Line-based file processing

reading: 6.3

self-check: #7-11

exercises: #1-4, 8-11

Hours question

- Given a file `hours.txt` with the following contents:

```
123 Victoria 12.5 8.1 7.6 3.2
456 Brad 4.0 11.6 6.5 2.7 12
789 Alan 8.0 8.0 8.0 8.0 7.5
```

  - Consider the task of computing hours worked by each person:

```
Victoria (ID#123) worked 31.4 hours (7.85 hours/day)
Brad (ID#456) worked 36.8 hours (7.36 hours/day)
Alan (ID#789) worked 39.5 hours (7.9 hours/day)
```

- Let's try to solve this problem token-by-token ...

Hours answer (flawed)

```
// This solution does not work!
import java.io.*;                    // for File
import java.util.*;                  // for Scanner

public class HoursWorked {
    public static void main(String[] args)
            throws FileNotFoundException {
        Scanner input = new Scanner(new File("hours.txt"));
        while (input.hasNext()) {
            // process one person
            int id = input.nextInt();
            String name = input.next();
            double totalHours = 0.0;
            int days = 0;
            while (input.hasNextDouble()) {
                totalHours += input.nextDouble();
                days++;
            }
            System.out.println(name + " (ID#" + id +
                    ") worked " + totalHours + " hours (" +
                    (totalHours / days) + " hours/day)");
        }
    }
}
```

Flawed output

```
Susan (ID#123) worked 487.4 hours (97.48 hours/day)
Exception in thread "main"
java.util.InputMismatchException
        at java.util.Scanner.throwFor(Scanner.java:840)
        at java.util.Scanner.next(Scanner.java:1461)
        at java.util.Scanner.nextInt(Scanner.java:2091)
        at HoursWorked.main(HoursBad.java:9)
```

- The inner `while` loop is grabbing the next person's ID.
- We want to process the tokens, but we also care about the line breaks (they mark the end of a person's data).

- A better solution is a hybrid approach:
  - First, break the overall input into lines.
  - Then break each line into tokens.

Line-based `Scanner` methods

Method	Description
`nextLine()`	returns the next entire line of input
`hasNextLine()`	returns `true` if there are any more lines of input to read (always true for console input)

- `nextLine` consumes from the input cursor to the next `\n` .

```
Scanner input = new Scanner(new File("file name"));
while (input.hasNextLine()) {
    String line = input.nextLine();
    process this line;
}
```

Line-based scanner mini-exercise

- Write a program that prompts the user for a file name, and prints out the contents of that file, line by line.

Mini-exercise -- solution

```
/* Prompt the user for a file name and print out the
   contents of the file */
   import java.io.*;     // for File
   import java.util.*;   // for Scanner
   public class PrintFile {
       public static void main(String[] args)
               throws FileNotFoundException {
           Scanner console = new Scanner(System.in);
           System.out.print("File name: ");
           String name = console.next();
           Scanner fileScan = new Scanner(new File(name));
           while (fileScan.hasNextLine()) {
               String line = fileScan.nextLine();
               System.out.println(line);
           }
       }
   }
```

Consuming lines of input

```
23    3.14 John Smith     "Hello world"
                 45.2       19
```

- The `Scanner` reads the lines as follows:

```
23\t3.14 John Smith\t"Hello world"\n\t\t45.2  19\n
^
```

  - `String line = input.nextLine();`

```
23\t3.14 John Smith\t"Hello world"\n\t\t45.2  19\n
                                    ^
```

  - `String line2 = input.nextLine();`

```
23\t3.14 John Smith\t"Hello world"\n\t\t45.2  19\n
                                                  ^
```

  - Each `\n` character is consumed but not returned.

Scanners on Strings

- A `Scanner` can tokenize the contents of a `String`:

```
Scanner name = new Scanner(String);
```

  - Example:

```
String text = "15  3.2 hello   9  27.5";
Scanner scan = new Scanner(text);

int num = scan.nextInt();
System.out.println(num);                 // 15

double num2 = scan.nextDouble();
System.out.println(num2);                // 3.2

String word = scan.next();
System.out.println(word);                // hello
```

Tokenizing lines of a file

Input file `input.txt`:	Output to console:

`The quick brown fox jumps over`
`the lazy dog.`
	`Line has 6 words`
	`Line has 3 words`

```
// Counts the words on each line of a file
Scanner input = new Scanner(new File("input.txt"));
while (input.hasNextLine()) {
    String line = input.nextLine();
    Scanner lineScan = new Scanner(line);

    // process the contents of this line
    int count = 0;
    while (lineScan.hasNext()) {
        String word = lineScan.next();
        count++;
    }
    System.out.println("Line has " + count + " words");
}
```

