

Test 2022-2023-KEN1120-RegularExam



Number of questions: 10

Session period: 26 october 2022 09:00 - 11:00

Duration: 120 minutes

Instruction

Instructions to students:

- The exam consists of 10 questions.
- Answer every question in the online form. Use the sheets provided for brainstorming and scratch space.
- Ensure that you properly motivate your answers (except for multiple choice, true/false, etc.).
- Provide clear explanations. Answers that cannot be easily understood may lower your grade.
- You are not allowed to have a communication device within your reach, nor to wear or use a watch.
- You have to return all pages of the exam (and the Chromebook as well). You are not allowed to take any sheets, even blank, home.
- If you think a question is ambiguous, or even erroneous, and you cannot ask during the exam to clarify this, explain this in detail in the space reserved for the answer to the question. Similarly, if you need to establish assumptions to solve the exercise, clearly describe them
- If you have not registered for the exam, your answers will not be graded, and thus handled as invalid.
- Success! Break a pencil (a keyboard?).

Question 1 – Multiple choice – Question-ID: 118828 (5 points)

A variable:

- A Can hold values *←* *apparently, yes*
- B Has a name which represents a position in the memory *no*
- C Can change during the execution of the code *✓*
- D All the other options are valid

Question 2 – Open-ended – Question-ID: 118819 (6 points)

Answer the following questions:

a. What does the following message mean and how is it generated?

Exception in thread "main" java.lang.ArithmeticException: / by zero
when during runtime, a division by 0 is attempted

b. Write TWO Java statements that can lead to this error. Each statement must include a different possible source for this error to be valid.

*a / 0 a % 0 • Division by 0] -> exception
• Modulo by 0] -> exception*

✓ Question 3 – Hotspot: 5 hotspots – Question-ID: 118798 (5 points)

Mark the **compilation** errors in the code below:



```
public static String exam2022_2023(int a, b) {  
    boolean bool; ← not initialized anywhere before it is returned  
    String c = a+b;  
  
    if(c < a > 0)  
        System.out.println("b is negative");  
    else  
        bool = false;  
  
    return bool;  
}
```

✓ **Question 4 – Fill in (multiple) – Question-ID: 118799 (5 points)**

Fill the gaps to complete a piece of code that prints all the odd numbers from a to b (both inclusive) but backwards. You must consider that both numbers are positive and that $a \leq b$.

```
public static void fillGaps(int a, int b) {  
    for(int i=b; i>=a; b--) {  
        if(i%2!=0)  
            System.out.println(i);  
    }  
}
```

✓ **Question 5 – Multiple choice – Question-ID: 118826 (4 points)**

What will be the outcome of the following code snippet?

```
1 String a = "1", b="2";  
2  
3 if(a!=b)  
4     System.out.println("Both numbers are different");  
5     System.out.println("Both numbers are equal");
```

- A Both numbers are different
- ☒ B None of the other options → it will print both statements
- C Will not compile. There is a syntax error in line 1
- D Both numbers are equal
- E Will not compile. There is a syntax error in line 3

✓ **Question 6 – Fill in – Question-ID: 118789 (5 points)**

Which would be the array returned by the following method when called as `createArray(10)`?

```
public static int[] createArray(int numElements) {  
    int[] array = new int[numElements];  
  
    for(int i=0; i<array.length; i=i+2) {  
        if(i%2!=0)  
            array[i] = i;  
        else  
            array[i] = i+1;  
    }  
    return array;  
}
```

| i | |
|----|------------|
| 0 | arr[0] = 1 |
| 2 | arr[2] = 3 |
| 4 | 5 |
| 6 | 7 |
| 8 | 9 |
| 10 | |

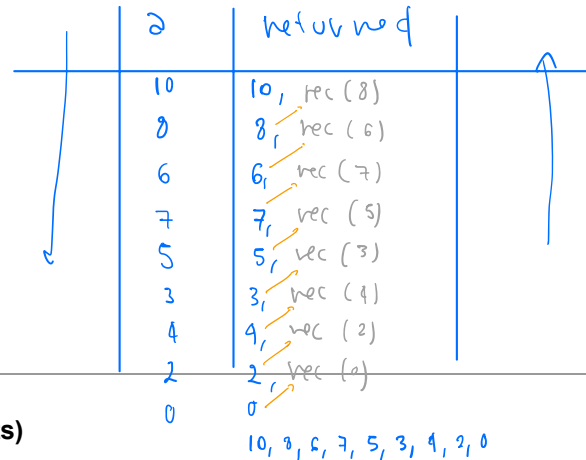
Note: In the solution, use square brackets, separate the elements of the array with commas and do not leave any spaces between elements such as in this example: `[1,1,1,1]`

