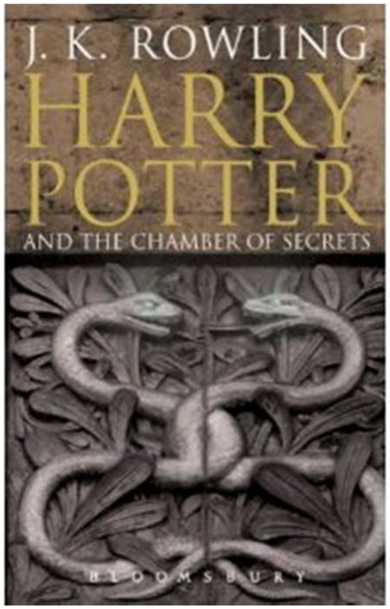
CompSci 100e
Program Design and Analysis II



February 17, 2011

Prof. Rodger

Announcements

- Test 1
  - Closed book, closed notes
  - Except can bring 4 sheets of paper written front/back
- Test 1 Topics
  - Strings, Sets, Maps - hashing, arrays and ArrayLists, Classes, Inheritance, Comparable, Files, Scanner, Analysis
- Will review in Lab Fri/Mon with old test questions
  - Try test questions before coming to lab, don’t look at solutions
  - Practice writing code on paper!

Analysis

- ArrayList – elements not in order
  - Assume n items already in the ArrayList
  - How long does it take to put one new item in?
    - myList.add(value)
    - Worst case?
    - Average case?
- ArrayList – elements in sorted order – maintain property
  - Assume n items in ArrayList
  - How long does it take to put one new item in?
    - myList.add(value)
    - Worst case?
    - Average case?

Analysis

- HashMap
  - Assume n items already in the map
  - How long does it take to put one new item in?
    - myMap.put(key, value)
    - Worst case?
    - Average case?

Analysis

- TreeMap
  - Assume n items already in the map
  - How long does it take to put one new item in?
    - myMap.put(key, value)
    - Worst case?
    - Average case?

Analysis

- TreeSet
  - – Assume n items already in the set
  - – How long does it take to put one new item in?
    - mySet.add(value)
    - Worst case?
    - Average case?

Binary Search

- Given a sorted array of n names, how do you find a name?

- How does binary search work?
- Can you apply binary search to any array?

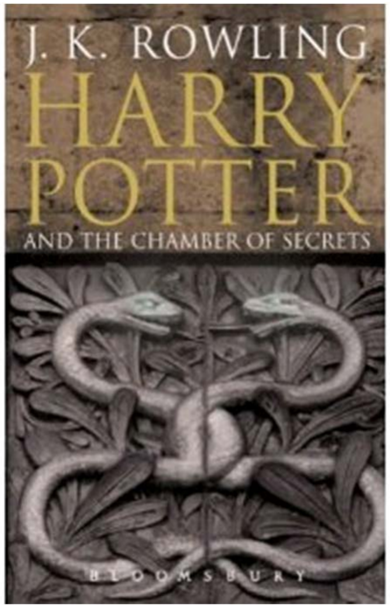
- How long does binary search take?
  - Worst case?
  - Average case?

