CMIS 141

Final Project

Emily Martens

University of Maryland University College

Author Note

Submitted by Emily Martens, student, Department of Computer Science, University of Maryland University College. Correspondence concerning this article should be emailed to Emily Martens. Contact: ekmrtns@gmail.com

USCrime Class:

```
/*
* File: USCrime.java
* Author: Emily Martens
* Date: April 3, 2018
* Purpose: This program creates a USCrime object to store all of the
information in the crime.csv file
*/

import java.io.BufferedReader;
import java.io.FileReader;
import java.io.IOException;
import java.util.*;

public class USCrime {

  private String file;
  public ArrayList<String> fileContents;
  public String[] categories;
  public int[] population;
  public int[] year;
  public float[] murderRate;
  public float[] robberyRate;
  public int[] violentCrimes;
  public int[] propertyCrimes;
  public String[][] theData;

  //Constructor
  public USCrime(String filename){
    this.file = filename;
    storeFile();
    getCategories();
    getPopulation();
    getYear();
    getMurderRate();
    getRobberyRate();
    getViolentCrimes();
    getPropertyCrimes();
  }


  //getter method
  public String getFileName(){
    return this.file;
  }

  //method to read the file and store the info in a multidimensional
array
  public void storeFile() {
    //initialize BufferedReader
    BufferedReader inBuffer = null;
    this.fileContents = new ArrayList <String>();
```

```
    String l; //lines of file
    try {
      //open file, ready to read
      inBuffer = new BufferedReader(new FileReader(this.file));

        //read contents of cities file line by line
        while ((l = inBuffer.readLine() ) != null) {
          this.fileContents.add(l);
        } // end while
      }  catch (IOException io) {
           //for any input/output issues, print message
           System.out.println("File IO exception " + io.getMessage());
        } finally { //clean up regardless of above try block
            try {
                // Close inBuffer
                if (inBuffer != null) {
                inBuffer.close();
                }
             } catch (IOException io) {
                System.out.println("Problem closing file: " +
io.getMessage());
               }
      }

      int fileSize = this.fileContents.size();
      String[] tempArray = new String[fileSize];
      this.fileContents.toArray(tempArray);
      this.theData = new String[fileSize][tempArray.length];

      for (int j = 0; j < tempArray.length; j++){
        this.theData[j] = tempArray[j].split(",");
      }
  }

  //method to store the crime categories
  public void getCategories(){
    this.categories = new String[this.theData[0].length];
    for (int i = 0; i < this.theData[0].length; i++){
      this.categories[i] = this.theData[0][i];
    }
  }

  //method to store the population
  public void getPopulation() {
    //calculate the index of the Population category
    String findCategory = "Population";
    int popIndex = 0;
    for (int i = 0; i < this.categories.length; i++){
      if (this.categories[i].equals(findCategory)){
        popIndex = i;
      }
    }
```

```
    //get all population values from their indexes in the
multidimensional data array, parse to int and save in population
    this.population = new int[this.theData.length - 1];
    for (int j = 0; j < this.theData.length - 1; j++){
      this.population[j] = Integer.parseInt(this.theData[j+1]
[popIndex]);
    }
  }

  //method to store the years
  public void getYear(){
    //calculate the index of the Population category
    String findCategory = "Year";
    int yearIndex = 0;
    for (int i = 0; i < this.categories.length; i++){
      if (this.categories[i].equals(findCategory)){
        yearIndex = i;
      }
    }

    //get all year values from their indexes in the multidimensional
data array, parse to int and save in year
    this.year = new int[this.theData.length - 1];
    for (int j = 0; j < this.theData.length - 1; j++){
      this.year[j] = Integer.parseInt(this.theData[j+1][yearIndex]);
    }
  }

  //method to store the murder rates
  public void getMurderRate() {
    //calculate the index of the Population category
    String findCategory = "Murder and nonnegligent manslaughter rate";
    int murderIndex = 0;
    for (int i = 0; i < this.categories.length; i++){
      if (this.categories[i].equals(findCategory)){
        murderIndex = i;
      }
    }

    //get all murder rate values from their indexes in the
multidimensional data array, parse to int and save in population
    this.murderRate = new float[this.theData.length - 1];
    for (int j = 0; j < this.theData.length - 1; j++){
      this.murderRate[j] = Float.parseFloat(this.theData[j+1]
