Assignment 1: UML Modeling and Programming with EMF

This piece of coursework will contribute with **20%** to the module mark. This is an **individual** assignment. Do not work together to avoid plagiarism concerns.

Return your answers through Blackboard by Friday 1st of March, 23:59 UK time.

Marking will be done anonymous (your identity will only be revealed to the marker after all marks have been assigned). Please do not include your name in your submission.

Submit the answers to modelling questions (Tasks 1-3) in PDF format, and a zipped file containing the code of your EMF projects (Tasks 2 & 3). Unreadable diagrams will not be marked. Please read the sections on late submission of coursework and plagiarism in the student handbook.

Assessed learning outcomes:

- Use UML and OCL for designing views of software systems
- Check the consistency of the UML design of an application
- Use techniques for model-driven development

Introduction:

The aim of this project is to develop software models for a customer management system to support a business. You will choose the business and the main functionality of the system as part of Task 1 and model this system in the remaining tasks.

To illustrate what is expected from your submission, we have **included an example answer** in the appendix.

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Task 1: System Description [10 marks]

Describe a business, list its stakeholders (e.g., customers and staff), list important information about the business entities (e.g., products and services), and informally describe the main use cases and activities of the business.

Make sure your description is within 100-150 words and covers sufficient information to allow you to complete Tasks 1-4 for this particular system.

Marking:

- Listing main stakeholders [3p]
- Listing business entities [4p]
- Describing use cases and activities [3p]

Note, if you choose a library (see Appendix) or an airport (see Tutorial 1) your work might be considered plagiarism.

Task 2: Behavior Model [30 marks]

a) Create a UseCase diagram for the customer management system supporting your selected business. The diagram can be drawn in whatever medium you choose. **[15 marks]**

Marking:

- At least 6 meaningful UseCases
  (.5 marks each) [3 marks]
- Correct and non-trivial (i.e., more than one) participation of actors in UseCases
  (1 mark each per UseCase) [6 marks]
- Correct use of at least one <<extend>> and <<include>>
  (2 marks for extend, 2 marks for include) [4 marks]
- Good use of generalization UseCases or actors
  (2 marks each) [2 marks]

b) Create one activity diagram for the customer management system supporting your selected business. The diagram can be drawn in whatever medium you choose. **[15 marks]**

Marking:

- At least 6 meaningful actions
  (1 mark each) [6 marks]
- At least 2 correct uses of decision nodes (2.5 marks each) [5 marks]
- At least one correct use of a fork node [4 marks]

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Task 3: Structural Model [45 marks]

a) Using EMF, design a class diagram for the customer management system of your chosen business. Use role names and multiplicities on all association ends. **[20 marks]**

Marking:

- Identification of main classes with correct class names [5 marks]
- Use of generalization and abstract classes [5 marks]
- Use of attributes (at least one per class) [5 marks]
- Correct association role names and non-trivial multiplicities (not all * or 0..*) [5 marks]

b) Identify, document and explain 4 business constraints relevant to your chosen system. *Recall the example from the tutorial "Passengers can only checked-in on flights that they have a ticket for."*
Select 2 of the business constraints you listed and express these in OCL. Make sure these constraints relate to your class diagram and use collections as well as navigation and Boolean operators. **[15 marks]**.

Marking:

- Business constraints formulated as sentences (1 mark each) [4 marks]
- Correct OCL constraint for given business constraint on class diagram of Task 3a (2.5 marks each) [5 marks]
- Use of navigation (2 marks) and collection operators (2 marks) and Boolean operators (2 marks) [6 marks]

c) Design an object diagram for a possible scenario of your customer management system. The object diagram has to be consistent with your class diagram. This diagram can be drawn in whatever medium you choose.
[10 marks]

Marking:

- At least 5 objects [5 marks]
- At least 5 links [5 marks]

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Task 4 [15 marks]

a) Using the EMF API (not the generated editor), create a model instance for your business based on your object diagram from Task 3c and save it in XMI format. **[15 marks]**
(You will need to create a plugin, as done in Lab 2 to define a model instance and save it to XMI as done in Lab 3.)

