Department Mathematik/Informatik, Abteilung Informatik
Software & System Engineering
Weiterführende Konzepte der Programmierung, SS 2025

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Homework 2. Object-Oriented Programming

Exercise 1. Textbook Info System

Implement the following class hierarchy:

- Class `Publication` with attributes `title` (String) and `year` (int), and a method `getInfo()` that returns a formatted string.
- Class `Book` that extends `Publication`, adds `author`, and overrides `getInfo()` to include the author.
- Class `Textbook` that extends `Book`, adds `subject`, and overrides `getInfo()` to also include the subject.

Example output:

```
Data Structures, published in 2020, by Jane Doe Subject: Computer Science
```

Exercise 2. LibrarySystem

Given the following Java code:

```
1  class User {
2      String name = "Unknown";
3      public String getRole() {
4          return "General user";
5      }
6
7      public String getName() {
8          return this.name;
9      }
10 }
11
12 class Librarian extends User {
13     String department = "Reference";
14     @Override
15     public String getRole() {
16         return this.name + "Librarian";
17     }
18
19     public void work() {
```

```
20          //do some work
21      }
22  }
23
24  public class LibrarySystem {
25      public static void main(String[] args) {
26          User u1 = new User();
27          Librarian l1 = new Librarian();
28          User u2 = l1;
29
30          System.out.println(u1.getRole());
31          System.out.println(l1.getRole());
32          System.out.println(u2.getRole());
33
34          l1.getName();
35          u1.getName();
36
37          l1.work();
38          u2.work();
39      }
40  }
```

Draw the memory diagram of the code, including:

- Stack and heap memory.
- Objects, their attributes and references.
- Classes and vTables.
- Show exactly which methods are inherited.
- Provide indices for all object attributes and vTable entries.

Say what the print statements print to the console and explain briefly why.

Then, show how the

- three method calls in lines 30–32 of `getRole()`,
- two calls in lines 34–35 of `getName()`,
- and two calls in lines 37–38 of `work()`

would be translated using static indices only. It could be that some of the calls can not be compiled at all. In this case, explain why

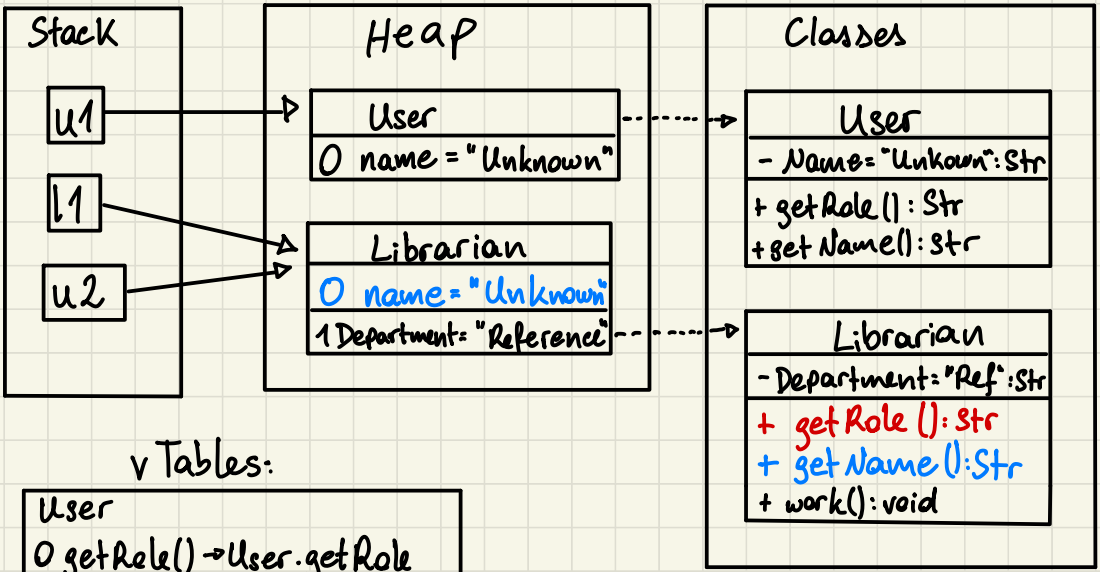
Exercise 3. Mailbox

Create a very simple e-Mail inbox. For this, create

- a class `Mail`.
- a class `Inbox`.

Exercise 2)

Inherited Overriden



v Tables:

User
0 getRole() → User.getRole
1 getName() → User.getName

Librarian
0 getRole() → Librarian.getRole (overriden)
1 getName() → User.getName (Inherited)
2 work → Librarian.work

Print Statements:

1. u1.getRole() → "General User"
   ↳ Calls method in User

2. l1.getRole() → "Unknown Librarian"
   ↳ Calls overridden method in Librarian

3. u2.getRole → "Unknown Librarian"
   ↳ Runtime Type is Librarian
   ↳ Calls overridden method in Librarian

Line	Method Called	Actual Class Method Call
30	u1.getRole()	User.getRole()
31	l1.getRole()	Librarian.getRole()
32	u2.getRole()	Librarian.getRole()
34	l1.getName()	User.getName()
35	u2.getName()	User.getName()
37	l1.work()	Librarian.work()
38	u2.work()	compile Error

↳ Will not compile. Even though u2 refers to a Librarian object, it's declared as type User, which does not have a work() method.

↳ Solution: Comment out or cast → ((Librarian) u2).work();