

Masha task (MMAN) 14

Course: 20441 - Introduction to Computer Science and the Java Language

Task object: efficiency and recursion

Study material for the assignment: Units 9-10

Task weight: 5 codes

Number of questions: 4

Deadline for submission: 2022.1.15

Semester: 2022 a

The questions in this assignment are clients from final or similar exams to final exam questions. It is highly recommended, in the first stage, to do them without running on a computer (as is customary in the final stage).

You must write the answers to all the questions in one class called java.Ex14 (exactly).

Write the answers to the complexity questions as part of the API.

Codes 25 -1 question

Give a one-dimensional array a full of integers.

Write a static method, which accepts as such a parameter an array, and that there are integers x and y. The method should

Return the maximum distance from cell cells between these six numbers in the array. It can be expressed

That the numbers x and y are equal to each other.

If one of the numbers (or both) is not found in the array, the value VALUE_MAX.Integer) number will be returned

The maximum possible whole).

The signature of the method is:

```
public static int findMinDiff (int [] a, int x, int y)
```

For example,

If the array a is this:

0	1	2	3	4	5	6	7	8	9
1	3	5	4	8	2	4	3	6	5

x = 3, y = 2: are y and x the numbers if •

The number 3 is found in the array of indexes 1 and 7

The number 2 is found in an array in Idex 5

Therefore, the minimum distance between 3 and 2 in the array is 2) between the Idex 5 and the Idex 7.

The method will return 2

$x = 2, y = 5$: are y and x the numbers if •

The method will return 3) The distance between INDEX 2 and INDEX 5 (

$x = 2, y = 7$: are y and x the numbers if •

The method will return VALUE_MAX.Integer (because the number 7 is not in the array)

pay attention:

The method you write should be as effective as possible, both in terms of time complexity and

Stimulates the complexity of the place. An answer that is effective enough means that it will be complicated

Larger than the required to solve the problem you will get only a few points.

What are the running time complications and place complications of the method you wrote?

Explain your answer.

Do not forget to document what you wrote!

Codes 25 -2 question

In this question, refer to quadratic two-dimensional arrays, that is, the number of rows and columns is equal.

Which is equal to n . (

• For the purpose of the question n is an integer

power of 2 for such an array, n define its physical division into four quarters of size $2 / n \times 2 / n$, numbered from 1 to 4

as follows:

1	2
4	3

, n said that the array is **circular** (if all the members in the 1st district are exactly all of those in the 2nd district, those in the 2nd district are exactly all of those in the 3rd district, and those in the 3rd district are literally all of those in the 4th district).

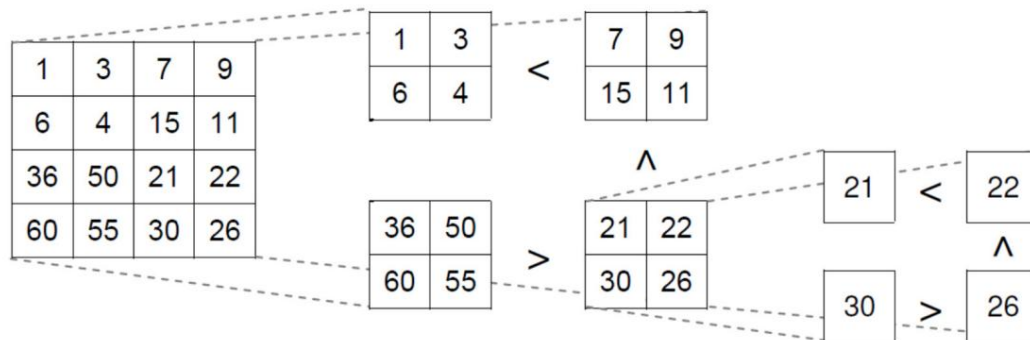
For example, the following array is rotary:

1	5
9	7

For the statements, n also define each 1×1 array as a rotary array. n It is said that an $n \times n$ array is **sorted-circular** (sorted circular), if it is rotary, the four quarters

• Its rotary, and so on up to 1×1 quarters

For example, the following array is sorted-rotationally:



You must write a Boolean static method for searching in a sorted-rotation array. The method accepts

As parameters, a two-dimensional array of mat that is sorted-rotationally, and a value to search for num.