[murderIndex]);
    }
  }

  //method to store the robbery rates
  public void getRobberyRate() {
    //calculate the index of the Population category
    String findCategory = "Robbery rate";
    int robberyIndex = 0;
    for (int i = 0; i < this.categories.length; i++){
```

```
      if (this.categories[i].equals(findCategory)){
        robberyIndex = i;
      }
    }

    //get all robbery rate values from their indexes in the
multidimensional data array, parse to int and save in population
    this.robberyRate = new float[this.theData.length - 1];
    for (int j = 0; j < this.theData.length - 1; j++){
      this.robberyRate[j] = Float.parseFloat(this.theData[j+1]
[robberyIndex]);
    }
  }

  //method to store the violent crimes
  public void getViolentCrimes(){
    //calculate the index of the Violent Crime category
    String findCategory = "Violent crime";
    int violenceIndex = 0;
    for (int i = 0; i < this.categories.length; i++){
      if (this.categories[i].equals(findCategory)){
        violenceIndex = i;
      }
    }

    //get all violent crime values from their indexes in the
multidimensional data array, parse to int and save in year
    this.violentCrimes = new int[this.theData.length - 1];
    for (int j = 0; j < this.theData.length - 1; j++){
      this.violentCrimes[j] = Integer.parseInt(this.theData[j+1]
[violenceIndex]);
    }
  }

  //method to store the property crimes
  public void getPropertyCrimes(){
    //calculate the index of the Violent Crime category
    String findCategory = "Property crime";
    int propertyIndex = 0;
    for (int i = 0; i < this.categories.length; i++){
      if (this.categories[i].equals(findCategory)){
        propertyIndex = i;
      }
    }

    //get all property crime values from their indexes in the
multidimensional data array, parse to int and save in year
    this.propertyCrimes = new int[this.theData.length - 1];
    for (int j = 0; j < this.theData.length - 1; j++){
      this.propertyCrimes[j] = Integer.parseInt(this.theData[j+1]
[propertyIndex]);
    }
  }
```

```
  //method to calculate population growth
  public void popGrowth(){
    float percentageGrowth;
    for (int i = 0; i < this.population.length - 1; i++){
      percentageGrowth = ((this.population[i+1] - this.population[i])/
(float) this.population[i])*100;
      System.out.println("Growth from " + this.year[i] + " - " +
this.year[i+1] + ": " + percentageGrowth + "%");
    }
  }

  //method to calculate the highest murder rate
  public void highestMurderRate(){
    float max = this.murderRate[0];
    int maxYear = this.year[0];
    for(int i = 0; i < this.murderRate.length; i++){
      if (this.murderRate[i] > max){
        max = this.murderRate[i];
        maxYear = this.year[i];
      }
    }
    System.out.println("The Murder rate was highest in " + maxYear);
  }

  //method to calculate the lowest murder rate
  public void lowestMurderRate(){
    float min = this.murderRate[0];
    int minYear = this.year[0];
    for(int i = 0; i < this.murderRate.length; i++){
      if (this.murderRate[i] < min){
        min = this.murderRate[i];
        minYear = this.year[i];
      }
    }
    System.out.println("The Murder rate was lowest in " + minYear);
  }

  //method to calculate the highest robbery rate
  public void highestRobberyRate(){
    float max = this.robberyRate[0];
    int maxYear = this.year[0];
    for(int i = 0; i < this.robberyRate.length; i++){
      if (this.robberyRate[i] > max){
        max = this.robberyRate[i];
        maxYear = this.year[i];
      }
    }
    System.out.println("The Robbery rate was highest in " + maxYear);
  }

  //method to calculate the lowest robbery rate
  public void lowestRobberyRate(){
    float min = this.robberyRate[0];
    int minYear = this.year[0];
```

```
    for(int i = 0; i < this.robberyRate.length; i++){
      if (this.robberyRate[i] < min){
        min = this.robberyRate[i];
        minYear = this.year[i];
      }
    }
    System.out.println("The Robbery rate was lowest in " + minYear);
  }

  //method to calculate the average number of violent violentCrimes
  public void averageViolentCrimes(){
    int total = 0;
    int average = 0;
    for (int i = 0; i < this.violentCrimes.length; i++){
      total += this.violentCrimes[i];
    }
    average = total/this.violentCrimes.length;
    System.out.println("The average number of violent crimes from 1994
- 2013 was " + average);
  }

  //method to calculate the total property crimes from 1994 - 2004
  public void totalPropertyCrimes(){
    int total = 0;
    for (int i = 0; i < 10; i++){
      total += this.propertyCrimes[i];
    }
    System.out.println("The total property crimes from 1994 - 2004
were: " + total);
  }

}
```

