ASHESI UNIVERSITY

CS222: Data Structures and Algorithms
Fall Semester (Aug - Dec 2023)
Lab Exercise 2 (Generics)

STATEMENT ABOUT ACADEMIC HONESTY AND INTEGRITY

Academic honesty and integrity are very important at Ashesi and central to the achievement of our mission: To train a new generation of ethical and entrepreneurial leaders in Africa to cultivate within our students the critical thinking skills, concern for others, and the courage it will take to transform a continent. As this mission is our moral campus, we recommend you take it seriously in this course without any exceptions at all.

Ashesi therefore does not condone any form of academic dishonesty, including plagiarism and cheating on tests and assessments, amongst other such practices. Ashesi requires students to always do their own assignments and to produce their own academic work unless given a group assignment.

As stated in Ashesi's student handbook, Section 7.4:

"Academic dishonesty includes plagiarism, unauthorized exchange of information or use of material during an examination, unauthorized transfer of information or completed work among students, use of the same paper in more than one course, unauthorized collaboration on assignments, and other unethical behaviour. Disciplinary action will be taken against perpetrators of academic dishonesty."

All forms of academic dishonesty are viewed as misconduct under Ashesi Student Rules and Regulations. Students who make themselves guilty of academic dishonesty will be brought before the Ashesi Judicial Committee and such lack of academic integrity will have serious consequences for your academic records.

INSTRUCTIONS:

1. This is an individual assignment. So, every student must independently work and submit.
2. This lab assignment contains *two* questions. You are required to solve both of them.
3. Each question carries 50 Marks and thus the total assignment will be evaluated for 100 Marks.
4. You are required to show the execution of your program as a screen-recorded video (max 5 min) and may have to answer oral questions to prove your knowledge and understanding of the concepts.
5. Your solution program should contain comments explaining statements that involve important computations.
6. You need to upload your original '.java' file, screen-recorded video, and a document (pdf/Word) containing an answer to the oral question given in the class.
7. Marks for each question are awarded as follows.
   Submission: 10%
   Execution: 20%
   Comments on program statements: 10%
   Answering oral questions: 10%
8. The deadline for submission: 15 September 2023, 12 PM.

PROBLEM 1:

Building a Generic Inventory System:

You are tasked with creating a generic inventory system for a store. The store sells various types of products, such as electronics, clothing, and books. Each product has a name, a price, and a quantity in stock. Your goal is to design a generic inventory system that can manage different types of products using the generics concept in Java.

Create a Product class that is generic and can store information about a product, including its name (a String), price (a double), and quantity in stock (an integer).

Create a StoreInventory class that uses generics to store products in an inventory. It should provide methods for the following operations:

addProduct: Adds a product to the inventory.

removeProduct: Removes a product from the inventory based on its name.

findProduct: Finds and returns a product in the inventory based on its name.

listAllProducts: Lists all the products in the inventory.

getTotalValue: Calculates and returns the total value of all products in the inventory (sum of price * quantity for each product).

Create classes for specific types of products (e.g., ElectronicProduct, ClothingProduct, and BookProduct) that extend the Product class. Each of these classes should have constructors to initialize their specific properties.

Demonstrate the use of your generic inventory system by creating instances of the StoreInventory class and adding various products to it. Test all the methods to ensure they work correctly with different types of products.

Calculate and display the total value of the inventory.

Optionally, implement additional functionality such as updating product quantities or prices, sorting products by name or price, or finding the most expensive product in the inventory.

PROBLEM 2:

Building a Generic Data Storage System

You are asked to design a generic data storage system that can store and manage various types of data. The system should be able to store data, retrieve data by its identifier, and provide statistics on the stored data.

Create a DataEntry class that is generic and can store information about a data entry. Each data entry has an identifier (a unique string), a data value (of any type), and a timestamp (a long value representing the time of entry).

Create a DataStorage class that uses generics to store data entries. It should provide methods for the following operations:

addEntry: Adds a data entry to the storage.

retrieveEntry: Retrieves a data entry based on its identifier.

getEntryCount: Returns the total number of data entries.

getAverageTimestamp: Calculates and returns the average timestamp of all data entries.

Demonstrate the use of your generic data storage system by creating instances of the DataStorage class and adding various data entries to it. Test all the methods to ensure they work correctly with different types of data.

Optionally, implement additional functionality such as removing entries, listing all entries, or finding the entry with the earliest or latest timestamp.