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1  # Advanced Stack Implementation Using Linked List (Conceptual for Large Data)
2  # Sometimes, stacks are implemented using linked lists
3  # To avoid resizing issues with lists and to practice pointer manipulation.
4
5  # Node class for linked list
6  class StackNode:
7      def __init__(self, value):
8          self.value = value # Store the node's data
9          self.next = None # Pointer to the next node (below in stack)
10
11 # Stack implemented with linked list
12 class LinkedListStack:
13     def __init__(self):
14         self.top = None # Points to the top node in the stack
15
16     def is_empty(self):
17         # Stack is empty if top pointer is None
18         return self.top is None
19
20     def push(self, value):
21         # Create a new node with the value
22         new_node = StackNode(value)
23
24         # New node's next pointer should point to current top node
25         new_node.next = self.top
26
27         # Update top pointer to new node (new top of stack)
28         self.top = new_node
29
30     def pop(self):
31         # If stack is empty, raise error
32         if self.is_empty():
33             raise Exception("Cannot pop from empty stack!")
34
35         # Retrieve value from top node
36         popped_value = self.top.value
37
38         # Move top pointer to next node down the stack
39         self.top = self.top.next
40
41         # Return popped value
42         return popped_value
43
44     def peek(self):
45         # Return top element value without removing it
46         if self.is_empty():
47             raise Exception("Cannot peek on empty stack!")
48         return self.top.value
49
50     def display(self):
51         # Print stack from top to bottom
52         current = self.top
53         values = []
54         while current:
55             values.append(str(current.value))
56             current = current.next
57         print("Stack from top to bottom:", " -> ".join(values))
58
59 # Example usage:
60 if __name__ == "__main__":
61     stack_ll = LinkedListStack()
62     stack_ll.push(5)
63     stack_ll.push(10)
64     stack_ll.push(15)
65
66     stack_ll.display() # Expected: Stack from top to bottom: 15 -> 10 -> 5

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68
69 print("Peek top:", stack_11.peek()) # Expected: 15
70
71 print("Pop:", stack_11.pop()) # Expected: 15
72 stack_11.display() # Expected: 10 -> 5
73
```