

# MO52: Software Engineering - Final exam 2024P

Duration: 1h30

*Note 1: Documents and electronic devices are not authorized.*

*Note 2: Given points are for information only ( $\pm 1$  point).*

## Exercise 1 (6 points)

**Choose between (True/False) for the following statements. Leave it empty if not sure because the wrong answers are noted negatively (you lose points).**

- A. In object-oriented design, encapsulation helps with data integrity, securing sensitive information, and enhancing modifiability and flexibility
- B. Main program & subroutine is a language-based system that is fundamentally focused on functions. It can be modeled as a directed graph where arrows are procedure calls. However, inheritance is not explicitly supported.
- C. Mockups are used in the conceptual design of the developing software process.
- D. In Pipes & Filters systems, applying the filters in a different order may change the end result.
- E. Subclasses can overload the methods of its superclass, meaning that a subclass can provide its own implementation for an inherited superclass's method.
- F. One indication of improper use of abstraction is breaking the Liskov Substitution Principle.

## Exercise 2 (10 points)

A bank has a set of branches, and the bank manager wants to automate the processes in a branch.

Clients can be individuals or companies, and they can open one or more of three types of accounts:

### **Normal account:**

It can be used to deposit and withdraw money at the branch, carry out online transactions or withdraw money using an ATM. The client cannot withdraw money if the balance of the account is 0.

**Savings account:**

It can be used to deposit money at the branch. The client receives 2.5% interest on the balance in this account each year.

**Credit account:**

It can be used for deposits and withdrawals at the branch, online transactions or cash withdrawals from ATMs. The client can withdraw up to 1000 euros even if the account balance is 0, but he/she pays monthly fines when the account is negative. Once reaching the 1000 euros allowed limit, the client cannot withdraw money anymore.

To apply for a loan, the following procedure must be followed:

- The client submits an application to the branch secretary.
- The secretary proposes an appointment for the client with his/her counselor.
- During this appointment, the counselor explains the terms of the loan.
- The loan application must be signed by both the client and the counselor at the same time.

The maximum loan amount for individuals is 10,000 euros and for companies 50,000 euros. The loan is granted only if the client has not had a negative account for at least 3 years.

Based on the indicated system requirements, answer the following questions:

- A.** Provide the class diagram of the entire system.
- B.** Provide the use case diagram of the entire system.
- C.** Give the description table of the use case “Apply for a loan”.
- D.** Give the state machine diagram of the states of the object “Credit account”.

**Exercise 3** (4 points)

- Draw the UML class diagram that explains the Singleton design pattern, and transform it to Java code.

End of exam