1. **Classes exercise.**

   Implement console program which will meet the following requirements:
   a. Implement class Book that has next properties:
      i.   int id - unique identifier
      ii.   String name - name of a book
      iii. Author[] authors - array of authors
      iv.   Publisher publisher - book publisher
      v.   int publishingYear - year of publishing
      vi.   int amountOfPages - amount of pages
      vii. BigDecimal price - price of a book
      viii. CoverType coverType - type of book binding, enum (Paperback, Hardcover)

   b. Implement Author class that has next properties:
      i.   int id - unique identifier
      ii.   String firstName - author's first name
      iii. String lastName - author's last name

   c. Implement Publisher class that has next properties:
      i.   int id - unique identifier
      ii.   String publisherName - name of a publisher

   d. Implement multiple constructors for Book, Author and Publisher class.

   e. Implement enum type CoverType with two enums - Paperback and Hardcover

   f. Override toString methods for Book, Author and Publisher class.

   g. Implement class BookService with the next methods

   public Book[] filterBooksByAuthor(Author author, Book[] books) {
   *   <write your code here>*
   }

   public Book[] filterBooksByPublisher(Publisher publisher, Book[]
   books) {
   *   <write your code here>*
   }

   // methods keeps books with publishing year inclusively.
   public Book[] filterBooksAfterSpecifiedYear(int yearFromInclusively,
   Book[] books) {
   *   <write your code here>*
   }

h. Implement a Demo class that has the main method. In demo class perform next actions:

    i. Create an array of books. You can use the next variable for demo purposes.

```
Book[] books = new Book[] {
new Book(1, "Book_1", new Author[] { new Author(1, "Jon", "Johnson")
}, new Publisher(1, "Publisher_1"), 1990, 231,
BigDecimal.valueOf(24.99), CoverType.PAPERBACK),

new Book(2, "Book_2", new Author[] { new Author(1, "Jon",
"Johnson"), new Author(2, "William", "Wilson") }, new Publisher(2,
"Publisher_2"), 2000, 120, BigDecimal.valueOf(14.99),
CoverType.PAPERBACK),

new Book(3, "Book_3", new Author[] { new Author(3, "Walter",
"Peterson") }, new Publisher(1, "Publisher_1"), 1997, 350,
BigDecimal.valueOf(34.99), CoverType.HARDCOVER),

new Book(4, "Book_4", new Author[] { new Author(4, "Craig",
"Gregory") }, new Publisher(3, "Publisher_3"), 1992, 185,
BigDecimal.valueOf(19.99), CoverType.PAPERBACK) };
```

    ii. Create an instance of the BookService type and demonstrate the work of BookService methods, namely - filterBooksByAuthor, filterBooksByPublisher, filterBooksAfterSpecifiedYear.

2. **Inheritance and polymorphism exercise**

Implement console program which will meet the following requirements:

a. Implement a hierarchy of Sweets. All Sweets should have next properties: name, weight and sugarWeight. Weight is a weight of the specific sweet in kilograms. sugarWeight is a weight of sugar in this sweet in kilograms.

I don't want to give you specific directions here to give you an opportunity to decide what will work the best here to start describing the Sweet hierarchy: an interface or an abstract class?

b. Candy, Lollipop and Cookie - three other types from Sweet hierarchy.

c. Create class Present. Present has next behavior:

```java
// the method filters sweets by sugar weight inclusively
public Sweet[] filterSweetsBySugarRange(double minSugarWeight,
double maxSugarWeight) {
        <write your code here>
}

// the method calculates total weight of the present
public double calculateTotalWeight() {
        <write your code here>
}

// the method that adds sweet to the present
public void addSweet(Sweet sweet) {
        <write your code here>
}

// the method returns copy of the Sweet[] array so that nobody could
// modify state of the present without addSweet() method.
// Also array shouldn't contain null values.
public Sweet[] getSweets() {
        <write your code here>
}
```

3. Inner and Nested Classes exercise

   Implement console program which will meet the following requirements:
   a. Implement class Account. Class Account has next fields:
      i.   int id
      ii. Transaction[] transactions

   b. Implement enum StandardAccountOperations that contains next enums:
      i.   MONEY_TRANSFER_SEND
      ii. MONEY_TRANSFER_RECEIVE
      iii. WITHDRAW

   c. Implement nested class Transaction that has next fields:
      i.   Account accountFrom
      ii. Account accountTo
      iii. double moneyAmount
      iv. StandardAccountOperations operation

   d. In Account class implement next methods:

      public void sendMoneyToAccount(Account accountTo, double

```
        moneyAmount) {
                <write your code here>
        }

        public void withdrawMoney(double moneyAmount) {
                <write your code here>
        }

        public Transaction[] getTransactions() {
                <write your code here>
        }
```

e. Pay attention that when money is sent from one account to another - one transaction MONEY_TRANSFER_SEND created in one account, and the second transaction MONEY_TRANSFER_RECEIVE is created in other account.

