

NED UNIVERSITY OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES AND ALGORITHMS (CS-218)

OPEN ENDED LAB

Library Management System

Name	Musfirah
Roll no.	CS-20080
Dept.	Computer Information System Engineering
Course code	CS-218
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PROBLEM DESCRIPTION:

Implement a library management system having the following functionalities:

- ☐ Add/Remove/Edit book: To add, remove or modify a book or book item.
- ☐ Search catalogue: To search books by title, author, subject or publication date.
- ☐ Register new account/cancel membership: To add a new member or cancel the membership of an existing member.
- ☐ Check-out book: To borrow a book from the library.
- ☐ Reserve book: To reserve a book which is not currently available.
- ☐ Renew a book: To reborrow an already checked-out book.
- ☐ Return a book: To return a book to the library which was issued to a member

a. Implement and use any sorting algorithm to sort the books on the basis of any attribute (e.g. book ID, no. of books, author, title etc.).

b. Prepare the complete software (in Python)

- i. Insert at least 15 records in the system
- ii. Implement the feature to display the whole collection of books

FEATURES OF LIBRARY:

The code is designed to implement many features which are necessary to manage a library system. These features include:

- Librarian login system
- Open membership account (for user)
- User login system
- Easy to understand options

Users have access to the following options:

- View books in the library
- Search a particular book in the collection of books
- Lend a book
- Reserve a book
- Return a book

- Renew a book
- Cancel their membership
- Make new account

However, there is only one librarian named “Musfirah” The librarian has access to all the above options as well as that she can add or remove any book from the record of books.

FEATURES OF PROGRAMMING:

The program uses many features of object-oriented programming, data structures and efficient algorithms. Some features of object-oriented programming and data structures are listed below:

- Inheritance
- Association
- Sorting Algorithm (Bubble Sort)
- Use of list etc.

PROJECT DETAILS:

The code contains different classes which include different methods which are called to perform different tasks.

List of classes:

- Users
- Librarian (child class of Users)
- Features (child class of Users)
- Date
- BookReservation (child class of Date)
- BookItem
- BookLending (child class of Users and Date)

Methods implemented in different classes include:

1. Users:

This class contains the following methods:

- Check_details_librarian (name,pw): Verifies librarian by checking her name, email and password
- Verify_useraccount (name): Verifies a user by checking name, email and password
- Create_useraccount (name,email,pw): Create an account for a new user and store the data in files
- Cancel_membership (record): removes information of a user from the file “users_data.txt”.

2. Librarian:

This class contains the following methods:

- Add_book (ID,t,a,p,q,l): adds details of a book in the file “books.txt”
- Remove_book (br): removes details of a book from the file “books.txt”

3. Features:

This class contains the following methods:

- Display_book (): Displays the whole collection of books in table format.
- Search_book (br): Finds a particular record based on title, author or publication date.
- Return_book (): Tells the user that the book has been returned.
- Renew_book (): Tells the user that the book has been renewed.
- Sort_books (): It sorts the books alphabetically (based on the first letter of title of the book using *bubble sort algorithm*).

4. Date:

This contains the following methods:

- Issue_date(): prints when was the book issued.
- Due_date(): calculates due date of a borrowed book.
- Check_fine(): maintains a check for the due date so that fine can be issued.

5. Book Reservation:

This class contains the following methods:

- Fetch_reservation_details():checks the book in the record and prints a message regarding reservation of the book.

6. BookItem:

It only stores a dictionary containing titles and book_id of the books.

7. BookLending:

This contains the method

- Lend_book():prints the due date after a book has been borrowed.

LIMITATIONS:

- Everything entered as input should be carefully written as it is case sensitive. Difference in caps of the input may result in generation of errors.

Outputs are attached on the next page.

OUTPUTS

1.As the program runs, it displays a menu to login, after access has been given, further selection menu is displayed.

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\HP\Desktop\Python> & C:/Python/Python38/python.exe c:/Users/HP/Desktop/Python/library.py

*****
WELCOME IN THE LIBRARY INFINITE
(1)Log in as a librarian
(2)Log in as a member
(3)Create account
(4)Cancel membership:1
Enter your name: Musfirah
Enter email: musfirah@gmail.com
Enter password: qwerty123
You have access to library management system!

