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كليات عنيزة الأهلية
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library management system using single linked list

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Introduction

Data structures play an essential role in computer science as they provide efficient ways to organize, store, and manage data. They enable programs to handle information in a structured format that allows easier processing and retrieval. One of the commonly used data structures is the Linked List, which stores data in sequential nodes that are connected together dynamically. Unlike arrays, linked lists allow insertion and deletion without shifting elements, which makes them more flexible in applications where data changes frequently.

In this project, a simple Library Management System is implemented using the principles of data structures. Each book in the system contains information such as the title, author, and publication year, which are stored inside a structured object. The program allows users to add new books, delete existing ones, search for a specific book, update book details, and display all stored books. These operations demonstrate how data can be handled using list-based structures and show the practical importance of data organization.

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```
# This class represents a Book object that stores title, author, and publication year
class Book:
    # Constructor that initializes the book information
    def __init__(self, title, author, year):
        self.title = title      # Stores the book title
        self.author = author    # Stores the book author
        self.year = year        # Stores the publish year

    # This method displays the book details when called
    def display(self):
        print(f"Title: {self.title}")
        print(f"Author: {self.author}")
        print(f"Year: {self.year}")
        print("-------------------------")


# This class represents the Library which works as a list of Book objects
class Library:
    # Constructor that initializes an empty library list
    def __init__(self):
        self.books = []     # Acts as a simple linked list to store books

    # This method adds a new book to the library list
    def add_book(self):
        title = input("Enter book title: ")
        author = input("Enter book author: ")
        year = input("Enter publish year: ")

        # Create a new Book object and append it to the list
        new_book = Book(title, author, year)
        self.books.append(new_book)
        print("Book added successfully!\n")

    # This method prints all books in the library
    def show_books(self):
        # Checks if the library is empty
        if not self.books:
            print("No books in the library yet.\n")
            return

        print("\n--- Library Books ---")
        # Iterates through the list and displays each book
        for book in self.books:
            book.display()

    # This method searches for a book by title
    def search_book(self):
```

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```
    # This method searches for a book by title
    def search_book(self):
        title = input("Enter title to search: ")
        found = False

        # Loops through books and compares titles (case insensitive)
        for book in self.books:
            if book.title.lower() == title.lower():
                print("\nBook Found:")
                book.display()
                found = True

        # If book not found
        if not found:
            print("Book not found.\n")

    # This method deletes a book based on its title
    def delete_book(self):
        title = input("Enter title of the book to delete: ")
        # Loops to find the matching book
        for book in self.books:
            if book.title.lower() == title.lower():
                self.books.remove(book)      # Removes the book from the list
                print("Book deleted successfully!\n")
                return
        print("Book not found.\n")

    # This method updates the information of an existing book
    def update_book(self):
        title = input("Enter the book title to update: ")
        # Searches for the book to update
        for book in self.books:
            if book.title.lower() == title.lower():
                print("Leave field empty if you don't want to change it.")

                new_title = input("New title: ")
                new_author = input("New author: ")
                new_year = input("New year: ")

                # Updates only if a new value was entered
                if new_title:
                    book.title = new_title
                if new_author:
                    book.author = new_author
                if new_year:
                    book.year = new_year
```

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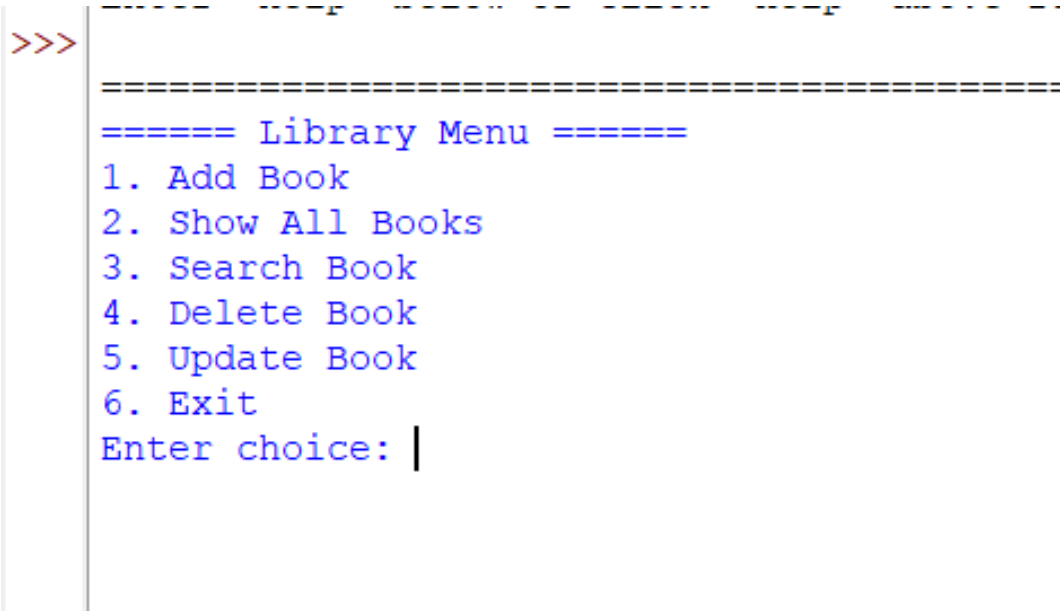
```
                    book.title = new_title
                if new_author:
                    book.author = new_author
                if new_year:
                    book.year = new_year

                print("Book updated successfully!\n")
                return

        print("Book not found.\n")


# ---------------- MAIN MENU ----------------
# Creates a Library object to access its methods
library = Library()

# Infinite loop that keeps the program running until user exits
while True:
    print("====== Library Menu ======")
    print("1. Add Book")
    print("2. Show All Books")
    print("3. Search Book")
    print("4. Delete Book")
    print("5. Update Book")
    print("6. Exit")

    # User enters a choice for operation
    choice = input("Enter choice: ")

    # Calls the corresponding function based on user input
    if choice == "1":
        library.add_book()
    elif choice == "2":
        library.show_books()
    elif choice == "3":
        library.search_book()
    elif choice == "4":
        library.delete_book()
    elif choice == "5":
        library.update_book()
    elif choice == "6":
        print("Exiting program…")
        break
    else:
        # Handles invalid menu selections
        print("Invalid choice. Try again.\n")
```



