

CE Stable CODE

| 10/17/2022

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Attempt 1



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Sorting

CE: Stable CODE



Learning Objectives

- Demonstrate the behavior of stable sorting algorithms.
- Compare and contrast stable algorithms from algorithms that are not stable.
- Create a custom class, that provides two different ways to compare its objects.

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Overview

In this CE, you will create a class `Rectangle` that provides two different ways of sorting its objects. It implements the interface `Comparable` which sorts the rectangles by length (the natural order) and it exposes a `Comparator` that allows its objects to be sorted by area.

You will create an array of rectangles and sort its elements twice, first by lengths and then by area, to demonstrate stability. You will check and confirm that rectangles with the same area maintained the original order.

Then you'll repeat the sorting of the array using an algorithm that is not stable and compare the results.



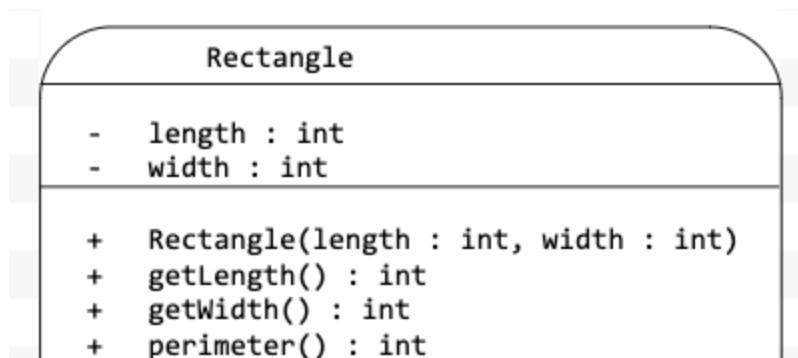
Instruction

- Create a package called **ceStable**.

Add a class **Rectangle** as described below and a class called **StablesApp** that includes the main method.

- **Class Rectangle:**

Implement the class as specified in the UML class diagram.

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[{length}x{width}]

where {length} and {width} are the corresponding field values. E.g., [4x2]

In addition, implement the interface **Comparable<Rectangle>**.

The method `compareTo` should compare rectangles based on their length. The width should be irrelevant for the comparison.

Also, provide a second way of sorting rectangles by creating a nested static class called **CompareByArea** that implements **Comparator<Rectangle>**. It compares rectangles based on their area.

Add a static final constant called **BY_AREA**. It is initialized with an object of type `CompareByArea` and provides convenient access to a `Comparator<Rectangle>`.

- **Class StablesApp**

In this class, we demonstrate the difference between a stable sort and a sort that is not stable.

1. Create an array of rectangles and initialize it with the following eleven rectangles: [4x2], [3x5], [4x3], [6x2], [3x4], [4x4], [6x4], [12x2], [2x4], [4x6], and [2x12]
2. Print the rectangles

3. Print a header "Stable Sort:"

4. Sort the array rectangles using the natural order and print the results.

You can use any sorting method you like. E.g., the method `sort` from class `Arrays` or one of the sorting algorithms from `algs4`.

When demonstrating stability, only the algorithm of the second sort matters.

5. Sort the array again - this time by area.

Use Insertion-sort which is a stable sorting algorithm and print the results.

Notice: multiple rectangles have the same area.

E.g., [3x4], [4x3], [6x2] all have an area 12

E.g., [2x12], [4x6], [6x4], [12x2] have an area 24

Also, notice that all rectangles within the same area remain sorted by length. That's because we used a stable sorting algorithm.

6. Print a header "Not-Stable Sort"

7. Repeat step 4)

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[4x6] is listed before [2x12] which means, rectangles with the same area are no longer ordered by length. That's because we used a sorting algorithm that was not stable

Format your output using labels and white space to match the expected output shows below.



Expected Output

This output has fairly long lines. You might need to increase the width of your browser window to see the proper linebreaks. Verify that [4x6] and [2x12] are in the appropriate order after sorting by area.

```
rectangles : [[4x2], [3x5], [4x3], [6x2], [3x4], [4x4], [6x4], [12x2], [2x4], [4x6],
[2x12]]
```

Stable Sort:

```
sorted by length: [[2x4], [2x12], [3x4], [3x5], [4x3], [4x4], [4x2], [4x6], [6x4], [6x2],
[12x2]]
```

```
sorted by area : [[2x4], [4x2], [3x4], [4x3], [6x2], [3x5], [4x4], [2x12], [4x6], [6x4],
[12x2]]
```

Not-Stable Sort:

```
sorted by length: [[2x4], [2x12], [3x4], [3x5], [4x3], [4x4], [4x2], [4x6], [6x2], [6x4],
[12x2]]
```

```
sorted by area : [[2x4], [4x2], [3x4], [4x3], [6x2], [3x5], [4x4], [4x6], [2x12], [6x4],
[12x2]]
```



Submission

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