*-*-*-*-*-*-*-* SELECT THE OPTIONS BELOW *-*-*-*-*-*-*-*
1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book
press any other number to exit
Enter your choice: 2
```

2. On selecting the option “Display books”, this is displayed.

Enter your choice: 2

BOOK_ID	TITLE	AUTHOR	PUBLICATION_DATE	QUANTITY	LENDING_PRICE
1	A Thousand Splendid Sun	Khaled Hosseini	22/05/2007	200	800
2	One Hundred Years of Solitude	Gabriel Garcia Marquez	21/03/1967	50	300
3	Where the Crawdads Sing	Delia Owens	14/08/2018	23	900
4	Celestial Bodies	Jokha Alharthi	09/08/2010	14	900
5	Charlotte's Web	E B White	16/10/1952	22	900
6	The Heart of the Matter	Graham Greene	04/09/1948	12	670
7	Silent Patient	Alex Michaelides	05/02/2019	10	200
8	Harry Potter	J. K. Rowling	14/06/1997	10	230
9	Ulysses	James Joyce	09/12/1922	12	600
10	Hamlet	William Shakespeare	10/06/1603	32	1200
11	Right Under Our Nose	R. Giridharan	05/11/2020	30	500
12	When Breath Becomes Air	Paul Kalanithi	12/01/2016	50	1000
13	The Phantom Tollbooth	Norton Juster	02/02/1961	17	430
14	Fear of Flying	Erica Jong	04/04/1973	40	450
15	The Adventures of Tom Sawyer	Mark Twain	10/06/1876	20	1200
16	In the Heart of the Sea	Nathaniel Philbrick	08/05/2000	20	600

17	Mind-Master	Viswanathan Anand	08/12/2019	15	650
18	Alchemist	Paul Coelho	02/01/1998	50	150
19	Cheque book	Vasdev Mohi	09/11/2012	50	1090
20	Lolita	Vladimir Nabokov	08/12/1955	40	1000
21	The Overstory	Richard Powers	02/01/2018	32	900
22	In Search of Lost Time	Marcel Proust	05/03/1913	25	800
23	War and Peace	Leo Tolstoy	18/09/1867	2	400
24	Vahana Masterclass	Alfredo Covelli	03/03/2020	18	700
25	Letting Go	Philip Roth	31/09/2012	15	900
26	Educated	Tara Westover	07/09/2018	12	450
27	Encyclopedia Brown Boy Detective	Donald J.Sobol	06/09/1963	12	890
28	Little Women	Louisa May Alcott	01/08/1868	8	2200
29	The Great Gatsby	F Scott Fitzgerald	09/07/1925	2	900
30	The Handmaid's Tale	Margaret Atwood	09/06/1985	1	300
31	Frozen	John George	12/12/1912	32	450

*** SELECT THE OPTIONS BELOW ***

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book

3. On selecting “Add a book”, details of the book are requested. `Display_books` can show that the book has been added.

[illegible]

17	Mind-Master	Viswanathan Anand	08/12/2019	15	650
18	Alchemist	Paul Coelho	02/01/1998	50	150
19	Cheque book	Vasdev Mohi	09/11/2012	50	1090
20	Lolita	Vladimir Nabokov	08/12/1955	40	1000
21	The Overstory	Richard Powers	02/01/2018	32	900
22	In Search of Lost Time	Marcel Proust	05/03/1913	25	800
23	War and Peace	Leo Tolstoy	18/09/1867	2	400
24	Vahana Masterclass	Alfredo Covelli	03/03/2020	18	700
25	Letting Go	Philip Roth	31/09/2012	15	900
26	Educated	Tara Westover	07/09/2018	12	450
27	Encyclopedia Brown Boy Detective	Donald J.Sobol	06/09/1963	12	890
28	Little Women	Louisa May Alcott	01/08/1868	8	2200
29	The Great Gatsby	F Scott Fitzgerald	09/07/1925	2	900
30	The Handmaid's Tale	Mangaret Atwood	09/06/1985	1	300
31	Frozen	John George	12/12/1912	32	450
32	Wealth	Franklin	12/09/1675	45	320