This section displays the main interface of the 'Library Management System' (Library Menu), which provides the user with 6 core options for managing the book collection (Add, Show, Search, Delete, Update, Exit)

*In Python, lists do not use size(); instead, the built-in function len() is used to get the number of elements.

```
================================================
====== Library Menu ======
1. Add Book
2. Show All Books
3. Search Book
4. Delete Book
5. Update Book
6. Exit
Enter choice: 1
Enter book title: To Kill a Mockingbird
Enter book author: Harper Lee
Enter publish year: 1960
Book added successfully!

====== Library Menu ======
1. Add Book
2. Show All Books
3. Search Book
4. Delete Book
5. Update Book
6. Exit
Enter choice: 1
Enter book title: 1984
Enter book author: George Orwell
Enter publish year: 1949
Book added successfully!
```

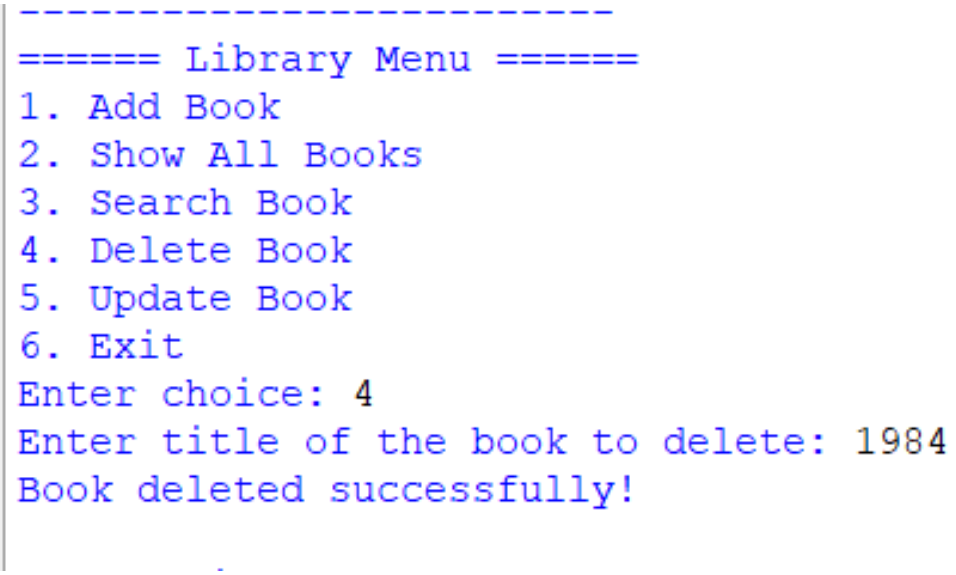
The user selected Option 1 (Add Book) to register a new book. The book details (Title, Author, Year) were entered, and the addition process was completed successfully

```
====== Library Menu ======
1. Add Book
2. Show All Books
3. Search Book
4. Delete Book
5. Update Book
6. Exit
Enter choice: 2

--- Library Books ---
Title: To Kill a Mockingbird
Author: Harper Lee
Year: 1960
------------------------
Title: 1984
Author: George Orwell
Year: 1949
```

user selected option number 2 (Show All Books), and the system displayed all the books that the user had previously added to the library

```
-------------------------
====== Library Menu ======
1. Add Book
2. Show All Books
3. Search Book
4. Delete Book
5. Update Book
6. Exit
Enter choice: 3
Enter title to search: To Kill a Mockingbird

Book Found:
Title: To Kill a Mockingbird
Author: Harper Lee
Year: 1960
-------------------------
```

user selected option 3 (Search Book), then entered the book title “To Kill a Mockingbird”
The book was successfully found, and all its details (Title, Author, and Year) were displayed



The user selected option 4 (Delete Book) to remove a book. The user entered the title of the book to be deleted, which was '1984', and the deletion process was successful the book was removed from the library list

```
====== Library Menu ======
1. Add Book
2. Show All Books
3. Search Book
4. Delete Book
5. Update Book
6. Exit
Enter choice: 5
Enter the book title to update: To Kill a Mockingbird
Leave field empty if you don't want to change it.
New title: Frankenstein
New author: Mary Shelley
New year: 2003
Book updated successfully!
```

The user selects option 5 (Update Book) to modify the details of an existing book. First, the title of the book to be updated is entered, then the user is prompted to enter new values (for the Title, Author, or Year of Publication), and the book is successfully updated

```
====== Library Menu ======
1. Add Book
2. Show All Books
3. Search Book
4. Delete Book
5. Update Book
6. Exit
Enter choice: 6
Exiting program...
```

The user selects option 6 (Exit) to terminate the program. A message is displayed confirming the exit from the system, and the program stops running