4. EXAM! Implement console program which will meet the following requirements:

You have to implement a backend for an online shop. The system should support such basic operations as:
- User registration
- User sign in and sign out
- Product catalog navigation
- Adding product to cart
- Submitting an order
- Checkout
- Users management
- And others

This code will be used in further education and next topics and will end up with creating your web e-commerce application.

*** MENU NAVIGATION ***

Scenario - main menu
GIVEN I'm an app user
WHEN I run the program
THEN I see the main menu

Tech notes:
Main menu consists of the next items:

1. Sign Up
2. Sign In / Sign Out
3. Product Catalog
4. My Orders
5. Settings
6. Customer List

When User is logged in, then paragraph 2 label is changed to "Sign Out" instead of Sign In.

Scenario - stop the program
GIVEN I'm an app user
AND I'm in main menu
WHEN I enter **'exit'** in console
THEN program execution is stopped

Scenario - incorrect input handling
GIVEN I'm an app user
WHEN I entered any digit except 1, or 2, or 3, or 4, or 5
THEN I see the error message "Only 1, 2, 3, 4, 5 is allowed. Try one more time."
AND I navigated back to the main menu

*** SIGN UP ***

Scenario - new user sign up
GIVEN I'm an app user
AND I see main menu in console
WHEN I entered 1
AND I selected 'Sign Up' in main menu
THEN registration process is started
AND I asked to enter my first name
AND I asked to enter my last name
AND I asked to enter my password
AND I asked to enter my email
AND application successfully registered me
AND I see notification that 'New user is created'
AND I navigated back to main menu
AND instead of 'Sign In' I see 'Sign Out' label

Technical note:
- Each new user should have an ID.
- The ID number should be automatically incremented for each new user (static counter field should be a part of DefaultUser class)

Scenario - new user sign up - unique email successful validation
GIVEN I'm an app user
AND I see main menu in console

WHEN I entered 1
AND I selected 'Sign Up' in main menu
THEN registration process is started
AND I asked to enter my first name
AND I asked to enter my last name
AND I asked to enter my password
AND I asked to enter my email
AND I enter unique email
AND application successfully registered me
AND I see notification that 'new user is created'
AND I navigated back to main menu
AND instead of 'Sign In' I see 'Sign Out' label

Scenario - new user sign up - unique email unsuccessful validation
GIVEN I'm an app user
AND I see main menu in console
WHEN I entered 1
AND I selected 'Sign Up' in main menu
THEN registration process is started
AND I asked to enter my first name
AND I asked to enter my last name
AND I asked to enter my password
AND I asked to enter my email
AND I enter NOT unique email
AND application doesn't register me
AND I see notification that 'This email is already used by another user. Please, use another email'
AND I navigated back to main menu

Scenario - new user sign up - empty email unsuccessful validation
GIVEN I'm an app user
AND I see main menu in console
WHEN I entered 1
AND I selected 'Sign Up' in main menu
THEN registration process is started
AND I asked to enter my first name
AND I asked to enter my last name
AND I asked to enter my password
AND I asked to enter my email
AND I enter empty email
AND application doesn't register me
AND I see notification that 'You have to input email to register. Please, try one more time'
AND I navigated back to main menu

*** SIGN IN ***

Scenario - successful sign in
GIVEN I'm an app user
AND I have registered account
WHEN I entered 2
AND I selected 'Sign In' in main menu
THEN Login process is started
AND I asked to enter my email
AND I asked to enter my password
AND credentials are valid
AND I see welcome message 'Glad to see you back <First Name> <Last Name>'
AND I see main menu
AND instead of 'Sign In' I see 'Sign Out' label

Scenario - unsuccessful sign in
GIVEN I'm an app user
AND I have registered account
WHEN I entered 2
AND I selected 'Sign In' in main menu
THEN Login process is started
AND I asked to enter my email
AND I asked to enter my password
AND credentials are not valid
AND I see error message 'Unfortunately, such login and password doesn't exist'
AND I see main menu

Technical notes:
  - 'not valid' credentials mean that user either not exist or password is wrong

*** SIGN OUT ***

Scenario - successful sign out
GIVEN I'm an app user
AND I'm logged in
AND I navigated to the main menu
WHEN I entered 2
AND I selected 'Sign Out' in main menu
THEN I see sign out message 'Have a nice day! Look forward to welcoming back!'
AND I see main menu
AND instead of 'Sign Out' I see 'Sign In' label

