Computer Programming Fundamentals

CS 152
Professor: Leah Buechley
TAs: Melody Horn, Noah Garcia, Andrew Geyko, Juan Ormaza
Time: MWF 10:00-10:50am
https://handandmachine.cs.unm.edu/classes/CS152_Fall2021/

READING DATA FROM A FILE

- The data is read in as text, as Strings
- The data is read in line by line
- We don't know how big the file is (how many lines/ rows the files has) until we open it and read it

- We want to read in the data and store temperature and humidity in a 2D array of integers

WHAT THE DATA LOOKS LIKE

```
date,temperature,humidity
2021-11-11T00:52:00,47,34
2021-11-11T01:52:00,44,35
2021-11-11T02:00:00,44,35
2021-11-11T02:52:00,44,34
2021-11-11T03:52:00,45,35
2021-11-11T04:52:00,44,37
2021-11-11T05:00:00,44,37
2021-11-11T05:52:00,42,40
2021-11-11T06:52:00,41,41
2021-11-11T07:52:00,45,37
2021-11-11T08:00:00,45,37
2021-11-11T08:52:00,49,33
2021-11-11T09:52:00,51,31
2021-11-11T10:52:00,54,28
2021-11-11T11:00:00,54,28
2021-11-11T11:52:00,57,24
2021-11-11T12:38:00,59,19
2021-11-11T12:52:00,60,18
```

READING THE DATA & PRINTING IT

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";

}
```

line variable will hold text from each line

READING THE DATA & PRINTING IT

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    while (scan.hasNext()) {

    }
}
```

hasNext() method:

returns true if there is data left in the file

returns false if the end of the file has been reached

READING THE DATA & PRINTING IT

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
    }
}
```

nextLine() method:

returns the next line in the file as a string

questions?

CALLING OUR METHOD IN main

HAVE TO ACKNOWLEDGE EXCEPTION

```java
public static void main(String[] args) throws FileNotFoundException {

}
```

EDIT main

```java
public static void main(String[] args) throws FileNotFoundException {
    importData();
}
```

```
2021-11-17T15:52:00,62,17
2021-11-17T16:52:00,60,18
2021-11-17T17:00:00,60,18
2021-11-17T17:52:00,57,20
2021-11-17T18:52:00,52,32
2021-11-17T19:52:00,48,36
2021-11-17T20:00:00,48,36
2021-11-17T20:52:00,45,31
2021-11-17T21:52:00,43,31
2021-11-17T22:52:00,42,30
2021-11-17T23:00:00,42,30
2021-11-17T23:52:00,40,33
2021-11-18T00:52:00,39,33
```

questions?

READING DATA FROM A FILE

- The data is read in as text, as Strings
- The data is read in line by line
- We don't know how big the file is (how many lines/ rows the files has) until we open it and read it

- We want to read in the data and store temperature and humidity in a 2D array of integers

COUNT THE NUMBER OF ROWS

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
}
```

HOW MANY ROWS DOES THE FILE HAVE?

HOW MANY ROWS OF DATA DOES IT HAVE?

one less than the total number of rows because of the column headings

COUNT THE NUMBER OF ROWS

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
}
```

questions?

READING DATA FROM A FILE

- ~~The data is read in as text, as Strings~~
- ~~The data is read in line by line~~
- ~~We don't know how big the file is (how many lines/ rows the files has) until we open it and read it~~

- We want to read in the data and store temperature and humidity in a 2D array of integers

STORING DATA IN AN ARRAY

- Create the array. In Java we have to know how big the array needs to be before we can create it.
- Store each temperature reading in the array
- Store each humidity reading in the array

STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
}
```

create the array variable

it has the number of rows found in the file

it has 2 columns (for temperature & humidity)

STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
}
```

re-initialize the scan variable from the file
we'll need to scan it again the get the data

STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
}
```

create a string array variable

SCAN THE FIRST ROW OF THE FILE

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    line = scan.nextLine();  //scan header row from file
}
```

scan first row of headers
don't store it in array

FIRST ROW CONTAINS COLUMN HEADERS
CAN'T STORE IN ARRAY