Marking:

- Code to create the instance [10 marks]
- Code to save the instance into XMI [5 marks]
- If any of the code does not compile or the projects cannot be imported from the ZIP file, then 0 marks will be awarded.

Submission:

You need to submit via Blackboard. Once you select this assignment from "Assessment and Feedback" you will be taken to a different screen that allows you to submit your solution.

Your submission should include:

- a PDF file containing: text, diagrams and explanations for Tasks 1 to 3 (please submit a screen capture of the EMF class model as well);

- a zip file containing the complete Eclipse projects for Tasks 3 and 4.

Once all files are added and you are happy to proceed with submission click the Submit button (Save will not transfer your submission, but allow you to store work at intermediate stages). You can re-submit your assignment as many times before the deadline as you like, but only the last submission will be marked.

If you do not follow the submission guidelines your work will not be marked.

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Appendix 1: Example System and Models

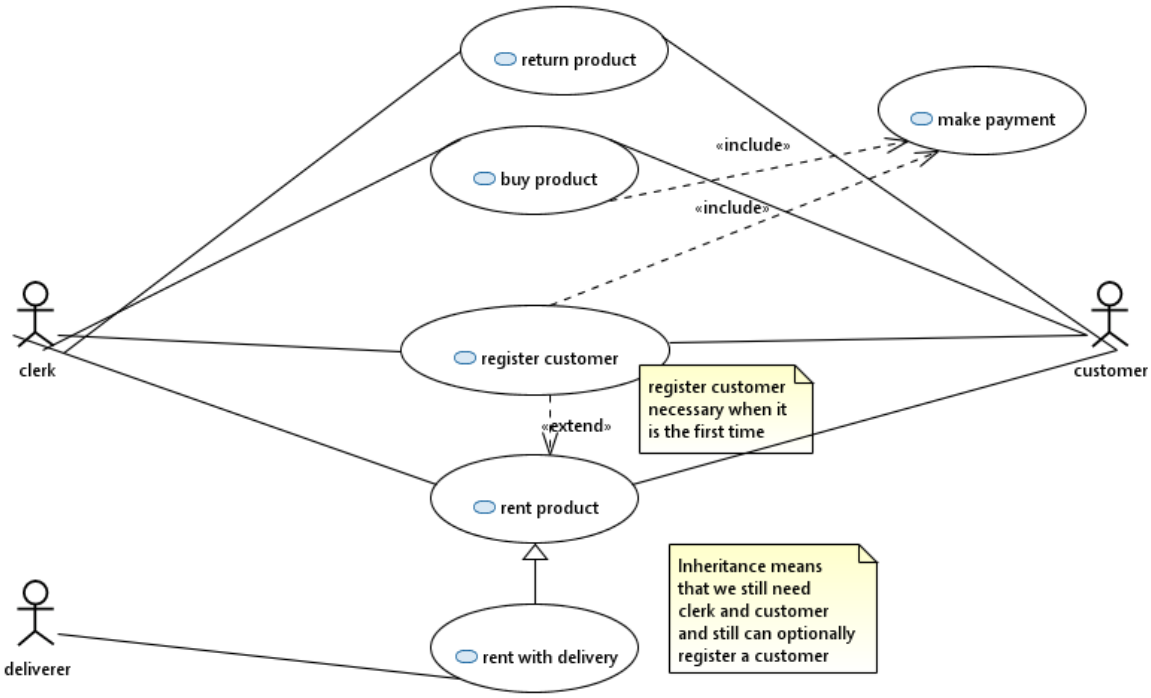
To better illustrate the assignment, this appendix provides parts of an example submission and briefly describes their marking.

Task 1: Library Customer Management System

The responsibility of the system is keeping track of the customers and transactions of a library. The library employs several librarians and couriers. It lends books only to registered customers (librarians can register new customers). Optionally, librarians can send couriers to deliver books to customers. From time to time the library sells used books (then the customer does not need to be registered). Customers pay and later return books unless they bought them.

Marking: This description would receive full marks.

Task 2a: UseCase Diagram



Marking: This diagram would receive full marks.

