Issue Date: 4 October 2021 Due date: 12 October 2021

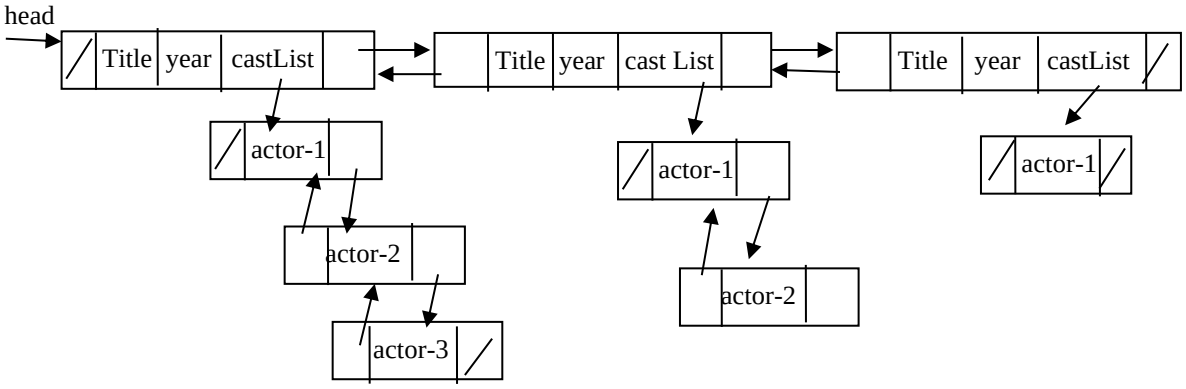
Instructions:

- Plagiarism is defined as "taking and using the thoughts, writings, and inventions of another person as one's own". IBA has a no-compromise policy on Plagiarism – in case, plagiarism is proved student will be given an **F grade**.
- Your assignment should represent your effort. However, you are not expected to work alone. It is fine to discuss the exercises and try to find solutions together, but each student shall write down and submit his/her solutions separately. It is a good academic standard to acknowledge collaborators, so if you worked together with other students, please list their names.
- Electronic Submission on LMS is compulsory.
- The assignment will be graded based on **timely submission on LMS**.

Deliverables:

Submit the JAVA project as a zip folder.

1. Design a data structure to implement movie store using nested doubly linked list.
   a. Consider the diagram below where each node will store movie-title and movie-year and nested list of Movie-cast. Suppose you have to enter N movies thus have to create N nodes in a doubly-linked list.



Implement the following methods and find the Big-Oh of each of the methods

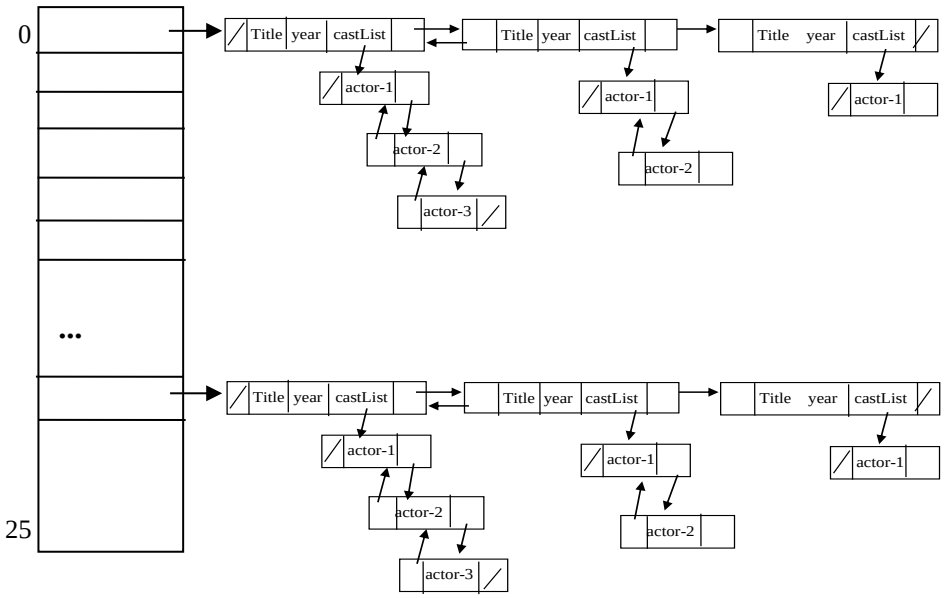
- Insert(String title, String Year)
- Delete(String title)
- Find(String title)
- toString()

b. To improve the performance of the methods implemented in part a., let's make some changes in the data structure design. Rather than maintain a single large linked list, split the linked list into several small-size sub-list in such a way so that you only need to search in a specific sub-list that requires less time.

To do this create an array of a doubly-linked list as shown in the diagram below where each sub-list will insert movies according to the first letter of the title and maintain all sub-list in this manner in an array. For example,

- arr[0] contain the reference of a nested doubly linked list that will store those movies in which the title starts with the letter A.
- arr[1] contain the reference of a nested doubly linked list that will store those movies in which the title starts with the letter B.

- and so on ….
- arr[25] contains the reference of a nested doubly linked list that will store those movies in which the title starts with the letter Z.



Since not all movies start with the same letter, therefore, it is possible to divide the large size of a linked list into 26 sub-lists and exploit the use of direct access mechanism of an array.

To access any of the sub-list in constant time, create a mapping scheme as follows, the ASCII code of capital letters are A = 65, b = 66, …., Z = 90

As array starts from 0^{th} index so to map A-Z to array indexes from 0-N, pick the first letter of the movie title and subtract 65 from its ASCII value, thus

A=65 and 65 – 65 = 0
B=66 and 66 – 65 = 1
C=67 and 67 – 65 = 2
…
Z=90 and 90 – 65 = 25

The code in java to align with array indexes shown below

```
ch=title.charAt(0);
index=ch – 65
arr[index].find(title); // find title in sub list only and avoid the comparison of list
```

Finally in the end implement the following methods for the modified data structure design and estimate the big-oh of each of the following methods.

- Insert(String title, String Year)
- Delete(String title)
- Find(String title)
- toString()