```
*_*_**_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_*_*_*_*_*_*_*_*_*_*_*_*
```

1. Add a book
2. Display books

3. On selecting “Remove a book”, details of the book are requested. `Display_books` can show that the book has been removed.

*_*_*_*_*_*_*_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_*_*_*_*_*_*_*_*_*_*_*_*_*_*

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book

```
press any other number to exit
```

Enter your choice: 6

Enter book title inorder to remove it: Wealth

Book removed successfully

*_*_*_*_*_*_*_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_*_*_*_*_*_*_*_*_*_*_*_*_*_*

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book

```
press any other number to exit
```

Enter your choice: ☐

20	Lolita	Vladimir Nabokov	08/12/1955	40	1000
21	The Overstory	Richard Powers	02/01/2018	32	900
22	In Search of Lost Time	Marcel Proust	05/03/1913	25	800
23	War and Peace	Leo Tolstoy	18/09/1867	2	400
24	Vahana Masterclass	Alfredo Covelli	03/03/2020	18	700
25	Letting Go	Philip Roth	31/09/2012	15	900
26	Educated	Tara Westover	07/09/2018	12	450
27	Encyclopedia Brown Boy Detective	Donald J.Sobol	06/09/1963	12	890
28	Little Women	Louisa May Alcott	01/08/1868	8	2200
29	The Great Gatsby	F Scott Fitzgerald	09/07/1925	2	900
30	The Handmaid's Tale	Margaret Atwood	09/06/1985	1	300
31	Frozen	John George	12/12/1912	32	450

```
*_*_*_*_*_*_*_*_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_*_*_*_*_*_*_*_*_*_*_*_*_*_*_*
```

- ```

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book
press any other number to exit
Enter your choice: 1

```

Enter your choice:

4. On selecting “Lend a book”, this is displayed on the screen.

```
*_*_*_*_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_*_*_*_*_*_*_*_*_*_*_*_*
```

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book

press any other number to exit  
Enter your choice: 3  
Enter the name of book you want to lend:The Great Gatsby  
the bookThe Great Gatsby is issued  
the issued date is 2022-02-06 23:32:47.703063  
the due date is 16

5. On selecting “Reserve a book”, this is displayed on the screen.

```
*_*_*_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_*_*_*_*_*_*_*_*_*_*
```

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book

press any other number to exit

Enter your choice: 4

enter the name of book you want to reserveWhen Breath Becomes Air

your book is reserved now, you can lend it whenever you want

6. On selecting “Return a book”, this is displayed on the screen.

```
*_*_*_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_*_*_*_*_*_*_*_*_*_*_*
```

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book

press any other number to exit  
Enter your choice: 5  
Enter book you want to return:The Great Gatsby  
['29', 'The Great Gatsby', 'F Scott Fitzgerald', '09/07/1925', 3, '900\n']  
Thank you for returning the book!

7. On selecting "Search book", output is displayed according to the parameter on which book is searched.

```
*_*_*_*_*_*_*_*_*_* SELECT THE OPTIONS BELOW *_**_**_**_**_**_*
```

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book

press any other number to exit  
Enter your choice: 7  
Search by (1)Title (2)Author or (3)Publication date:1  
Enter title of the book: Silent

| BOOK_ID | TITLE          | AUTHOR           | PUBLICATION_DATE | QUANTITY | LENDING_PRICE |
|---------|----------------|------------------|------------------|----------|---------------|
| 7       | Silent Patient | Alex Michaelides | 05/02/2019       | 10       | 200           |

1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book

press any other number to exit

Enter author of the book: Tara

| BOOK_ID | TITLE    | AUTHOR        | PUBLICATION_DATE | QUANTITY | LENDING_PRICE |
|---------|----------|---------------|------------------|----------|---------------|
| 26      | Educated | Tara Westover | 07/09/2018       | 12       | 450           |

Enter publication date of the book: 09

| BOOK_ID | TITLE                            | AUTHOR             | PUBLICATION_DATE | QUANTITY | LENDING_PRICE |
|---------|----------------------------------|--------------------|------------------|----------|---------------|
| 4       | Celestial Bodies                 | Jokha Alharthi     | 09/08/2010       | 14       | 900           |
| 6       | The Heart of the Matter          | Graham Greene      | 04/09/1948       | 12       | 670           |
| 9       | Ulysses                          | James Joyce        | 09/12/1922       | 12       | 600           |
| 19      | Cheque book                      | Vasdev Mohi        | 09/11/2012       | 50       | 1090          |
| 23      | War and Peace                    | Leo Tolstoy        | 18/09/1867       | 2        | 400           |
| 25      | Letting Go                       | Philip Roth        | 31/09/2012       | 15       | 900           |
| 26      | Educated                         | Tara Westover      | 07/09/2018       | 12       | 450           |
| 27      | Encyclopedia Brown Boy Detective | Donald J.Sobol     | 06/09/1963       | 12       | 890           |
| 29      | The Great Gatsby                 | F Scott Fitzgerald | 09/07/1925       | 2        | 900           |
| 30      | The Handmaid's Tale              | Margaret Atwood    | 09/06/1985       | 1        | 300           |

8. On selecting “Renew a book”, this is displayed on the screen.

