Data Structures and Algorithms
Assignment 3

Fall 2024

SECTION C

DUE: Sunday Nov 24, 2024

NOTE: Late submissions will not be accepted.

TO SUBMIT: Documented and well-written code in `C++`.

In this assignment, you will have to simulate some functionality of a database system to efficiently process the records of a library, mainly books in the library. The book record contains the following information:

1. **ISSN**
2. **Title**
3. **List of Author name(s)**
4. **# of copies available as reference book**
5. **# of copies available as issuable book**

Here **ISSN** is unique. It is assumed that a number of users want to access a library database. In order to efficiently perform the operations on books, an index is created. The index is an AVL tree where each node of the tree will contain the **ISSN** and the location of the book record in the main memory. The complete record of all the books is stored in a doubly linked-list sorted according to the **ISSN**. The following functions can be performed on the database:

1. **Create a book record (C):** A new book record is added to the tree as well as in the linked list in sorted order.
2. **Review a book record (R):** Given an **ISSN**, display the complete book record.
3. **Update a book record (U):** Given **ISSN**, any field in the book record can be updated except the **ISSN**.

4. **Delete a book record (D):** Given an **ISSN**, delete the book record from the tree and from the list.

Make sure that all your operations are performed in $O(\log n)$ time.

Below is an illustrative example of the books database. All the records of the books are stored in a sorted doubly linked list. An index is created on the **ISSN** in the form of an AVL tree that keeps the **ISSN** as well as the address of the node of the doubly linked list that keeps the entire record. The dotted links are pointers to the nodes of the doubly linked list. The oval in the bottom right is the magnified view of a node in the doubly linked list.

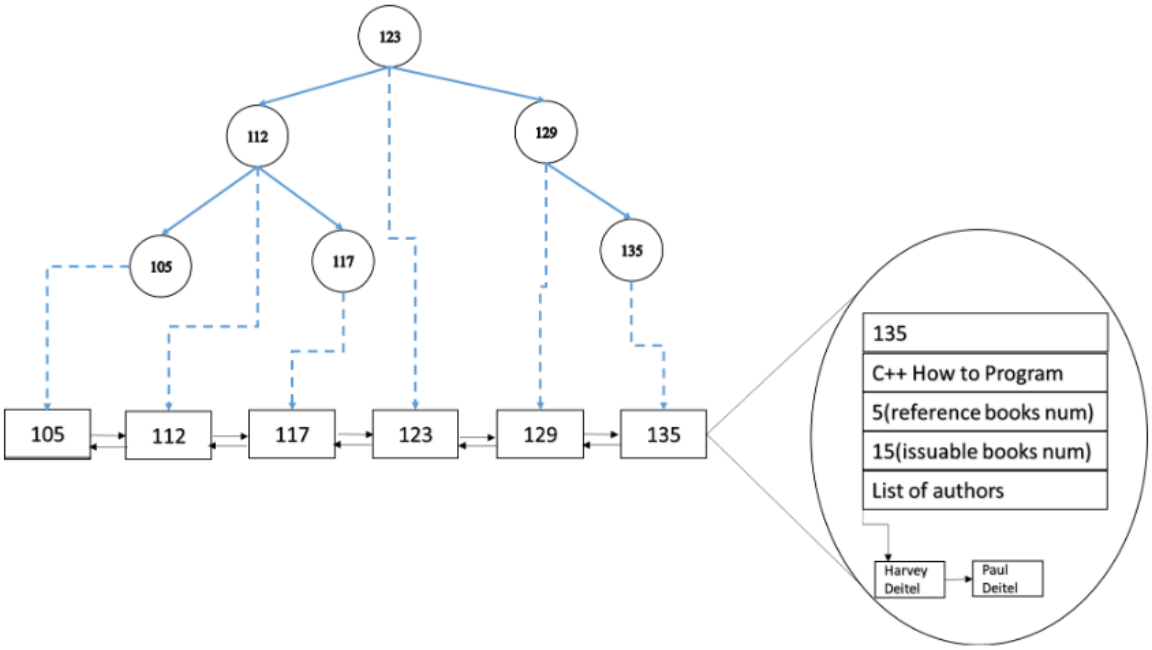

Figure 1: Illustrative Example of Book Database