*** PRODUCT CATALOG ***

Scenario - list products

GIVEN I'm an app user
WHEN I entered 3
AND I selected 'Product Catalog' in main menu
THEN I see list of products printed to console

Technical notes:
- Product has next fields:
    - int id
    - String productName
    - String categoryName
    - double price

Scenario - navigate back to menu
GIVEN I'm an app user
AND I navigated to Product Catalog menu
WHEN I enter **'menu'** in console
THEN I navigated back to the main menu

Scenario - add product to cart
GIVEN I'm an app user
AND I entered 3
AND I selected 'Product Catalog' in main menu
AND I see product list
AND I see message 'Enter product id to add it to the cart or 'menu' if you want to navigate back to the main menu'
WHEN I entered any product id
THEN I see the message 'Product <PRODUCT_NAME> has been added to your cart. If you want to add a new product - enter the product id. If you want to proceed with checkout - enter word 'checkout' to console'
AND I see product list again

Scenario - add product to cart - error handling
GIVEN I'm an app user
AND I entered 3
AND I selected 'Product Catalog' in main menu
AND I see product list
AND I see message 'Enter product id to add it to the cart or 'menu' if you want to navigate back to the main menu'
WHEN I entered any random number that doesn't match with product id
THEN I see the message 'Please, enter product ID if you want to add product to cart. Or enter 'checkout' if you want to proceed with checkout. Or enter 'menu' if you want to navigate back to the main menu.'
AND I see product list again

*** CHECKOUT ***

Scenario - successful checkout
GIVEN I'm an app user
AND I'm logged in
AND I entered 3
AND I selected 'Product Catalog' in main menu
AND I see product list
AND I see message 'Enter product id to add it to the cart or 'menu' if you want to navigate back to the main menu'
AND I added products to the cart
WHEN I entered 'checkout'
THEN I see the message 'Enter your credit card number without spaces and press enter if you confirm purchase'
AND I entered credit card number
AND I pressed enter
AND I see the message 'Thanks a lot for your purchase. Details about order delivery are sent to your email.'
AND I navigated back to main menu

Technical notes:
- Cart should be cleared after order is created

Scenario - checkout - error handling - empty cart
GIVEN I'm an app user
AND I entered 3
AND I selected 'Product Catalog' in main menu
AND I see product list
AND I see message 'Enter product id to add it to the cart or 'menu' if you want to navigate back to the main menu'
AND I have empty cart because I didn't add products yet
WHEN I entered 'checkout'
THEN I see the message 'Your cart is empty. Please, add product to cart first and then proceed with checkout'
AND I see product list again

Scenario - checkout - error handling - not logged in user
GIVEN I'm an app user
AND I entered 3
AND I selected 'Product Catalog' in main menu
AND I see product list
AND I see message 'Enter product id to add it to the cart or 'menu' if you want to navigate back to the main menu'
AND I added products to the cart
AND I'm not logged in
WHEN I added products to the cart
THEN I see the message 'You are not logged in. Please, sign in or create new account'

AND I navigated back to the main menu

Scenario - checkout - error handling - invalid credit card number
GIVEN I'm an app user
AND I'm logged in
AND I entered 3
AND I selected 'Product Catalog' in main menu
AND I see product list
AND I see message 'Enter product ID to add it to the cart'
AND I added products to the cart
WHEN I entered 'checkout'
THEN I see the message 'Enter your credit card number without spaces and press enter if you confirm purchase'
AND I entered invalid credit card number
AND I pressed enter
AND I see the message 'You entered invalid credit card number. Valid credit card should contain 16 digits. Please, try one more time.'
AND I'm asked to enter credit card number one more time

Technical note:
- Implement credit card validation: any 16 digits

*** MY ORDERS ***

Scenario - list my orders
GIVEN I'm an app user
AND I'm logged in
WHEN I entered 4
AND I selected 'My Orders' in main menu
THEN I navigated to 'My Orders'
AND I see list of all my purchases
AND I navigated back to the main menu

Scenario - list my orders - error handling - not logged in
GIVEN I'm an app user
WHEN I entered 4
AND I selected 'My Orders' in main menu
THEN I see message 'Please, log in or create new account to see list of your orders'
AND I navigated back to the main menu

Scenario - list my orders - error handling - no orders
GIVEN I'm an app user
AND I'm logged in
AND I don't have any purchases yet
WHEN I entered 4

AND I selected 'My Orders' in main menu
THEN I navigated to 'My Orders'
AND I see the message 'Unfortunately, you don't have any orders yet. Navigate back to main menu to place a new order'