Hours question

- Fix the `Hours` program to read the input file properly:

```
123 Victoria 12.5 8.1 7.6 3.2
456 Brad 4.0 11.6 6.5 2.7 12
789 Alan 8.0 8.0 8.0 8.0 7.5
```

  - Recall, it should produce the following output:

```
Victoria (ID#123) worked 31.4 hours (7.85 hours/day)
Brad (ID#456) worked 36.8 hours (7.36 hours/day)
Alan (ID#789) worked 39.5 hours (7.9 hours/day)
```

Hours answer, corrected

```
// Processes an employee input file and outputs each employee's hours.
import java.io.*;     // for File
import java.util.*;   // for Scanner

public class Hours {
    public static void main(String[] args) throws FileNotFoundException {
        Scanner input = new Scanner(new File("hours.txt"));
        while (input.hasNextLine()) {
            String line = input.nextLine();
            Scanner lineScan = new Scanner(line);
            int id = lineScan.nextInt();              // e.g. 456
            String name = lineScan.next();            // e.g. "Brad"
            double sum = 0.0;
            int count = 0;
            while (lineScan.hasNextDouble()) {
                sum = sum + lineScan.nextDouble();
                count++;
            }

            double average = sum / count;
            System.out.println(name + " (ID#" + id + ") worked " +
                    sum + " hours (" + average + " hours/day)");
        }
    }
}
```

Hours v2 question

- Modify the `Hours` program to search for a person by ID:
  - Example:

```
Enter an ID: 456
Brad worked 36.8 hours (7.36 hours/day)
```

  - Example:

```
Enter an ID: 293
ID #293 not found
```

Hours v2 answer 1

```
// This program searches an input file of employees' hours worked
// for a particular employee and outputs that employee's hours data.
import java.io.*;     // for File
import java.util.*;   // for Scanner

public class HoursWorked {
  public static void main(String[] args) throws FileNotFoundException {
      Scanner console = new Scanner(System.in);
      System.out.print("Enter an ID: ");
      int searchId = console.nextInt();        // e.g. 456

      Scanner input = new Scanner(new File("hours.txt"));
      String line = findPerson(input, searchId);
      if (line.length() > 0) {
          processLine(line);
      } else {
          System.out.println("ID #" + searchId + " was not found");
      }
  }

  ...
```

Hours v2 answer 2

```
// Locates and returns the line of data about a particular person.
public static String findPerson(Scanner input, int searchId) {
    while (input.hasNextLine()) {
        String line = input.nextLine();
        Scanner lineScan = new Scanner(line);
        int id = lineScan.nextInt();                // e.g. 456
        if (id == searchId) {
            return line;                            // we found them!
        }
    }
    return "";              // not found, so return an empty line
}

// Totals the hours worked by the person and outputs their info.
public static void processLine(String line) {
    Scanner lineScan = new Scanner(line);
    int id = lineScan.nextInt();                    // e.g. 456
    String name = lineScan.next();                  // e.g. "Brad"
    double hours = 0.0;
    int days = 0;
    while (lineScan.hasNextDouble()) {
        hours += lineScan.nextDouble();
        days++;
    }

    System.out.println(name + " worked " + hours + " hours ("
                         + (hours / days) + " hours/day)");
}
}
```

Mixing tokens and lines

- Using `nextLine` in conjunction with the token-based methods on the same `Scanner` can cause bad results.

```
23   3.14
Joe    "Hello world"
         45.2   19
```

  - You'd think you could read `23` and `3.14` with `nextInt` and `nextDouble`, then read `Joe "Hello world"` with `nextLine` .

```
System.out.println(input.nextInt());       // 23
System.out.println(input.nextDouble());    // 3.14
System.out.println(input.nextLine());      //
```

  - But the `nextLine` call produces no output! Why?

