Step 1: Understand Search Algorithms

Linear Search:

Linear search is a simple search algorithm that checks each element of a list one by one until it finds the desired element. It has a time complexity of O(n), where n is the number of elements in the list.

Binary Search:

Binary search is a more efficient search algorithm that works on sorted lists. It divides the list into two halves and checks if the desired element is in the first half or the second half. It has a time complexity of O(log n), where n is the number of elements in the list.

Step 2: Setup

Create a Book class with attributes like bookId, title, and author:

public class Book {

private int bookId;

private String title;

private String author;

public Book(int bookId, String title, String author) {

this.bookId = bookId;

this.title = title;

this.author = author;

}

// Getters and setters

public int getBookId() {

return bookId;

}

public void setBookId(int bookId) {

this.bookId = bookId;

}

public String getTitle() {

return title;

}

public void setTitle(String title) {

this.title = title;

}

public String getAuthor() {

return author;

}

public void setAuthor(String author) {

this.author = author;

}

}

Step 3: Implementation

Implement linear search to find books by title:

public class LibraryManagementSystem {

private Book[] books;

public LibraryManagementSystem(Book[] books) {

this.books = books;

}

public Book linearSearchByTitle(String title) {

for (Book book : books) {

if (book.getTitle().equals(title)) {

return book;

}

}

return null;

}

}

Implement binary search to find books by title (assuming the list is sorted):

public class LibraryManagementSystem {

private Book[] books;

public LibraryManagementSystem(Book[] books) {

this.books = books;

}

public Book binarySearchByTitle(String title) {

int low = 0;

int high = books.length - 1;

while (low <= high) {

int mid = (low + high) / 2;

if (books[mid].getTitle().equals(title)) {

return books[mid];

} else if (books[mid].getTitle().compareTo(title) < 0) {

low = mid + 1;

} else {

high = mid - 1;

}

}

return null;

}

}

Step 4: Analysis

Time Complexity Comparison:

Linear Search: O(n) - Linear search has a time complexity of O(n), where n is the number of books.

Binary Search: O(log n) - Binary search has a time complexity of O(log n), where n is the number of books.

When to Use Each Algorithm:

Linear Search: Use linear search when the data set is small or when the data is not sorted. Linear search is simple to implement and works well for small data sets.

Binary Search: Use binary search when the data set is large and sorted. Binary search is more efficient than linear search for large data sets, but it requires the data to be sorted.

In conclusion, the choice of search algorithm depends on the size and order of the data set. Linear search is suitable for small data sets, while binary search is more efficient for large sorted data sets.