`[1, 0, 3, 0, 5, 0, 7, 0, 9, 0]`

✓ **Question 7 – Fill in – Question-ID: 118792 (5 points)**

Given the recursive method below, which is the expected output when called as `recursion(10)`?

```
public static String recursion(int a) {  
    if(a<=0)  
        return "0";  
    else if(a%3==0)  
        return a+", "+recursion(a+1);  
    else  
        return a+", "+recursion(a-2);  
}
```



Question 8 – Open-ended – Question-ID: 118800 (15 points)

Shifting vectors

A vector (or 1D array) is just a list of elements. In this exercise, our vector contains an **indeterminate** number of integers in a **disordered** matter. You must implement a method that, given two vectors, calculates the **number of shiftings to the left** (see example below) **needed to transform the second one (defined as vector) to the first (also called target)**. If this is not possible, the method must **return -1**. Some examples are provided below:

Example 1: Given `target = [0,1,2]` and `vector = [2,0,1]`, the method must return 1 since, while moving all the elements to the left just once (and making the element in position 0 the last one in the resulting vector), both vectors are equal. You can see it visually as:



Example 2: Given `target = [0,1,2,3]` and `vector = [1,2,3,0]`, the method must return 3 since we need three shiftings (moving all the elements to the left and moving the element in position 0 to the last position AFTER EACH SHIFTING) to make both vectors equal. This time, the steps would be, visually:



Example 3: Given `target = [0,1,2]` and `vector = [3,0,1]`, the method must **return -1** since, vector cannot be equal to target, regardless the number of shiftings performed (different elements in each vector)

Example 4: Given `target = [0,1,2]` and `vector = [2,2,0,1]`, the method must return -1 since, vector cannot be equal to target, regardless the number of shiftings performed (size is different).

Use the following signature for the method to be implemented:

```
public static int shiftedEqual (int[] target, int[] vector)
```


Question 9 – Open-ended – Question-ID: 118803 (15 points)

Additions

In this exercise, the method to be implemented must calculate the minimum number of additions needed to reach a specific value from a given one. However, there are some restrictions. In order to reach the target value, only values equal to or less than the initial one can be used. See the following examples for clarification.

Example 1: Given an `initial` value of 3 and a `target` value of 7, we would need a minimum of 2 addition operations. The first one can use the initial number ($3+3=6$). However, for the second operation, we must use a number which is lower, 1 in this case ($3+3+1=7$). Therefore, the minimum number of additions is 2. Notice that, as you cannot use a number greater than the initial one, 4 cannot be used ($3+4=7$ would lead to 1 operation but this operation is not valid).

Example 2: Given an initial value of 4 and a target of 15, the output of the method must be 3 ($4+4+4+3=15$)

Use the following signature for the method to be implemented:

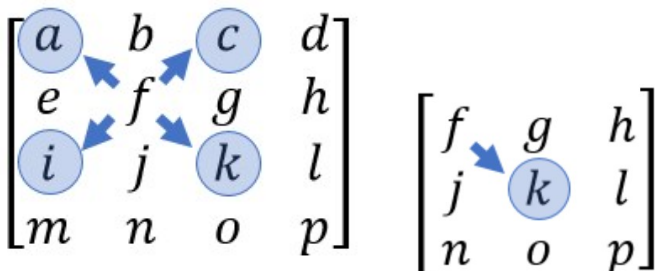
```
public static int additions(int initial, int target)
```

Question 10 – Open-ended – Question-ID: 118801 (15 points)

Checking diagonal

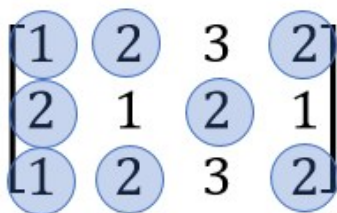
We have a program that works with 2D arrays of integers. To improve this program, we want to implement a new method able to calculate how many elements in the array meet a condition. The condition is that the element has all its neighbouring elements in the diagonal direction equal to it. Notice that each element has, at most, four neighbouring elements in its diagonals, namely left-up, left-down, right-up and right-down (see figure below). The input array can have any dimension and shape (different numbers of rows and columns may apply).

For clarification, the following images visualize the "neighbouring elements in the diagonal direction" of the element with value f in two different cases. In the first one, the element has four "neighbouring elements in the diagonal direction" while in the second example it has only one.

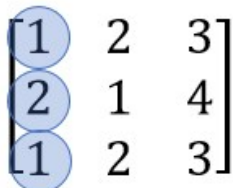


Some examples of the expected behaviour of the method are given below.

Example 1: With the given 2D array, the method must return 6 (see the elements in a circle). Notice that, for elements in the borders, not all four diagonals exist



Example 2: In this second example, only the elements in the first column meet the requirement.



Use the following signature for the method to be implemented:

```
public static int equalDiagonals(int[][] array)
```

End of test 2022-2023-KEN1120-RegularExam

