150015-Semester II - 5781

Data Structures I

**Homework Assignment #3**

**Question 1**

Given: A single linked list L containing natural numbers. Write an algorithim in pseudo-code to sort the list using bubble sort the list L.

Is the complexity different than bubble sort on an array. Explain.

**Question 2**

Given: Two single linked lists each L1 and L2.  L1 list contains *n* elements and L2 contains *m* elements and the key in each element is a natural number.

The list L1 contains the elements a1,a2,…,an

And the list L2 contains the elements b1,b2,…,bn

We want to build a new list L3 with *n\*m* elements c1,c2,…,cn\*m where the content(info, key) of each element is:

1. Write a function that builds the list L3 as described above.
2. What is the complexity of the function that you wrote?

**Question 3**

The school secretariat has **frenzied**, **urgent** and **regular** tasks. Frenzied tasks are carried out first, followed by urgent tasks and then ordinary tasks.

The secretariat has a computerized system, Manager.

**The assignment of tasks to the Manager** is done according to the following rules:

- A new frenzied task will be inserted before all the frenzied, urgent, and regular tasks currently in Manager

- A new urgent task will be inserted after all the frenzied tasks and before the urgent and regular tasks that are currently in Manager

- A new regular task will be inserted after all the frenzied, urgent, and regular tasks that are currently in Manager.

**Task Executing from Manager** is done in the order created in Manager.

The class Task has two properties:

content - a string that is a task description,

code - which is an integer representing the type of task:

1 represents a frenzied task;

2 represents an urgent task;

3 represents a regular task.

a. Suggest a data structure that is appropriate for the implementation of Manager so that the complexity of the input operation to Manager and the removal of an operation from Manager is O (1). (The structure can consist of a combination of a linked list (s) and arrays and auxiliary variables as needed).

b. Write a function in pseudo-code that accepts a task and inserts it into the Manager according to the rules described at the beginning of the question.

c. Write an algorithm in pseudo-code for an action that removes the next task to execute and returns it. If there is no Task in Manager, the action returns null.

**Question 4**

Given: A sparse matrix containing n\*m real numbers implemented by linked lists and arrays for the heads of the lists.

1. Write a function that accepts row number i and column number j and returns the value in the given place.
2. Write a function that returns the ration of the number of zeroes to the number of values that are not zero. For example if there are 10 zeroes and 4 which are not than the function will return 0.4