

Final Assignment: Array Sorting and HashMaps

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CS201: Data Structures and Algorithms 1

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Part 1 Overview

Develop a program that asks the user to enter a capital for a U.S. state. Upon receiving the user input, the program reports whether the user input is correct. For this application, the 50 states and their capitals are stored in a two-dimensional array in order by state name. Display the current contents of the array then use a bubble sort to sort the content by capital. Next, prompt the user to enter answers for all the state capitals and then display the total correct count. The user's answer is not case-sensitive.

Part 1 Code

```
import java.util.Scanner;

public class Main {

    public static void main(String [] args) {

        /*declare and instantiate a multidimensional array that contains
the 50 states in alphabetical order and their state capital*/

        String[][] statesAndCapitals = {

            {"Alabama", "Montgomery"},

            {"Alaska", "Juneau"},

            {"Arizona", "Phoenix"},

            {"Arkansas", "Little Rock"},

            {"California", "Sacramento"},

            {"Colorado", "Denver"},

            {"Connecticut", "Hartford"},

            {"Delaware", "Dover"},

            {"Florida", "Tallahassee"},

            {"Georgia", "Atlanta"},

            {"Hawaii", "Honolulu"},
```

```
{"Idaho", "Boise"},  
  
{"Illinois", "Springfield"},  
  
{"Indiana", "Indianapolis"},  
  
{"Iowa", "Des Moines"},  
  
{"Kansas", "Topeka"},  
  
{"Kentucky", "Frankfort"},  
  
{"Louisiana", "Baton Rouge"},  
  
{"Maine", "Augusta"},  
  
{"Maryland", "Annapolis"},  
  
{"Massachusetts", "Boston"},  
  
{"Michigan", "Lansing"},  
  
{"Minnesota", "St. Paul"},  
  
{"Mississippi", "Jackson"},  
  
{"Missouri", "Jefferson City"},  
  
{"Montana", "Helena"},  
  
{"Nebraska", "Lincoln"},  
  
{"Nevada", "Carson City"},  
  
{"New Hampshire", "Concord"},  
  
{"New Jersey", "Trenton"},  
  
{"New Mexico", "Santa Fe"},  
  
{"New York", "Albany"},  
  
{"North Carolina ", "Raleigh"},  
  
{"North Dakota", "Bismarck"},  
  
{"Ohio", "Columbus"},  
  
{"Oklahoma", "Oklahoma City"},
```

```

        {"Oregon", "Salem"},

        {"Pennsylvania", "Harrisburg"},

        {"Rhode Island", "Providence"},

        {"South Carolina", "Columbia"},

        {"South Dakota", "Pierre"},

        {"Tennessee", "Nashville"},

        {"Texas", "Austin"},

        {"Utah", "Salt Lake City"},

        {"Vermont", "Montpelier"},

        {"Virginia", "Richmond"},

        {"Washington", "Olympia"},

        {"West Virginia", "Charleston"},

        {"Wisconsin", "Madison"},

        {"Wyoming", "Cheyenne"}

    };

    //display the current contents of the array

    System.out.println("The 50 U.S. States and Their Capitals:");

    for (String[] capitalCity : statesAndCapitals) {

        System.out.println(capitalCity[0] + ": " + capitalCity[1]);

    }

    //use a bubble sort to sort the content by capital

    bubbleSort(statesAndCapitals);

```

```

        //prompt the user to enter answers (not case-sensitive) for all the
state capitals and then display the total correct count

        Scanner scanner = new Scanner(System.in);

        int countScore = 0;

        for (String[] capitalCity : statesAndCapitals) {

            System.out.println("What is the capital of " + capitalCity[0] +
"? ");

            String userCapitalInput = scanner.nextLine().trim();

            if (userCapitalInput.equalsIgnoreCase(capitalCity[1])) {

                countScore++;

            }

        }

        //display how many capitals were entered correctly by the user

        System.out.println("Your score is: " + countScore);

    }

    //bubble sort

    private static void bubbleSort(String[][] array) {

        for (int i = 0; i < array.length - 1; i++) {

            for (int j = 0; j < array.length - i - 1; j++) {

                if (array[j][1].compareToIgnoreCase(array[j + 1][1]) > 0) {

                    //elements swap

                    String[] temp = array[j];

                    array[j] = array[j + 1];

                    array[j + 1] = temp;

                }

            }

        }

    }

```

```
}  
    }  
    }  
    }  
}
```

Part 2 Overview

Now revise the code to store the pairs of each state and its capital in a Map using the HashMap function. Display the content of the Map, then use the TreeMap class to sort the map while using a binary search tree for storage. Next, your program should prompt the user to enter a state and it should then display the capital for the state.

