COMP 203 Data Structures and Algorithms, Fall 2022
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Midterm Exam

Submit your codes and answers to Canvas.

1. Implement an iterative method called reverse that reverses a singly linked list L using only a constant amount of additional space. Test your method by writing a main method. Print the content of an example list that contains three Integers before and after calling reverse. Hint: You can reverse a singly linked list by reversing the direction of next pointer links using pointers. For this purpose, you can use pointers called prev, curr, and next that traverse the linked list starting from the beginning. In each iteration, you can update the next pointer of curr to be prev and then update the three pointers for the next iteration. Be sure to handle boundary cases such as a link with zero, one and two nodes only.

2. We have the following method for computing the sum of prefix sums of a given array.

```
/** Returns the sum of the prefix sums of given array. */

1 public static int method(int[] arr){
2     int n = arr.length;
3     int total = 0;
3     for (int j=0; j < n; j++)
4           for (int k=0; k <= j; k++)
5                 total += arr[j];
6     return total;
7 }
```

(a) What is the running time complexity of this method in Θ-notation? Show your work by calculating the number of primitive operations that come from each line. You can use different constants for each line (e.g. line 2 has running time of c_1, line 2 has c_2, etc).

(b) Re-write the method such that it has less complexity (e.g. linear running time). What is the running time complexity of your method in Θ-notation?

3. Implement a recursive method called maximum for finding the maximum element in an array A, of n elements. What is your running time and space usage in Θ-notation? Implement a main method that tests your method.