Sabancı University

Faculty of Engineering and Natural Sciences

CS204 Advanced Programming

Fall 2023-2024

Homework #4

Due: 24/11/2023 - 23:55

PLEASE NOTE:

Your program should be a robust one such that you have to consider all relevant programmer mistakes and extreme cases; you are expected to take actions accordingly!

You HAVE TO write down the code on your own.
You CANNOT HELP any friend while coding.
Plagiarism will not be tolerated!!

1 Introduction

This homework aims to use linked lists to implement an ordered set class and overload operators to implement set operations. You will use a singly lisked list for data structure.

2 Sets and It's Operations

In mathematics, a set is a well-defined collection of distinct elements. These elements can be numbers, objects, or any other entities. The concept of a set is fundamental in various branches of mathematics, including set theory, algebra, and calculus.

Set Notation:
Sets are often denoted by curly braces ' {} '. For example:
- $A = \{1, 2, 3\}$
- $B = \{a, b, c\}$
- $C = \{x \mid x \text{ is a prime number } \}$

Common Set Operations:
- **Union** - The union of sets A and B, denoted as $A \cup B$, is the set of all elements that are in A, or in B, or in both.

$$A \cup B = \{x \mid x \in A \text{ or } x \in B\}$$

- **Intersection**: - The intersection of sets A and B, denoted as $A \cap B$, is the set of all elements that are both in A and in B.

$$A \cap B = \{x \mid x \in A \text{ and } x \in B\}$$

- **Difference**: - The difference of sets A and B, denoted as $A - B$, is the set of all elements that are in A but not in B.

$$A - B = \{x \mid x \in A \text{ and } x \notin B\}$$

3 LinkedListSet Class and it's Functions

You will implement a `LinkedListSet` class that creates and manages a singly linked list for your ordered set. You will overload operators $+, -, +=, -=, \&=$ to perform set operations with your class.

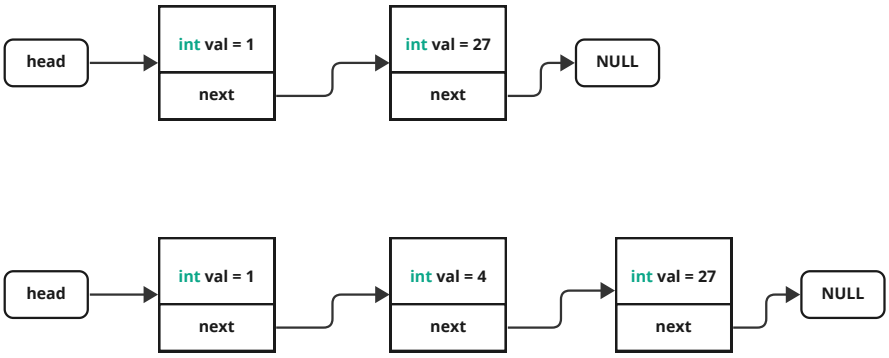


Figure 1: Example linked list structure with class and view of the linked list after an example insertion

Your `LinkedListSet` need to overload operators to match them with set operations as following:

Insertion: $+$ To add elements to your set, you need to overload $+$ operator. Keep in mind that your set should be sorted at all times.

Deletion: - To remove elements from your set, you need to overload $-$ operator.

Set Union: $+=$ To get the union of two sets, you need to overload $+=$ operator.

Set Difference: -= To get the union of two sets, you need to overload $-=$ operator.

Set Intersection: &= To get the intersection of two sets, you need to overload $\&=$ operator.

Additionally, you need to implement a `display()` function that prints your set in the given format.

4 Provided Files

A driver code for your class is provided in `orderedset.cpp` file. You should implement your class and all of it's functionalities in this file. You should not use any other header file. You need to write code that will work exactly as expected with the driver code. Expected output is provided in `expected.txt`.

5 Some Remarks

- You need to consider multiple right-hand side values for $+=, -=, \&=$ operators. For example;
  - a += b += c →**Is not valid in C++**
  - a += b + c + d →**Test case**
- You **can't** use `std::set`. You have to implement a linked list.
- You can implement any helper function for your class.
- Your output should be the **exact** same of the output of the provided driver code. We might alter your driver code and test your implementation with **huge** test cases.
- Submission guideline is changed. Please read again.

6 Some Important Rules

In order to get a full credit, your programs must be efficient and well presented, presence of any redundant computation or bad indentation, or missing, irrelevant comments are going to decrease your grades. You also have to use understandable identifier names, informative introduction and prompts. Modularity is also important; you have to use functions wherever needed and appropriate.

What and where to submit (PLEASE READ, IMPORTANT): We will use the standard C++ compiler and libraries while testing your homework. It'd be a good idea to write your name and last name in the program (as a comment line of course).

Submissions guidelines are below. Some parts of the grading process are automatic. Students are expected to strictly follow these guidelines in order to have a smooth grading process. If you do not follow these guidelines, depending on the severity of the problem created during the grading process, 5 or more penalty points are to be deducted from the grade.

Name your cpp file that contains your program as follows:

sucourseusername.cpp

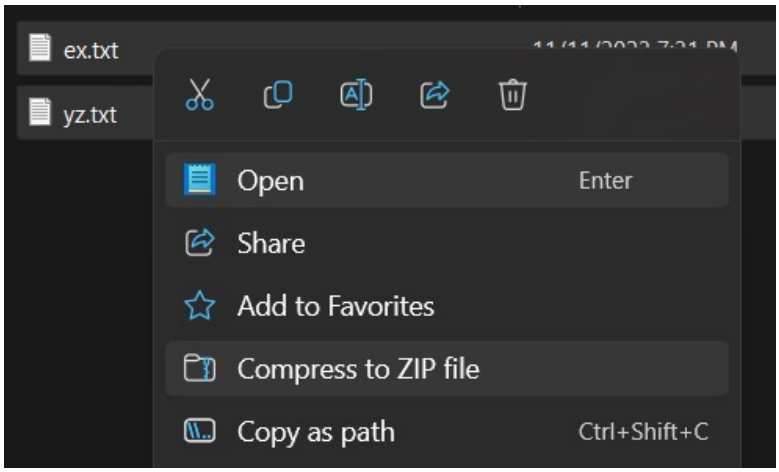
Your SUCourse user name is actually your SUNet username that is used for checking sabanciuniv e-mails. Do NOT use any spaces, non-ASCII and Turkish characters in the file name. For example, if your name is Alexander Zeus and your username is azeus; Then your cpp file should be named as;

azeus.cpp

Then compress your **files** (you should submit a single cpp for this homework) in a **.zip** file named same with your cpp file and submit this zip file to sucourse. If your name is Alexander Zeus and your username is azeus, then your zip file should be named

azeus.zip

Please **don't compress folders** into zip file. When your zip file is opened, it should not expand into folders within folders. Make sure you compressed your files as follows:



Submit via SUCourse ONLY! You will receive no credits if you submit by other means (e-mail, paper, etc.).

Good Luck!

CS204 Team (Fatih Taşyaran, Kamer Kaya)