
class QueueUsingStack:
    def __init__(self):
        self.stack1 = []
        self.stack2 = []

    def enqueue(self, value):
        self.stack1.append(value)

    def dequeue(self):
        if not self.stack1 and not self.stack2:
```

```
            raise Exception("Queue is empty (underflow)")

        if not self.stack2:
            while self.stack1:
                self.stack2.append(self.stack1.pop())

        return self.stack2.pop()

queue = QueueUsingStack()
queue.enqueue(10)
queue.enqueue(20)
queue.enqueue(30)
print(queue.dequeue())
print(queue.dequeue())
print(queue.dequeue())
```



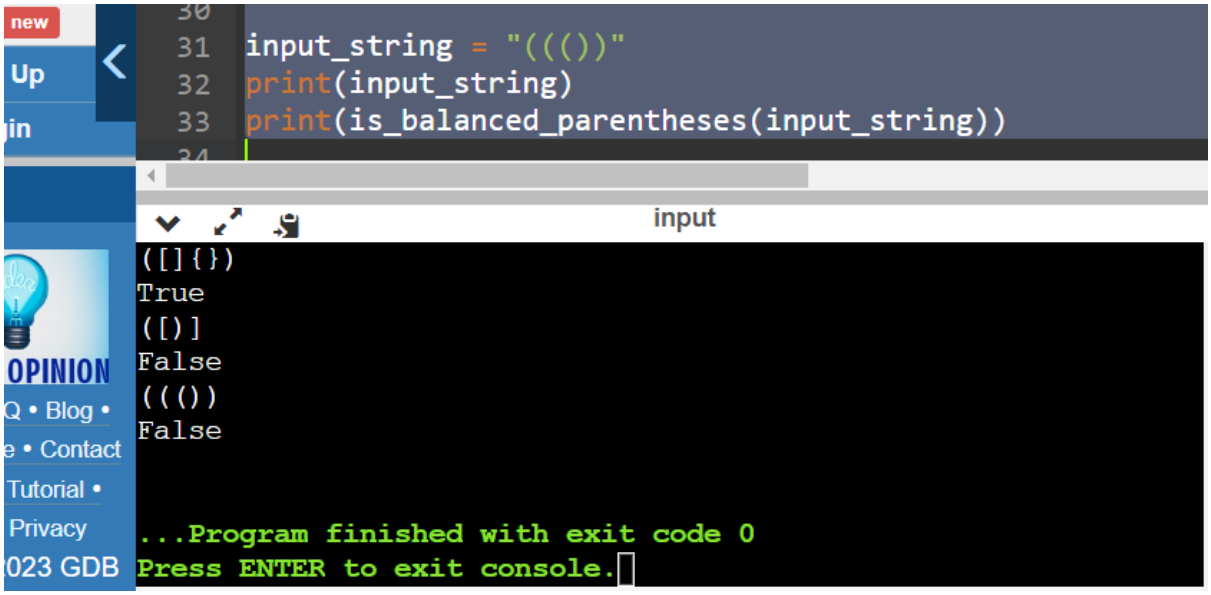
Problem Statement: Check Balanced Parentheses. Given string str containing just the characters ‘(‘, ‘)’, ‘{‘, ‘}’, ‘[‘ and ‘]’, check if the input string is valid and return true if the string is balanced otherwise return false.

Note: string str is valid if:

1. Open brackets must be closed by the same type of brackets.
2. Open brackets must be closed in the correct order.

```
def is_balanced_parentheses(string):
    stack = []
    opening_brackets = ['(', '[', '{']
    closing_brackets = [')', ']', '}']
    bracket_map = {')': '(', ']': '[', '}': '{'}

    for char in string:
        if char in opening_brackets:
            stack.append(char)
        elif char in closing_brackets:
            if len(stack) == 0:
                return False
            if stack[-1] == bracket_map[char]:
                stack.pop()
            else:
                return False
```

```
    return len(stack) == 0



input_string = "([]{})"
print(input_string)
print(is_balanced_parentheses(input_string))



input_string = "([)]"
print(input_string)
print(is_balanced_parentheses(input_string))



input_string = "((()"
print(input_string)
print(is_balanced_parentheses(input_string))
```



Problem Statement: Given a circular integer array **A**, return the next greater element for every element in A. The next greater element for an element x is the first element greater than x that we come across while traversing the array in a clockwise manner. If it doesn't exist, return -1 for this element.

```
def next_greater_elements(N, A):
    stack = []
    result = [-1] * N
    for _ in range(2):
        for i in range(N):
            while stack and A[i] > A[stack[-1]]:
                result[stack.pop()] = A[i]
            stack.append(i)

    return result
N = 11
```

A = [3, 10, 4, 2, 1, 2, 6, 1, 7, 2, 9]

result = next_greater_elements(N, A)

print(result)