Timer Class:

```
/*
* File: Timer.java
* Author: Emily Martens
* Date: April 3, 2018
* Purpose: This program creates a Timer object to keep track of start
time, end time, and duration of the program
*/

import java.util.*;

public class Timer {
  //create variables to store the start time (second)
  private Calendar startTime; // create an instance of today
  private long start; // get the current second
  private String totalTime;

  //constructor
  public Timer(){
```

```
    this.start = System.currentTimeMillis();
  }

  //getter methods
  public Calendar getStartTime(){
    return this.startTime;
  }

  public long getStart(){
    return this.start;
  }

  //method
  public String getTotalTime(){
    //create a new calendar instance and store the end time to
calculate the total program run time
    Calendar endTime = Calendar.getInstance(); // create an instance
of today's date
    long end = System.currentTimeMillis(); // get the current second
    long totalSeconds = (end - start)/1000;
    String totalTime = "Elapsed time in seconds: " +
Long.toString(totalSeconds);
    return totalTime;
  }


}//end class
```

Crime Statistics App:

```
/*
* File: SearchCrimeData.java
* Author: Emily Martens
* Date: April 3, 2018
* Purpose: This program allows the user to learn the answers to
questions about crime in the US by selecting from a menu. The program
then prints a thank you and the time elapsed since the program
started.
*/

import java.io.File;
import java.io.IOException;
import java.util.*;

public class SearchCrimeData {
  public static void main(String[] args) throws IOException {

    Timer runTime = new Timer(); // create new Timer object to keep
track of total runtime
    Scanner takeInput = new Scanner(System.in);
    char theInput;
    char quit;
    boolean isDone = false;
```

```
    //create new crime object on program start
    USCrime crime = new USCrime(args[0]);
    System.out.println("\n********* Welcome to the US Crime Statistics
App *********\n");

    while (isDone == false) {
      //Selection Menu
      System.out.println("Select your question. Enter Q to quit the
program.");
      System.out.println("1. What were the percentages in population
growth for each consecutive year from 1994 - 2013?");
      System.out.println("2. What year was the Murder rate the
highest?");
      System.out.println("3. What year was the Murder rate the
lowest?");
      System.out.println("4. What year was the Robbery rate the
highest?");
      System.out.println("5. What year was the Robbery rate the
lowest?");
      System.out.println("6. What was the average total of violent
crimes from 1994 to 2013?");
      System.out.println("7. What was the total number of property
crimes from 1994 - 2004?");
      System.out.println("Q. Quit the program");

      theInput = takeInput.next().charAt(0);

      switch(Character.toUpperCase(theInput)) {
        case '1':
           crime.popGrowth();
           break;
        case '2':
           crime.highestMurderRate();
           break;
        case '3':
           crime.lowestMurderRate();
           break;
        case '4':
           crime.highestRobberyRate();
           break;
        case '5':
           crime.lowestRobberyRate();
           break;
        case '6':
           crime.averageViolentCrimes();
           break;
        case '7':
           crime.totalPropertyCrimes();
           break;
        case 'Q':
           isDone = true;
           break;
       default:
           System.out.println("Please select a valid entry");
```

```
            break;
        }//end switch
    }//end while

    System.out.println("\nThank you for trying the US Crime Statistics
App");

    System.out.println(runTime.getTotalTime()); // call the Timer
function to calculate total runtime

  }//end main
}//end class
```

Test Table

Test Case	Input	Expected Output	Pass?
1	1 Q *Let program run to demonstrate timer*	Growth from 1994 - 1995: 0.95120937% Growth from 1995 - 1996: 0.9228561% Growth from 1996 - 1997: 0.96333325% Growth from 1997 - 1998: 0.92029387% Growth from 1998 - 1999: 0.9039142% Growth from 1999 - 2000: 3.201829% Growth from 2000 - 2001: 1.384275% Growth from 2001 - 2002: 0.93102044% Growth from 2002 - 2003: 0.97753716% Growth from 2003 - 2004: 0.98623604% Growth from 2004 - 2005: 0.9705951% Growth from 2005 - 2006: 0.9751616% Growth from 2006 - 2007: 0.7423795% Growth from 2007 - 2008: 0.8084867% Growth from 2008 - 2009: 0.96916026% Growth from 2009 - 2010: 0.75687927% Growth from 2010 - 2011: 0.729834% Growth from 2011 - 2012: 0.7336195% Growth from 2012 - 2013: 0.7184909% Elapsed time in seconds: (length of time)	Y
2	2 3 4 Q	The Murder rate was highest in 1994 The Murder rate was lowest in 2013 The Robbery rate was highest in 1994 Elapsed time in seconds: (length of time)	Y
3	@ 0 9 Hello q	Please select a valid entry Please select a valid entry Please select a valid entry Please select a valid entry Elapsed time in seconds: (length of time)	Y

Test Case	Input	Expected Output	Pass?
4	6 7 5 q	The average number of violent crimes from 1994 - 2013 was 1439004 The total property crimes from 1994 - 2004 were: 110237679 The Robbery rate was lowest in 2013 Elapsed time in seconds: (length of time)	Y