Part 2 Code

```
import java.util.HashMap;

import java.util.Map;

import java.util.Scanner;

import java.util.TreeMap;

public class Main {

    public static void main(String [] args) {

        /*declare and instantiate a map that contains the 50 states in
        alphabetical order and their state capital*/

        Map<String, String> statesAndCapitalsMap = new HashMap<>();

        statesAndCapitalsMap.put("Alabama", "Montgomery");

        statesAndCapitalsMap.put("Alaska", "Juneau");

        statesAndCapitalsMap.put("Arizona", "Phoenix");

        statesAndCapitalsMap.put("Arkansas", "Little Rock");

        statesAndCapitalsMap.put("California", "Sacramento");

        statesAndCapitalsMap.put("Connecticut", "Hartford");

        statesAndCapitalsMap.put("Florida", "Tallahassee");

        statesAndCapitalsMap.put("Georgia", "Atlanta");

        statesAndCapitalsMap.put("Hawaii", "Honolulu");

        statesAndCapitalsMap.put("Illinois", "Springfield");
```

```
statesAndCapitalsMap.put("Indiana", "Indianapolis");  
statesAndCapitalsMap.put("Iowa", "Des Moines");  
statesAndCapitalsMap.put("Kansas", "Topeka");  
statesAndCapitalsMap.put("Kentucky", "Frankfort");  
statesAndCapitalsMap.put("Louisiana", "Baton Rouge");  
statesAndCapitalsMap.put("Maine", "Augusta");  
statesAndCapitalsMap.put("Maryland", "Annapolis");  
statesAndCapitalsMap.put("Massachusetts", "Boston");  
statesAndCapitalsMap.put("Michigan", "Lansing");  
statesAndCapitalsMap.put("Minnesota", "St. Paul");  
statesAndCapitalsMap.put("Mississippi", "Jackson");  
statesAndCapitalsMap.put("Missouri", "Jefferson City");  
statesAndCapitalsMap.put("Montana", "Helena");  
statesAndCapitalsMap.put("Nebraska", "Lincoln");  
statesAndCapitalsMap.put("Nevada", "Carson City");  
statesAndCapitalsMap.put("New Hampshire", "Concord");  
statesAndCapitalsMap.put("New Jersey", "Trenton");  
statesAndCapitalsMap.put("New Mexico", "Santa Fe");  
statesAndCapitalsMap.put("New York", "Albany");  
statesAndCapitalsMap.put("North Carolina ", "Raleigh");  
statesAndCapitalsMap.put("North Dakota", "Bismarck");  
statesAndCapitalsMap.put("Ohio", "Columbus");  
statesAndCapitalsMap.put("Oklahoma", "Oklahoma City");  
statesAndCapitalsMap.put("Oregon", "Salem");  
statesAndCapitalsMap.put("Pennsylvania", "Harrisburg");
```



```

statesAndCapitalsMap.put("Rhode Island", "Providence");
statesAndCapitalsMap.put("South Carolina", "Columbia");
statesAndCapitalsMap.put("South Dakota", "Pierre");
statesAndCapitalsMap.put("Tennessee", "Nashville");
statesAndCapitalsMap.put("Texas", "Austin");
statesAndCapitalsMap.put("Utah", "Salt Lake City");
statesAndCapitalsMap.put("Vermont", "Montpelier");
statesAndCapitalsMap.put("Virginia", "Richmond");
statesAndCapitalsMap.put("Washington", "Olympia");
statesAndCapitalsMap.put("West Virginia", "Charleston");
statesAndCapitalsMap.put("Wisconsin", "Madison");
statesAndCapitalsMap.put("Wyoming", "Cheyenne");

//display the current contents of the map

System.out.println("The 50 U.S. States and Their Capitals:");

    for (Map.Entry<String, String> entry :
statesAndCapitalsMap.entrySet()) {

        System.out.println(entry.getKey() + ": " + entry.getValue());

    }

//sort the map by states (keys) using TreeMap

Map<String, String> sortedMap = new
TreeMap<>(String.CASE_INSENSITIVE_ORDER);

sortedMap.putAll(statesAndCapitalsMap);

//prompt the user to enter a state and display its capital

```

```
Scanner scanner = new Scanner(System.in);

String state;

String capital;

while (true) {

    System.out.print("\nEnter a state name\n(or 'q' to quit): \n");

    state = scanner.nextLine().trim().toLowerCase();

    if (state.equals("q")) {

        System.out.println("Exiting program.");

        //exit loop if user wants to quit

        break;

    }

    capital = sortedMap.get(state);

    if (capital != null) {

        System.out.println("The capital of " + state.substring(0,
1).toUpperCase() + state.substring(1) + " is: " + capital);

    } else {

        System.out.println("State not found. Please try again.");

        //continue loop if state is not found

        continue;

    }

}

}
```