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OCW: Data structures and algorithms. Author: I. Segura-Bedmar.

Example of Mid-Exam

Problem 1: Given the classes, DoublyNode and DoublyLinkedList, representing a doubly node and a doubly linked list of numbers, respectively:

A. (0.40) In the DoublyLinkedList class, add a new method, **isSorted(self),** that returns true if the list is sorted (in ascending order) and false otherwise. *Examples: 1, 2, 5 -> true; 1, 2, 3, 3, 4, 8, 8, 9 -> true; 1, 9, 2, 0, 1 -> false.* What is the complexity of this method (0.10)? (Just explain i.e., there is no need to calculate T(n)!!!). Discuss about the best and worst cases.

B. (0.80) Add a **removeSortDuplicates**(**self**) method that removes any duplicate number from the invoking object list. You must use *isSorted* method to check if the list is sorted or not. If the list is not sorted, the method just shows the following message “the list is not sorted!!!” and then ends. Otherwise, the method removes the duplicate elements. Your solution should be the most efficient possible one algorithm. *Example: if the linked list is: 1, 3, 3, 5, 7, 7, 7, 10, 11, 11, after the method, the list should be: 1, 3, 5, 7, 10, 11.* What is the complexity of this method ? (Just explain i.e., there is no need to calculate T(n)!!!). Discuss about the best and worst cases.

Note: You cannot use any of the methods of the DoublyLinkedList class (except isEmpty or isSorted). It is not allowed to use any other data structure such as Python List, stacks or queues, among others.

Problem 2 – **Recursive functions**

1. (0.25) Implement a recursive method, **count3**(n), which takes a a non-negative integer, n, and returns the count of the occurrences of the number 3 in n. *Example: if n=31315 then the method returns 2. Hint: You can use the integer division and modulus operators to solve this problem. Please, note that if n=31315, n%10=5, n/10=3131.*

2. (0.25) Write a recursive method, **largestEven(l)**, that takes a Python list of integers and returns the largest even integer of the array. *Example: Input : A = {1, 4, 3, -5, -4, 8, 6}; Output : 8*