BLG252E
Object Oriented Programming
Final Exam

July 7, 2020

You will have to zip all of your project files and upload your solutions to Ninova. The grading for the questions are indicated next to their titles. You are allowed to use third-party libraries, but make sure that the program works before submitting. Good luck!

Question 1 (30 pts)

In *numbers.txt* file, each line has integers separated with spaces. Each of these lines corresponds to an integer array. Your task is to find the number that occurs in the array more than once. You can assume that each array has one and only one duplicate element.

(a) Examine the following pseudo-code that contains an algorithm for this task. Create a new method and implement this pseudo-code in C#.

```
   Input: an array A of n integers
   Output: the index of the element that is occurring more than once, or -1 if no such
           element exists
1  for i from 0 to n do
2      for j from i + 1 to n do
3          if A[i] is equal to A[j] then
4              return i
5  return −1
```

(b) Using the method you obtained in part (a), read *numbers.txt* file and apply the operation to each line separately, then print the results.

(c) This method, although simple, can be slow especially when the input size is large. Examine the code to make adjustments or create your own method that has a better time complexity than this method.

(d) Write a program to compare your new method with the code from part (a) in terms of execution time. (You can use the built-in `Stopwatch` class). Make sure you do enough number of tests and take the average to ensure that random fluctuations are ignored. Write the results into a txt file inside the project folder.

Question 2 (50 pts)

You are given *covid19.csv*, a CSV file containing country-wise data on the SARS-CoV-2 pandemic. This dataset is taken from Kaggle which is available here. And here is an example of visualization and prediction done from such data.

Write a program that reads and parses the CSV file, and can sort and filter data according to the user input and print the results.

Your program should be able to do the following according to the user input:

1. Show results from a specific country
2. Sort the data according to any column
3. Filter the results (for example, >10000 cases)
4. Print the top or bottom n results

[Optional] You get bonus points if your program

- Can do partial country name search, meaning ”Tur” matches Turkey, ”Aus” matches Austria and Australia, etc.
- Saves the state of the CSV file (ordering) for later launches of the application.
- Visualizes the data in some way.

Question 3 (40 pts)

An API (Application Programming Interface) is the way of exchanging data between two programs. Web APIs for example are used all the time under the hood of almost every website a typical user would visit. Although JSON is the most used format nowadays, there are many ways to communicate with an API, even just plain text.

For example, if you visit this API you can search for books. Whereas this link, gives you the URL of a random cat picture. And here is a plain-text API to find out your public IP address. As you can see, the possibilities are endless.

(a) In this question, you will use the 7timer.info Web API to retrieve the weather information for a given latitude and longitude point. The Web API has the following URL:

http://www.7timer.info/bin/astro.php?lon=**LON**&lat=**LAT**&ac=0&unit=metric&output=json&tzshift=0

Where LON and LAT are your coordinates.

Your program should do the following:

- Take latitude and longitude information from the user
- Make a request to the API with those coordinates, and get the response
- Parse (deserialize) the incoming JSON data, and display the weather information

(b) (Bonus Question) In this question, you can choose another Web API to communicate with, then write a program that retrieves and displays the result in a meaningful way. For available public APIs you can use, click here. (I suggest you look for APIs with no authentication, since otherwise you need to signup to use the API).

Note: Since your choice of API determines the nature of your program, there are not many constrains here, but we expect more than just printing the API response. Try to make your program interactive.