

CSC 230: Elementary Data Structures and Algorithms
Fall 2020
Exam 2

- General programming guidelines:
 - Create a folder with the name “Exam-2” and save all your Netbeans projects in there.
 - For each programming question, create a separate NetBeans project with the name `QuestionXX`, where `XX` is the question number.
 - Do not forget necessary javadoc comments before classes and methods.
 - You should use *single line* or *multiline* comments, **if it is required**. Do not put unnecessary comments (Do not state the obvious!!!).
 - Use meaningful identifier.
 - Don’t forget to check the parameters of your methods and throw appropriate exceptions as necessary.
 - Both of these questions require Java generics. Make sure to use them properly. Your working code doesn’t mean that you use generic properly. Make sure to follow all the guidelines discussed in the class. Do not use raw types.
 - **Creating correct NetBeans projects, zipping your final exam folder, and testing it before uploading are your responsibilities. If any of these steps fails, you will receive a grade of zero.**
 - If you have questions or need clarifications, just ask.
- Academic integrity policy
 - You are **not** allowed to use any online resources EXCEPT Revel, class lecture notes and Java documentation.
 - All programs/ code must be your own work.
 - You should be able to clearly explain every line of your code, if instructor requests you to do so.
 - Any violation of these policies will be considered as plagiarism and dealt accordingly.

Question 1 (50 Points) Write a method (`findSecondMin`) to search for the second minimum element of an array (formally, second minimum is larger than the minimum but smaller than all the other elements in the array). Note that you need to have an array of size at least two (throw `IllegalArgumentException`, if that is not the case). Also, if you array has the same element, you will not have a second minimum even if it has more than one element (throw `NoSuchElementException`, in that case). **Note:**

- Your `findSecondMin` method must be generic and **proper** generic application guidelines must be used.

- The method should take the array as a parameter and return the element, if it has a second minimum.
- You must use the provided NetBeans project. Do not change the content in the `main`. Expected output is shown below the `main` method inside comments. If you look at carefully, it is not hard to understand why output should look like that.

Question 2 (50 points): Write a generic version of insertion sort algorithm. Your method should take an array as a parameter and return the sorted array. Create a `Circle` class and implement `Comparable` interface so that you can compare two circles (use radii of the circle for comparison). Then, show that your sorting algorithm works by sorting an array of circles.

- Your `sort` method must be generic and **proper** generic application guidelines must be used.
- Pseudo code for insertion sort is in your asymptotic analysis lecture notes.
- You may use the same `Circle` class implementation of question 1 for this task (just copy and paste it to your `Question02` project).
- Make sure to give few test cases. For each case, print the original array of circles and the sorted array.