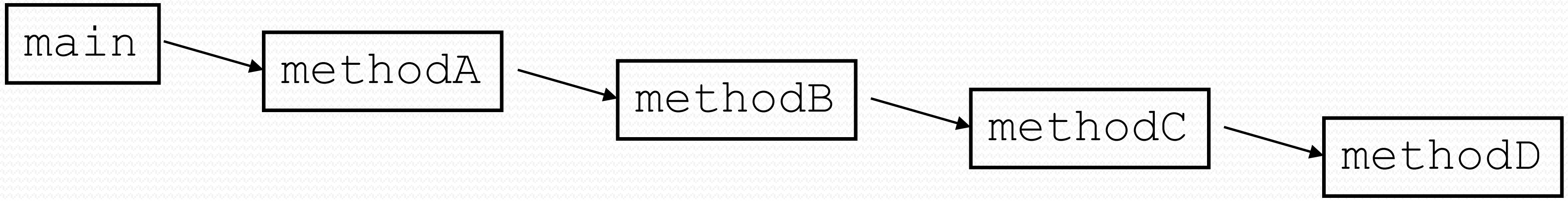
Mixing lines and tokens

- Don't read both tokens and lines from the same `Scanner`:

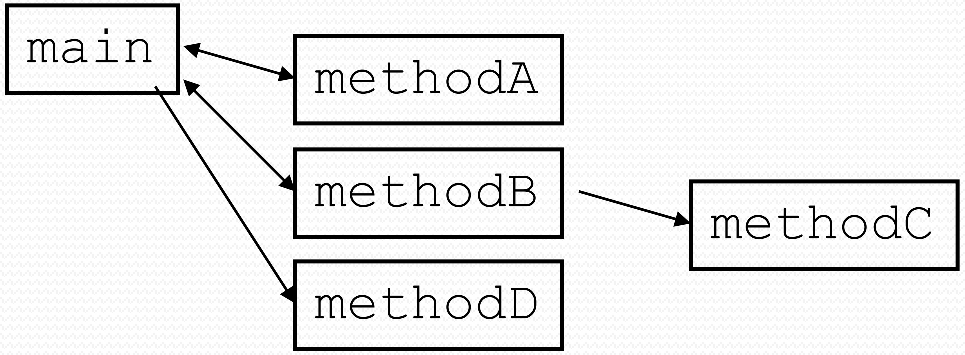
```
23    3.14
Joe    "Hello world"
              45.2   19

input.nextInt()                                        // 23
23\t3.14\nJoe\t"Hello world"\n\t\t45.2  19\n
  ^

input.nextDouble()                                     // 3.14
23\t3.14\nJoe\t"Hello world"\n\t\t45.2  19\n
        ^

input.nextLine()                                       // "" (empty!)
23\t3.14\nJoe\t"Hello world"\n\t\t45.2  19\n
          ^

input.nextLine()                              // "Joe\t\"Hello world\""
23\t3.14\nJoe\t"Hello world"\n\t\t45.2  19\n
                             ^
```

"Chaining"

- `main` should be a concise summary of your program.
  - It is bad if each method calls the next without ever considering that each will eventually return (we call this *chaining*):



- A better structure has each method do one thing well.
  - Return values to the caller (e.g., `main`) that can then be passed elsewhere.



IMDb movies problem

- Consider the following Internet Movie Database (IMDb) data:

```
1 196376 9.1 The Shawshank Redemption (1994)
2 139085 9.0 The Godfather: Part II (1974)
3 81507  8.8 Casablanca (1942)
```

- Write a program that displays any movies containing a phrase:

```
Search word? part

#       Rating  Votes  Title
2       9.0     139085 The Godfather: Part II (1974)
40      8.5     129172 The Departed (2006)
95      8.2     20401  The Apartment (1960)
192     8.0     30587  Spartacus (1960)
4 matches.
```

- (See handout with 3 solutions.)

Logical pieces

Key pieces:

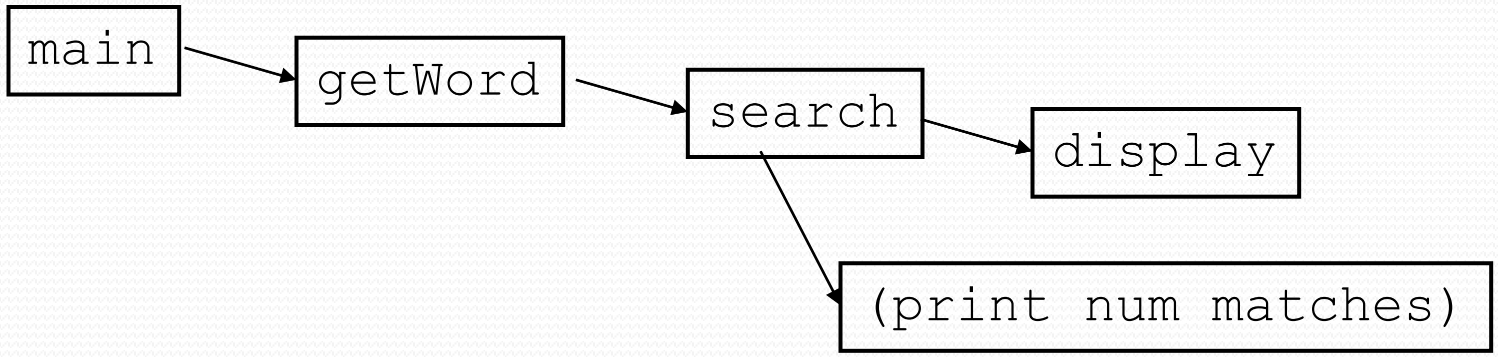
- Prompt for a phrase
- Search for lines with that phrase
- Scan each matching line and output it
- Output total number of matches