```
***** SELECT THE OPTIONS BELOW *****
1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book
press any other number to exit
Enter your choice: 9
Enter book you want to renew: Alchemist
Book renewed! You have 10 more days to return the book
```

9. On selecting “Sort books”, the books are sorted according to alphabetical order using *bubble sort*.

```
1. Add a book
2. Display books
3. Lend a book
4. Reserve a book
5. Return a book
6. Remove book
7. Search a book
8. Sort books alphabetically
9. Renew a book
press any other number to exit
Enter your choice: 8
Book Name: A Thousand Splendid Sun
Book ID: 1
~~~~~
Book Name: Alchemist
Book ID: 18
~~~~~
Book Name: Celestial Bodies
Book ID: 4
~~~~~
Book Name: Charlotte's Web
Book ID: 5
~~~~~
Book Name: Cheque book
Book ID: 19
~~~~~
Book Name: Educated
Book ID: 26
~~~~~
Book Name: Encyclopedia Brown Boy Detective
Book ID: 27
~~~~~
Book Name: Fear of Flying
Book ID: 14
~~~~~
Book Name: Frozen
Book ID: 31
```



10. Everytime the program runs, the user is asked to login in, create account or cancel membership. If the user selects “Create account”, account is created and record is stored in a file named **“users\_data.txt”**.

```

WELCOME IN THE LIBRARY INFINITE
(1)Log in as a librarian
(2)Log in as a member
(3)Create account
(4)Cancel membership:3
Enter your name: Haris
Enter email: haris123@gmail.com
Enter password: haris890
Haris,haris123@gmail.com,haris890

Your membership has been approved!
PS C:\Users\HP\Desktop\Python>
```

```
users_data.txt
1 Musfirah,musfirah@gmail.com,qwerty123
2 Warisha,warisha@hotmail.com,uiop12345
3 Areesha,areesha@gmail.com,areesha12345
4 Alina,Alina@hotmail.com,alina7890
5 Naheed,naheed123@gmail.com,naheed123
6 Ali,ali@gmail.com,ali890
7 Haris,haris123@gmail.com,haris890
```

11. On selecting “Cancel membership”, the particular record is erased from the file.

```
users_data.txt
1 Musfirah,musfirah@gmail.com,qwerty123
2 Warisha,warisha@hotmail.com,uiop12345
3 Areesha,areesha@gmail.com,areesha12345
4 Alina,Alina@hotmail.com,alina7890
5 Naheed,naheed123@gmail.com,naheed123
6 Ali,ali@gmail.com,ali890
7
```

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS C:\Users\HP\Desktop\Python> & C:/Python/Python38/python.exe c:/Users/HP/Desktop/Python/library.py

WELCOME IN THE LIBRARY INFINITE
(1)Log in as a librarian
(2)Log in as a member
(3)Create account
(4)Cancel membership:4
Enter your name: Haris
Enter email: haris123@gmail.com
Enter password: haris890
PS C:\Users\HP\Desktop\Python>
```

12. On selecting “Login as a member” ,the credentials of the user are verified and access is granted to the user.

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/powershell6

PS C:\Users\HP\Desktop\Python> & C:/Python/Python38/python.exe c:/Users/HP/Desktop/Python/library.py

WELCOME IN THE LIBRARY INFINITE
(1)Log in as a librarian
(2)Log in as a member
(3>Create account
(4)Cancel membership:2
Enter your name: Ali
Enter email: ali@gmail.com
Enter password: ali890
['Ali', 'ali@gmail.com', 'ali890\n']
Access granted!