Test 1

```
♥ java SearchCrimeData crime.csv

********* Welcome to the US Crime Statistics App *********

Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
```

```
1
Growth from 1994 – 1995: 0.95120937%
Growth from 1995 – 1996: 0.9228561%
Growth from 1996 – 1997: 0.96333325%
Growth from 1997 – 1998: 0.92029387%
Growth from 1998 – 1999: 0.9039142%
Growth from 1999 – 2000: 3.201829%
Growth from 2000 – 2001: 1.384275%
Growth from 2001 – 2002: 0.93102044%
Growth from 2002 – 2003: 0.97753716%
Growth from 2003 – 2004: 0.98623604%
Growth from 2004 – 2005: 0.9705951%
Growth from 2005 – 2006: 0.9751616%
Growth from 2006 – 2007: 0.7423795%
Growth from 2007 – 2008: 0.8084867%
Growth from 2008 – 2009: 0.96916026%
Growth from 2009 – 2010: 0.75687927%
Growth from 2010 – 2011: 0.729834%
Growth from 2011 – 2012: 0.7336195%
Growth from 2012 – 2013: 0.7184909%
```

```
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 - 2004?
Q. Quit the program
Q

Thank you for trying the US Crime Statistics App
Elapsed time in seconds: 279
```

Test 2

```
********* Welcome to the US Crime Statistics App *********

Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 - 2004?
Q. Quit the program
2
The Murder rate was highest in 1994
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 - 2004?
Q. Quit the program
```

```
3
The Murder rate was lowest in 2013
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 - 2004?
Q. Quit the program
4
The Robbery rate was highest in 1994
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 - 2004?
Q. Quit the program
Q
```

```
Thank you for trying the US Crime Statistics App
Elapsed time in seconds: 19
```

Test 3

```
********* Welcome to the US Crime Statistics App *********

Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
@
Please select a valid entry
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
0
```

```
0
Please select a valid entry
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program

Please select a valid entry
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
Hello
Please select a valid entry
```

```
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
q

Thank you for trying the US Crime Statistics App
Elapsed time in seconds: 25
emilykm: final-project
```

Test 4

```
********* Welcome to the US Crime Statistics App *********

Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
6
The average number of violent crimes from 1994 – 2013 was 1439004
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
7
The total property crimes from 1994 – 2004 were: 110237679
```

```
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
5
The Robbery rate was lowest in 2013
Select your question. Enter Q to quit the program.
1. What were the percentages in population growth for each consecutive year from 1994 – 2013?
2. What year was the Murder rate the highest?
3. What year was the Murder rate the lowest?
4. What year was the Robbery rate the highest?
5. What year was the Robbery rate the lowest?
6. What was the average total of violent crimes from 1994 to 2013?
7. What was the total number of property crimes from 1994 – 2004?
Q. Quit the program
q

Thank you for trying the US Crime Statistics App
Elapsed time in seconds: 11
```

NOTES:

This program took more testing than any other project this semester. In approaching it, I tried to make sure that every component worked exactly as I needed it to before moving on to the next piece of functionality. The very first piece I put into place was the Timer object to keep track of the start time and grab the end time to calculate the total seconds. After plugging that in to the crime app, I moved on to the USCrime object.

The crime object took some time for me to navigate. Not just the major functionality had to be tested, but each tiny component of each method. In the initial storing of the entire CSV file, I opted to use an ArrayList because even though I can personally count the number of items in the given file, I wanted to extend the flexibility of the USCrime class by not pre-assuming the length of the file. After containing the data into an array list, it was simple to cast the array list to an array with toArray(), giving it a measurable size for all future array creation.

Extracting the categories from my new data array was very simple since that information did not need to be altered at all. I just devised a method to grab the first line of theData. However, when I moved on to the next methods, I knew that I needed to convert the isolated data into the respective number formats instead of String in order to perform the required calculations. I started getting frustrated at this point because parseInt() was not working at all. I kept getting a NumberFormatException error. The first error was stating that the string that I was trying to convert was of an invalid type. It was not until I realized that I was including the first index of theData in my query, which contains the category Strings, that I was able to get past the first error message. The next NumberFormatException error was saying that the first piece of data I was trying to format was null. This led me to realize that I was now skipping the first index in my new array, and that I needed the counter to still start at zero for the new array but skip the first index in the array that I was copying from. After getting past this initial hurdle, saving the rest of the needed categories became a very quick process.

The last piece that took some figuring out was the menu system controls. At first I did not know how I would be able to keep track of ints and chars for user input. Then I realized that while I could not scan in the Q as an int, I could scan in the number selections (1, 2, 3 etc) as chars.