```
date,temperature,humidity
2021-11-11T00:52:00,47,34
2021-11-11T01:52:00,44,35
2021-11-11T02:00:00,44,35
2021-11-11T02:52:00,44,34
2021-11-11T03:52:00,45,35
2021-11-11T04:52:00,44,37
2021-11-11T05:00:00,44,37
2021-11-11T05:52:00,42,40
2021-11-11T06:52:00,41,41
```

STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    line = scan.nextLine();  //scan header row from file
    for (int i=0;i<rows;i++) {
        line = scan.nextLine();
    }
}
```

add for loop for data storage
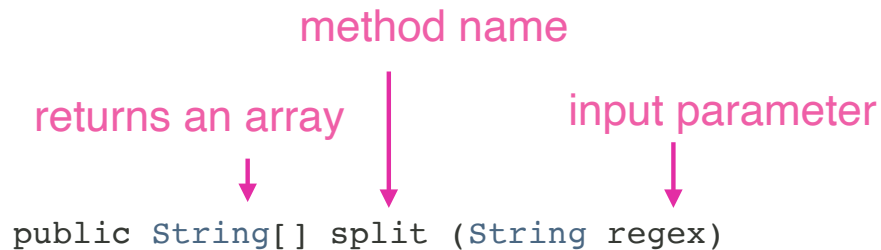
STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    line = scan.nextLine();  //scan header row from file
    for (int i=0;i<rows;i++) {
        line = scan.nextLine();
        rowString = line.split(",");
    }
}
```

split line into smaller strings
separated by commas

JAVA split METHOD FOR STRINGS

method name

returns an array

input parameter

```
public String[] split (String regex)
```

Splits this string around matches of the given regular expression.

Parameters:
regex – the regular expression

Returns:
The array of strings computed by splitting this string around matches of the given regular expression

https://docs.oracle.com/en/java/javase/16/docs/api/java.base/java/lang/String.html#split

JAVA split METHOD FOR STRINGS

```
line                            "2021-11-11T00:52:00,47,34"

rowString = line.split(",")     {"2021-11-11T00:52:00", "47", "34"}     split with commas


rowString[0]                    "2021-11-11T00:52:00"                   result
rowString[1]                    "47"
rowString[2]                    "34"
```

STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    line = scan.nextLine();  //scan header row from file
    for (int i=0;i<rows;i++) {
        line = scan.nextLine();
        rowString = line.split(",");
    }
}
```

questions?
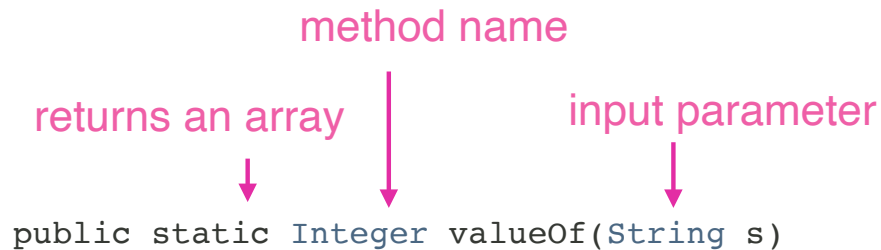
STORING DATA IN AN ARRAY

- ~~Create the array. In Java we have to know how big the array needs to be before we can create it.~~
- Store each temperature reading in the array
- Store each humidity reading in the array

rowString IS AN ARRAY OF STRINGS
WE NEED INTEGERS

JAVA valueOf METHOD FOR Integers

method name

returns an array

input parameter

```
public static Integer valueOf(String s)
```

Returns an Integer object holding the value of the specified String.

