**CS 250 - Fall 2021 - Homework 03**

**Due date: Oct 13, 2021, 11:59 PM**

# Objectives

The objectives of this assignment are:

* Testing your ability to use array data structures in problem-solving
* Testing your ability to be familiar with linear (sequential) and binary search

# Part 1. Non-programming Questions ( 50 points)

**Q1. (16 points) Fill in the blank?**

1. **\_\_\_\_\_\_\_\_ is the process of arranging the elements in an array into a particular order**

|  |  |
| --- | --- |
| a. searching | b. Creating |
| c. sorting | d. Declaration |

1. **One of the preconditions of the binary search method is that the array has to be \_\_\_\_\_\_\_\_\_\_.**

a. random b. ordered

c. initialized d. none of the above

**3. A 2D array of int is defined as int[][] arrInt = new int[5][10]. How many elements in this array?**

a. 15 b. 10

c. 50 d. 66

**4. A 2D array of int is defined as int[][] arrInt = {{15, 6, 78}, {45, 22, 14}, {4, -1, 8}}; What is the output of the following Java code:**

**System.out.println(arrInt[1][0] + arrInt[0][1] + arrInt[2][2]);**

a. 4568 b. 45

c. 59 d. Error (exeption occurs)

**5. A(n) \_\_\_\_\_\_\_\_\_\_\_ is an array of arrays**

a. multidimensional array b. one-dimensional array

c. String d. ArrayList

**6. A(n) \_\_\_\_\_\_\_\_\_\_ is the position of an element within the array. A(n)**

**\_\_\_\_\_\_\_\_\_\_\_\_ is an actual piece of data stored or referenced in the array**

a. element, subscript b. index, type

c. element, index d. subscript, element

**Q2. (16 points) Given the following array of integers: 4, 10, 29, 31, 16, 5, 20, 26, 14, 33. Complete the following tasks:**

1. (6 pts) Draw a diagram to illustrate a linear (sequential) search of 31 in the above array, similar to slide 29 of lecture 06.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 10 | 29 | 31 | 16 | 5 | 20 | 26 | 14 | 33 |

**↳**i=0

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 10 | 29 | 31 | 16 | 5 | 20 | 26 | 14 | 33 |

**↳** i=1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 10 | 29 | 31 | 16 | 5 | 20 | 26 | 14 | 33 |

**↳** i=2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 10 | 29 | 31 | 16 | 5 | 20 | 26 | 14 | 33 |

**↳** i=3 Founded

1. (10 pts) Draw a diagram to illustrate a binary search of 14 on the above array, similar to slides 32-33 of lecture 06. Remember to sort the array before doing a binary search.

0 1 2 3 4 5 6 7 8 9

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 5 | 10 | 14 | 16 | 20 | 26 | 29 | 31 | 33 |

**↳ ↳ ↳**

**low = 0 mid = (0+9)/2 = 4 high=9**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 5 | 10 | 14 | 16 | 20 | 26 | 29 | 31 | 33 |

**↳ ↳ ↳**

**low=0 mid=(0+4)/2=2 high=4**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 5 | 10 | 14 | 16 | 20 | 26 | 29 | 31 | 33 |

**low=2 ↲ ↓ ↳ high=4**

**mid=(4+2)/2=3 FOUND**

**Q3. (18 pts) Complete the following methods by filling the missing code:**

/\*\* \* Compute the sum of elements on each row of a 2D array

* @param arr -- a 2D integer array
* @return None but print the sum of the elements on each row of arr

\*/

public static int[] sumByColumns(int arr[][]){

//**TODO**: add code below

int intArr[] = new int[arr.length];

for (int row = 0; row < arr.length; row++)

for (int col = 0; col < arr[row].length; col++) {

intArr[row] += arr[row][col] ;

}

return intArr;

}

Complete the above-incompleted method to compute the sum of all elements on the same row for each row of the input array (arr). For example, given the following 2D array defined as int[][] arr = {{2, 4, 3, 4}, {7, 3, 4, 3}, {3, 3, 4, 3}, {9, 3, 4, 7}}; This array can be visualized as follow

|  |  |  |  |
| --- | --- | --- | --- |
| 2 | 4 | 3 | 4 |
| 7 | 3 | 4 | 3 |
| 3 | 3 | 4 | 3 |
| 9 | 3 | 4 | 7 |

If you call the above method with this array, it should print the following numbers 13, 17, 13, 23. Note: 13, 17, 13, and 23 are the sum of elements on the first row to the last row correspondingly).

**Hint**: Here are some steps to help you solve this problem:

* Define a 1D array to store the result (the length of this array should be the number of rows in the input array)
* Use two for loop to iterate through elements in the array, calculate the sum of the elements on each row, and print it to console.