

**Problem:**

We have  $m$  by  $n$  array where each row and each column are sorted, and we want to find the location of a given target item. There are various methods to solve this problem. In this project, you should use the **divide and conquer** method.

Write a **Java program** using **divide and conquer algorithm** that checks the item in the middle row and middle column. If that value is the target, print the location of the target. If the value in the middle row and column is too small, we can rule out the top left portion of the array. If the value in the middle row and middle column is too large, we can rule out the bottom right portion of the array. In either case where the value is not found, we are left with three subarrays, each approximately one-quarter the size of original one.

Please note that only code following the specified method will be accepted for this project.

**Input Format:**

Create **input2.txt** file in the same directory as the java and class files. "**input2.txt**" will be entered as a command line argument. The first line will have two integers  $m$  and  $n$  (representing the number of rows and columns). The second line of the file will have the target value. The next  $m$  lines will each contain  $n$  values in increasing order.

**Output Format:**

Your program should print the location (row and column) of the target and all the subarrays. If the target isn't in the array, your program should print "NOT FOUND".

**Notes:**

- For simplicity, our array contains no repeated numbers.
- When printing the location of the target, the location of the first element in the array is (1,1).
- Your Java program should be **commented, indented, and structured**. Output should be sent to **System.out**. The program should be named project2. Please place all your files (.java, .class, .txt) in a directory named after you, zip them and submit them to canvas. Don't include any extra files and directories from IDE environment. The program must compile with the command **javac \*.java** and run with the command **java project2 input2.txt**. Remember input2.txt is the command line argument.
- Don't place the classes in a package (use default package).

**Example:**

If input2.txt contains:

6 5

14

1 4 5 10 11

2 6 7 12 16

8 9 15 19 20

14 21 27 32 35

38 41 47 50 53

52 61 64 66 68

Then output will be:

Subarray:

1 4

2 6

Subarray:

5 10 11

7 12 16

Subarray:

11

Subarray:

7 12

Subarray:

16

Subarray:

8 9

14 21

38 41

52 61

Target location at:

4 1

First, you checked element at location (3,3) = 15, which is larger than your target, 14. You should then rule out the subarray:

15 19 20

27 32 35

47 50 53

64 66 68

And leave the 3 subarrays that you should check each one recursively:

1 4

2 6 → You don't need to check this one since the target isn't in range of 1 and 6.

5 10 11

7 12 16 → You should check the element at location (1,4)=10, which is smaller than your target, 14. You should then rule out 5 10. It leaves 3 new subarrays that you should check each one recursively.

Subarray: 11

Subarray: 7 12

Subarray: 16

8 9

14 21

38 41

52 61 → You should check the element at location (4,1)= 14, which is the target. Print the target location!