

Data Structures and Algorithms – (COMP SCI 2C03)
Winter 2021
Tutorial-I

January 25, 2021

Notes for the tutorial: When writing code involving linked lists, we must always be careful to properly handle the exceptional cases (when the linked list is empty, when the list has only one or two nodes) and the boundary cases (dealing with the first or last items). This is usually much trickier than handling the normal cases.

Question 1 Write an algorithm that traverses a linked list to print the data value in each node, in linear time in the length of the linked list.

Question 2 Write an algorithm that inserts a node with data value = 10 in a double ordered linked list L , containing the data values 1, 3, 6, 9, 11, 15, 21, 32, 45 in linear time in the length of the linked list.

Question 3 9.[15] Using ONLY the definition of $O(f(n))$ prove that the following statements are TRUE:

(a) $(7000n^3 + 3n + 2)/n = O(n^3)$

(b) $O(n^5 + n^4 \log n) = O(n^5)$

Question 4 Using ONLY the definition of $O(f(n))$ prove that the following statements are FALSE:

(a) $n2^n + 3n + 2 = O(2^n)$

(b) $n^{1.5} = O(n)$

Question 4 Write an implementation of the operations *Push* and *Pop* for a Stack data structure using a singly linked list.

- Question 5 Write an implementation of the operations *Enqueue* and *Dequeue* for a Queue data structure using a singly linked list.
- Question 6 Compute the running time function $T(n)$ for the below algorithm. Your solution should compute the frequencies as discussed in class to compute $T(n)$. Also, provide the big-Oh estimation for $T(n)$, and explain your answer.

```
int sum = 0;
for (int k = n; k > 0; k /= 2)
    for (int i = 0; i < k; i++)
        sum++;
```