--*-*-*-*-*-* SELECT THE OPTIONS BELOW *-*-*-*-*-*-*-*

1. Display books
2. Lend a book
3. Reserve a book
4. Return a book
5. Renew a book
6. Search a book
7. Sort books alphabetically
press any other number to exit
Enter your choice: █
```





## *BOOK LIST*

| BOOK ID | TITLE                            | AUTHOR                 | PUBLICATION DATE | QUANTITY | LENDING PRICE |
|---------|----------------------------------|------------------------|------------------|----------|---------------|
| 1       | A Thousand Splendid              | Sun,Khaled Hosseini    | 22/05/2007       | 200      | 800           |
| 2       | One Hundred Years of Solitude    | Gabriel García Márquez | 21/03/1967       | 50       | 300           |
| 3       | Where the Crawdads               | SingDelia Owens        | 14/08/2018       | 23       | 900           |
| 4       | Celestial Bodies                 | Jokha Alharthi         | 09/08/2010       | 14       | 900           |
| 5       | Charlotte's Web                  | E B White              | 16/10/1952       | 22       | 900           |
| 6       | The Heart of the Matter          | Graham Greene          | 04/09/1948       | 12       | 670           |
| 7       | Silent Patient                   | Alex Michaelides       | 05/02/2019       | 10       | 200           |
| 8       | Harry Potter                     | J. K. Rowling          | 14/06/1997       | 10       | 230           |
| 9       | Ulysses                          | James Joyce            | 09/12/1922       | 12       | 600           |
| 10      | Hamlet                           | William Shakespeare    | 10/06/1603       | 32       | 1200          |
| 11      | Right Under Our Nose             | R. Giridharan          | 05/11/2020       | 30       | 500           |
| 12      | When Breath Becomes Air          | Paul Kalanithi         | 12/01/2016       | 50       | 1000          |
| 13      | The Phantom Tollbooth            | Norton Juster          | 02/02/1961       | 17       | 430           |
| 14      | Fear of Flying                   | Erica Jong             | 04/04/1973       | 40       | 450           |
| 15      | The Adventures of Tom Sawyer     | Mark Twain             | 10/06/1876       | 20       | 1200          |
| 16      | In the Heart of the Sea          | Nathaniel Philbrick    | 08/05/2000       | 20       | 600           |
| 17      | Mind-Master                      | Viswanathan Anand      | 08/12/2019       | 15       | 650           |
| 18      | Alchemist                        | Paul Coelho            | 02/01/1998       | 50       | 150           |
| 19      | Cheque book                      | Vasdev Mohi            | 09/11/2012       | 50       | 1090          |
| 20      | Lolita                           | Vladimir Nabokov       | 08/12/1955       | 40       | 1000          |
| 21      | The Overstory                    | Richard Powers         | 02/01/2018       | 32       | 900           |
| 22      | In Search of Lost Time           | Marcel Proust          | 05/03/1913       | 25       | 800           |
| 23      | War and Peace                    | Leo Tolstoy            | 18/09/1867       | 2        | 400           |
| 24      | Vahana Masterclass               | Alfredo Covelli        | 03/03/2020       | 18       | 700           |
| 25      | Letting Go                       | Philip Roth            | 31/09/2012       | 15       | 900           |
| 26      | Educated                         | Tara Westover          | 07/09/2018       | 12       | 450           |
| 27      | Encyclopedia Brown Boy Detective | Donald J.Sobol         | 06/09/1963       | 12       | 890           |
| 28      | Little Women                     | Louisa May Alcott      | 01/08/1868       | 2        | 200           |
| 29      | The Great Gatsby                 | F Scott Fitzgerald     | 09/07/1925       | 2        | 900           |
| 30      | The Handmaid's Tale              | Margaret Atwood        | 09/06/1985       | 1        | 300           |