Parameters:
s – the string to be parsed

Returns:
An Integer object holding the value represented by the string argument

https://docs.oracle.com/en/java/javase/16/docs/api/java.base/java/lang/Integer.html#valueOf(String)

STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    line = scan.nextLine();   //scan header row from file
    for (int i=0;i<rows;i++) {
        line = scan.nextLine();
        rowString = line.split(",");
        data[i][0] = Integer.valueOf(rowString[1]);     temperature
    }
}
```

STORE DATA IN A 2D ARRAY

```java
static void importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    line = scan.nextLine();   //scan header row from file
    for (int i=0;i<rows;i++) {
        line = scan.nextLine();
        rowString = line.split(",");
        data[i][0] = Integer.valueOf(rowString[1]);
        data[i][1] = Integer.valueOf(rowString[2]);      humidity
    }
}
```

questions?

WANT TO GET DATA OUT OF METHOD

RETURN ARRAY

```java
static int[][] importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    for (int i=0;i<rows;i++) {
        line = scan.nextLine();
        rowString = line.split(",");
        if (i!=0) {
            data[i][0] = Integer.valueOf(rowString[1]);
            data[i][1] = Integer.valueOf(rowString[2]);
        }
    }
    return data;
}
```

add return type to method signature

RETURN ARRAY

```java
static int[][] importData() throws FileNotFoundException {
    String filename = "abq_weather.csv";
    File file = new File(filename);
    Scanner scan = new Scanner(file);
    String line="";
    int rows = 0;
    while (scan.hasNext()) {
        line = scan.nextLine();
        System.out.println(line);
        rows++;
    }
    System.out.println("Total rows: " +rows);
    rows--;
    System.out.println("Total data rows: " +rows);
    //store data in the array
    int[][] data = new int[rows][2];
    scan = new Scanner(file);
    String[] rowString;
    for (int i=0;i<rows;i++) {
        line = scan.nextLine();
        rowString = line.split(",");
        if (i!=0) {
            data[i][0] = Integer.valueOf(rowString[1]);
            data[i][1] = Integer.valueOf(rowString[2]);
        }
    }
    return data;
}
```

add return statement

EDIT main

```java
public static void main(String[] args) throws FileNotFoundException {
    int[][] data = importData();
}
```

questions?

READING DATA FROM A FILE

- The data is read in as text, as Strings
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- We don't know how big the file is (how many lines/rows the files has) until we open it and read it

- We want to read in the data and store temperature and humidity in a 2D array of integers

DONE READING IN DATA

VISUALIZING DATA: A BAR GRAPH

GRAPHING DATA

- Extend Basic Panel so we can draw stuff
- Add necessary class variables and methods

- Create a window for graphing that fits the data
- Draw a rectangle for each data point
- Rectangle starts at bottom of screen
- Height determined by data point

questions?

RE-DOWNLOAD BasicPanel.jar
ADD AS A LIBRARY

important: download again even if you already have a copy

EXTEND BasicPanel

```java
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class DataVisualization extends BasicPanel {
```

ADD CLASS VARIABLES

```java
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class DataVisualization extends BasicPanel {
    int[][] data;
    int rows;
    final static String FILENAME = "abq_weather.csv";
```

ADD CONSTRUCTOR

```java
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class DataVisualization extends BasicPanel {
    int[][] data;
    int rows;
    final static String FILENAME = "abq_weather.csv";

    DataVisualization () throws FileNotFoundException {
        data = importData();
        rows = data.length;
        setSize(rows*3,200);
    }
```
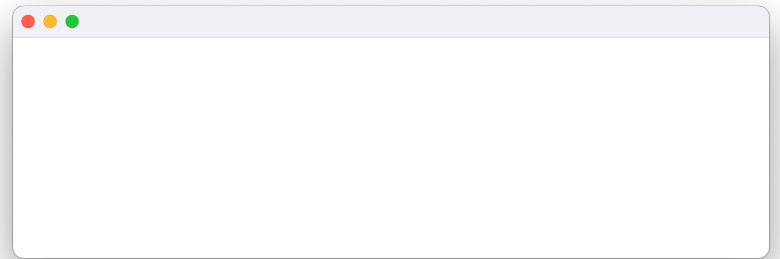
EDIT main

```java
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class DataVisualization extends BasicPanel {
    int[][] data;
    int rows;
    final static String FILENAME = "abq_weather.csv";

    DataVisualization () throws FileNotFoundException {
        data = importData();
        rows = data.length;
        setSize(rows*3,200);
    }

    public static void main(String[] args) throws FileNotFoundException {
        DataVisualization d = new DataVisualization();
        MyFrame frame = new MyFrame(d);
    }
```

questions?

Thank you!

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