· In the mat array, the method will return true. If the value num is not found in the mat array, the method will return false

~~You must write a Boolean static method for searching in a sorted-rotation array. The method accepts~~

~~As parameters, a two-dimensional array of mat that is sorted-rotationally, and a value to search for num.~~

~~In the mat array, the method returns true and prints the row number and column number where it find the number~~

~~num .If the value num is not found in the mat array, the method will return false and nothing will be printed.~~

The signature of the method is:

public static boolean search (int [] [] mat, int num)

For

,**example**, if the mat array is the array drawn above, and the number num is 22, the method returns the value true

~~And the following lines will be printed:~~

~~row = 2~~

~~col = 3~~

,If the array mat is the array drawn above, and the number num is 23, the method will return the value false

~~And nothing will be printed.~~

You can assume that the array mat is zero or is rotationally sorted. You need to check this out.

pay attention:

The method you write should be as effective as possible, both in terms of time complexity and

Stimulates the complexity of the place. An answer that is effective enough means that it will be complicated

Larger than the required to solve the problem you will get only a few points. What

are the running time complications and place complications of the method you wrote? Explain

your answer. Do not forget to document what you wrote!

Codesjö 25 -3 question

Write a Boolean recursive static method that takes an array of integers arr. The method should

Return true if it is possible to divide **all** the members of the array into two equal groups of **equal size** (ie a number

The organs in them are the same) so **that the sum of the organs in the two groups is equal**. If this is not possible, the method

Return false.

The signature of the method is:

public static boolean equalSplit (int [] arr)

Examples:

• For the following array:

0	1	2	3	4	5
-3	5	12	14	-9	13

The method will return true because $13 + 9 + -12 = 14 + 5 + 3$ -and each group has 3 members

• For the following array:

0	1	2	3	4	5
-3	5	-12	14	-9	13

The method will return false because $13 + 9 = -12 + -14 + 5 + 3$ -but the number of members

In both groups it is equal (in one there are four organs and in it there are only two).

• For the following array:

0	1	2	3	4
-3	5	-12	14	-9

The method will return false because there is no division of the array members into two groups of equal size.

The method you write should be recursive with no use of loops at all. So are all the auxiliary methods

What you write (if you write) can not contain loops.

You can use overloading. It can be assumed that the array is null and empty.

Do not change the contents of the array (not even temporary), and do not use an auxiliary array.

There is no need to worry about the effectiveness of the method! But of course care should be taken not to make recursive readings

Unnecessary!

Do not forget to document what you wrote!

Codesys 25 -4 question

Define **special** numbers by the following explanation and example: Take the set of positive integers:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20...

Now Delete any number in the group, and it will remain with the following group:

1, ~~2~~, 3, ~~4~~, 5, ~~6~~, 7, ~~8~~, 9, ~~10~~, 11, ~~12~~, 13, ~~14~~, 15, ~~16~~, 17, ~~18~~, 19, ~~20~~...

i.e. the group that remains is:

1, 3, 5, 7, 9, 11, 13, 15, 17, 19...

Now delete all third numbers in the remaining group, and stay with the following group:

1, 3, ~~5~~, 7, 9, ~~11~~, 13, 15, ~~17~~, 19...

That is, the group that remains is:

1, 3, 7, 9, 13, 15, 19...

And so it continues the process endlessly.

Any number that is not deleted during the process is called a "special number". Therefore, the beginning of the set of special numbers is:

1, 3, 7, 13

Write a recursive Boolean static method, which accepts an integer n parameter and returns true if

The number is a special number and otherwise false.

The signature of the method is:

public static boolean isSpecial (int n)

Possible clue to the

solution - note that if it locates any number, after each "round" of deletions, its position in the series is

Other. Look, for example, at the number 7. At first its position is, of course, 7. After deleting each number

Shi, he becomes the fourth number in the series. After deleting every third number from the series, it becomes

Be the third number in the series. Even after deleting every fourth number in the series (and so on), it will remain

The third number in the series. And is indeed a special number.

Think about how to calculate the next **position** of the number, when you know what the current position is, and what number

Is the one to be deleted (every Friday, every Tuesday, every Wednesday, etc.).

The method you write should be recursive with no use of loops at all. So are all the auxiliary methods

What you write (if you write) can not contain loops.

Overloading can be used.

pay attention:

In questions 3 and 4 there is no need to worry about the effectiveness of the method you will write! **But of course you have to put**

Be careful not to make unnecessary recursive readings! Global

**setups outside the methods themselves must not be used! In all questions - do not forget to
document what you wrote!**

Note that there is a tester on the course website. The tester must run with the department you wrote

No compilation errors. If there is a method that you did not write, write a signature and return an entry

**Just for the tester to run with the class without compilation errors. If the tester runs,
compilation errors are detected. The score on the task will be zero, without**

Possibility of appeal.

submission

1. The submission of the financial statement was done only electronically, through the task sending system.

2. Make sure that the names of the methods are **exactly** as defined in the MMAN.

3. You must document all the methods you write in the API documentation and in the physical documentation that explains what

You did the method. In this documentation they also wrote about the complexities of the methods (in questions 1 and 2).

4. You must write the answers to all the questions in one class called java.Ex14 (exactly). Packed

ÿ Itý insideÿ aÿ zipÿ fileÿ .Do not send ÿÿ filesÿ.

Successfully