Markov

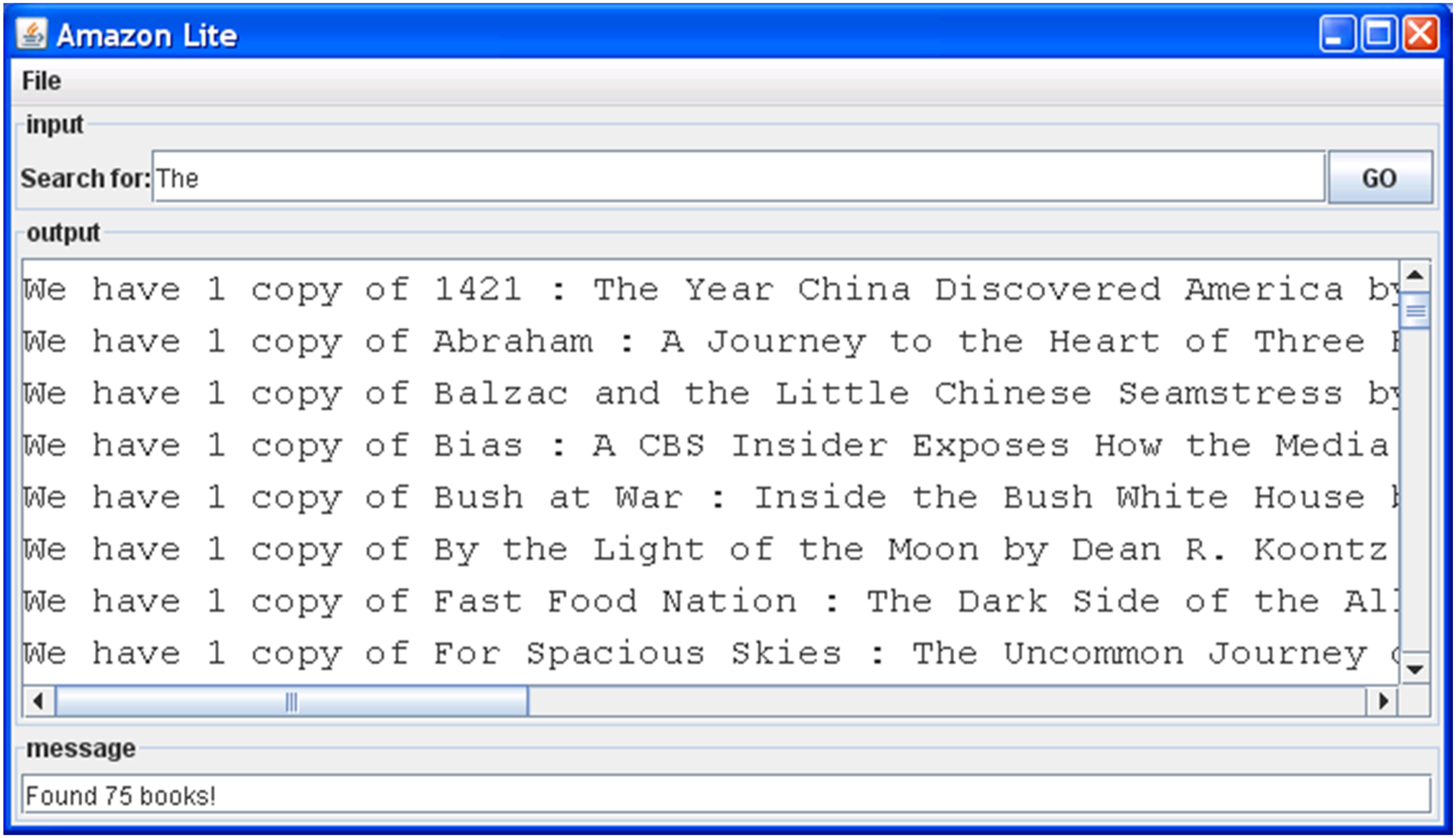
- Be sure to include analysis
  - Can put in your README file
  - OR include in another document (mention in README file if it is in another document)
- Read the assignment carefully after completing the coding part

Problem

- Given data on books in a library
  - Title, author, year published
  - May have multiple copies of books
- Search for books
  - Sort by title
  - Sort by author
  - Sorty by number of copies
  - (we will not focus on how to sort for this problem, just use Collections.sort();