(Complication: Output column titles only if there is a match)

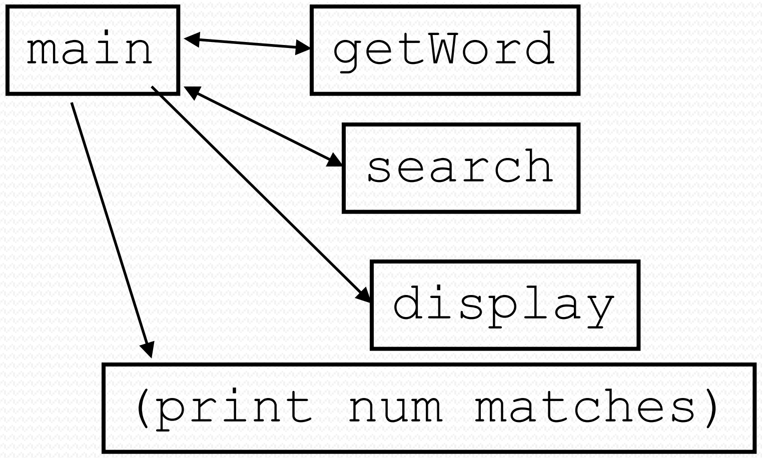
Each key piece is a separate part that can return what subsequent parts need

Chaining vs. Not Chaining

MoviesChaining.java shows bad style:



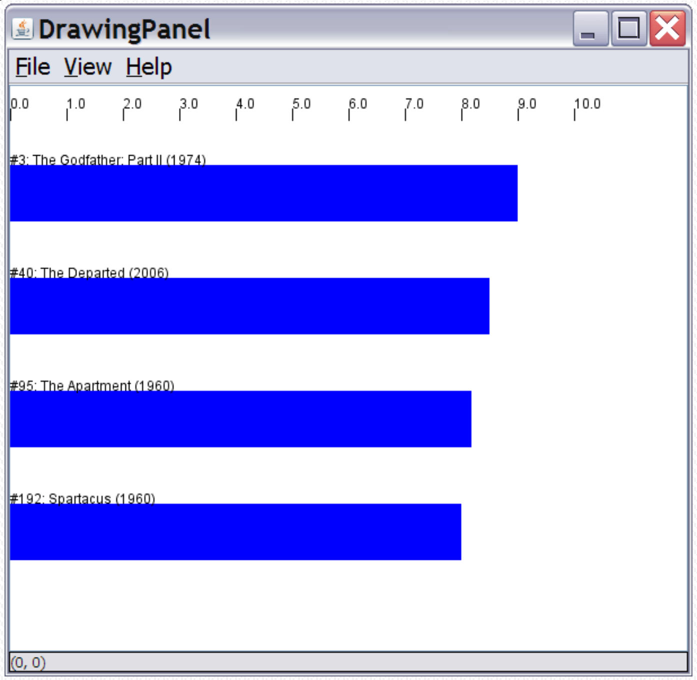
MoviesTextOutput.java shows better style:



A third version

- We could also plot the results on a DrawingPanel
  - You'll do something similar / more interesting in Homework 6
  - See MoviesGraphical.java

- Some particulars for our IMDB program
  - top-left 0.0 tick mark at (0, 20)
  - ticks 10px tall, 50px apart
  - first blue bar top/left corner at (0, 70)
  - bars 50px tall
  - bars 50px wide per rating point
  - bars 100px apart vertically



Mixing graphics and text

- When mixing text/graphics, solve the problem in pieces.

  Do the text and file I/O first:
  - Display any welcome message and initial console input.
  - Open the input file and print some file data.
    (Perhaps print every line, the first token of each line, etc.)
    - Can take this printing out later.
  - Search the input file for the line or lines you want.

  Then add the graphical output:
  - Draw any fixed graphics that do not depend on the file data.
  - Draw the graphics that do depend on the search result.