*** SETTINGS ***

Scenario - change password
GIVEN I'm an app user
AND I'm logged in
AND I entered 5
AND I selected 'Settings' in main menu
AND I see list of options to change settings
AND I select option number 1 'Change Password'
AND I enter 1 in console
AND I am asked to enter new password
WHEN I entered new password
THEN I see message 'Your password has been successfully changed'
AND I navigated to main menu

Scenario - change email
GIVEN I'm an app user
AND I'm logged in
AND I entered 5
AND I selected 'Settings' in main menu
AND I see list of options to change settings
AND I select option number 2 'Change Email'
AND I enter 2 in console
AND I am asked to enter new email
WHEN I entered new email
THEN I see message 'Your email has been successfully changed'
AND I navigated to main menu

Scenario - setting - error handling - not valid option
GIVEN I'm an app user
AND I'm logged in
AND I entered 5
AND I selected 'Settings' in main menu
AND I see list of options to change settings
WHEN I enter any number beside 1 and 2
THEN I see the message 'Only 1, 2 is allowed. Try one more time'
AND I see settings menu again

Scenario - setting - navigate back to the main menu
GIVEN I'm an app user

AND I'm logged in
AND I entered 5
AND I selected 'Settings' in main menu
AND I see list of options to change settings
WHEN I enter 'menu'
THEN I navigated back to the main menu

Scenario - setting - error handling - not logged in
GIVEN I'm an app user
WHEN I entered 5
AND I selected 'Settings' in main menu
THEN I see message 'Please, log in or create new account to change your account settings'

*** CUSTOMER LIST ***

Scenario - print list of customers to console

GIVEN I'm an app user
WHEN I entered 6
AND I selected 'Customer List' in main menu
THEN I see list of customers
AND I navigated back to the main menu

Technical note:
   -   We shouldn't print Customer password

=== Technical details ===

General technical requirements:
1) instance of each service (UserManagementService, OrderManagementService, ProductManagementService, ApplicationContext) exist in a single copy during the program execution. Access to the single copy is possible via static getInstance() method of each specific type. And I can't create objects of these types via constructor.

2) Each implementation of service should have this method

   void clearServiceState()

for the sake of testing. This method should reset state of service to default. Taking into account the instance of each service will be in single copy, our tests have to have method that will clear the state of the service to reproduce different test cases.

To reset user counter - implement clearState() method in the DefaultUser class.

3) During implementation of this task you have to implement next interfaces:
public interface Cart {

       boolean isEmpty();

       void addProduct(Product productById);

       Product[] getProducts();

       void clear();

}

public interface Order {

       boolean isCreditCardNumberValid(String userInput);

       void setCreditCardNumber(String userInput);

       void setProducts(Product[] products);

       void setCustomerId(int customerId);

       int getCustomerId();

}

public interface Product {

       int getId();

       String getProductName();

}

public interface User {

       String getFirstName();
       String getLastName();
       String getPassword();
       String getEmail();
       int getId();

```java
        void setPassword(String newPassword);
        void setEmail(String newEmail);


}


public interface Menu {

        void start();

        void printMenuHeader();
}


public interface OrderManagementService {

        void addOrder(Order order);

        Order[] getOrdersByUserId(int userId);

        Order[] getOrders();
}


public interface ProductManagementService {

        Product[] getProducts();

        Product getProductById(int productIdToAddToCart);

}


public interface UserManagementService {

        String registerUser(User user);

        User[] getUsers();

        User getUserByEmail(String userEmail);

}
```

And here is the class of ApplicationContext which will help you during implementation of this program:

```java
public class ApplicationContext {

        private static ApplicationContext instance;

        private User loggedInUser;
        private Menu mainMenu;
        private Cart sessionCart;

        private ApplicationContext() {
        }

        public void setLoggedInUser(User user) {
                if (this.sessionCart != null) {
                        this.sessionCart.clear(); // we have to clear session cart when new
user is logged in
                }
                this.loggedInUser = user;
        }

        public User getLoggedInUser() {
                return this.loggedInUser;
        }

        public void setMainMenu(Menu menu) {
                this.mainMenu = menu;
        }

        public Menu getMainMenu() {
                return this.mainMenu;
        }

        public static ApplicationContext getInstance() {
                if (instance == null) {
                        instance = new ApplicationContext();
                }
                return instance;
        }

        public Cart getSessionCart() {
                if (this.sessionCart == null) {
                        this.sessionCart = new DefaultCart();
                }
                return this.sessionCart;
```

```
        }

}
```

Solution of the exam task can be found here

https://github.com/AndriiPiatakha/learnit_java_core/tree/master/src/com/itbulls/learnit/javacore/oop/exam/onlineshop