Sort by Title

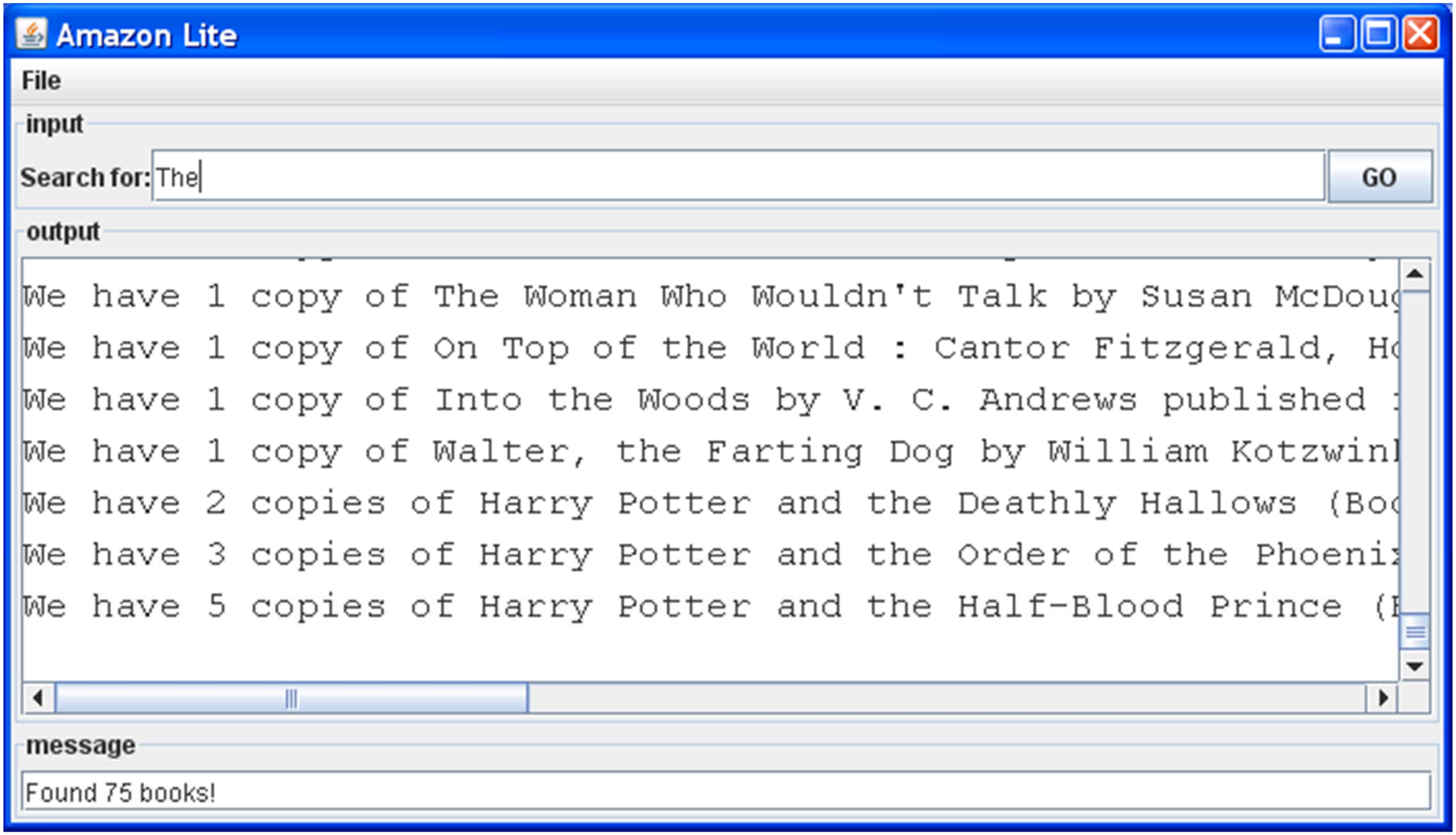


Search for: The

```
We have 1 copy of 1421 : The Year China Discovered America by
We have 1 copy of Abraham : A Journey to the Heart of Three
We have 1 copy of Balzac and the Little Chinese Seamstress by
We have 1 copy of Bias : A CBS Insider Exposes How the Media
We have 1 copy of Bush at War : Inside the Bush White House
We have 1 copy of By the Light of the Moon by Dean R. Koontz
We have 1 copy of Fast Food Nation : The Dark Side of the Al
We have 1 copy of For Spacious Skies : The Uncommon Journey
```

Found 75 books!

Sort by Count



Search for: The

```
We have 1 copy of The Woman Who Wouldn't Talk by Susan McDoug
We have 1 copy of On Top of the World : Cantor Fitzgerald, Ho
We have 1 copy of Into the Woods by V. C. Andrews published i
We have 1 copy of Walter, the Farting Dog by William Kotzwink
We have 2 copies of Harry Potter and the Deathly Hallows (Boo
We have 3 copies of Harry Potter and the Order of the Phoenix
We have 5 copies of Harry Potter and the Half-Blood Prince (B
```

Found 75 books!

How does one sort a type?

- ints, doubles: Compare with <, > , ==
- Strings: how do you compare?

- Book objects: how do you compare them?

Comparable interface

- public interface Comparable
- Classes must implement Comparable interface
- public class Book implements Comparable
- Book must have a compareTo method defined
- Another Example:
  - WordNgram implements Comparable to compare two WordNgrams

How does compareTo work?

- Compares two objects of the same type
- Returns an int
  - returns -1 if first object < second object
  - returns 0 if objects are equivalent
  - returns 1 if first object > second object
- What does compare two Book types mean?
  - By author
  - by title
  - by counts and then author

Classwork today – Amazon Lite

- Library Class
  - Read in the data to create Book object and put them in the library
  - findBooks to return a list of books on some criteria
- Book class
  - Write the method equals to return true if two books have the same author and title
  - Write the method matches – finding a word in a string

Classwork today (more)

- We will compare books several ways
  - 1) We will create Specific Comparator classes and pass them to a sorter
    - TitleComparator (DONE)
    - AuthorComparator
    - CountComparator
  - 2) We will change the Book class to make it Comparable
    - Implement the compareTo method based on titles

EXTRA SLIDES BELOW HERE

Analysis

- ArrayList – elements not in order
  - Assume n items already in the ArrayList
  - How long does it take to put one new item in?
    - myList.add(value)
    - Worst case? O(1)
    - Average case? O(1)
- ArrayList – elements in sorted order – maintain property
  - Assume n items in ArrayList
  - How long does it take to put one new item in?
    - myList.add(value)
    - Worst case? O(n)
    - Average case? O(n)

Analysis

- HashMap
  - Assume n items already in the map
  - How long does it take to put one new item in?
    - myMap.put(key, value)
    - Worst case? O(n)
    - Average case? O(1)

Analysis

- TreeMap
  – Assume n items already in the map
  – How long does it take to put one new item in?
    - myMap.put(key, value)
    - Worst case? O(n)
    - Average case? O(log n)
  – How would you know that?
    - You wouldn’t, because you don’t know what a tree is yet, just have to take my word…

Analysis

- TreeSet
  - Assume n items already in the set
  - How long does it take to put one new item in?
    - mySet.add(value)
    - Worst case? O(n)
    - Average case? O(log n)
  - How would you know that?
    - You wouldn’t, because you don’t know what a tree is yet, just have to take my word…

Binary Search

- Given a sorted array of n names, how do you find a name?

- How does binary search work?
- Can you apply binary search to any array?

- How long does binary search take?
  - Worst case? O(log n)
  - Average case? O(log n)