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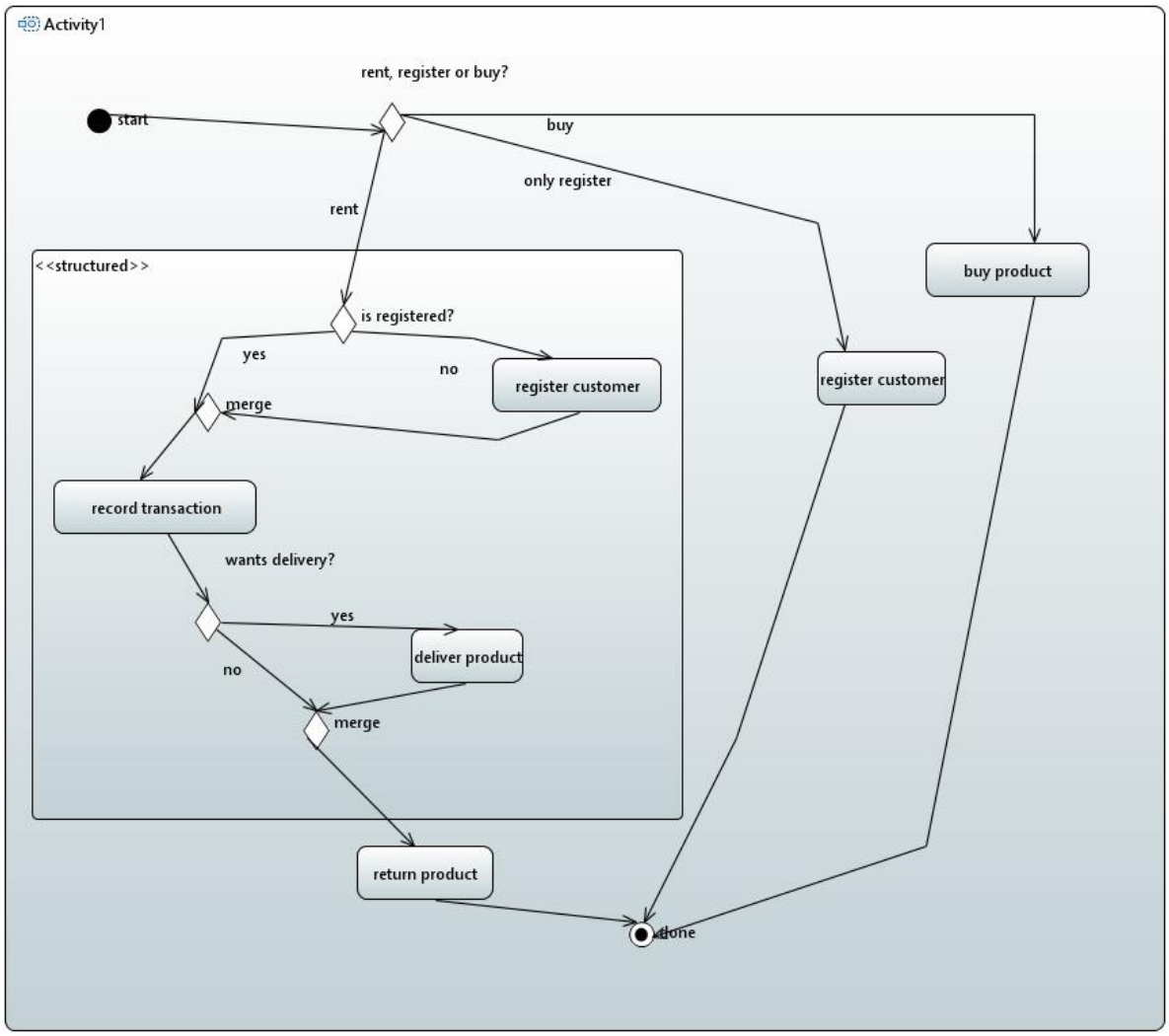
Task 2b: Activity Diagram



Marking: This diagram would not receive full marks because there are no fork nodes (- 4 marks).

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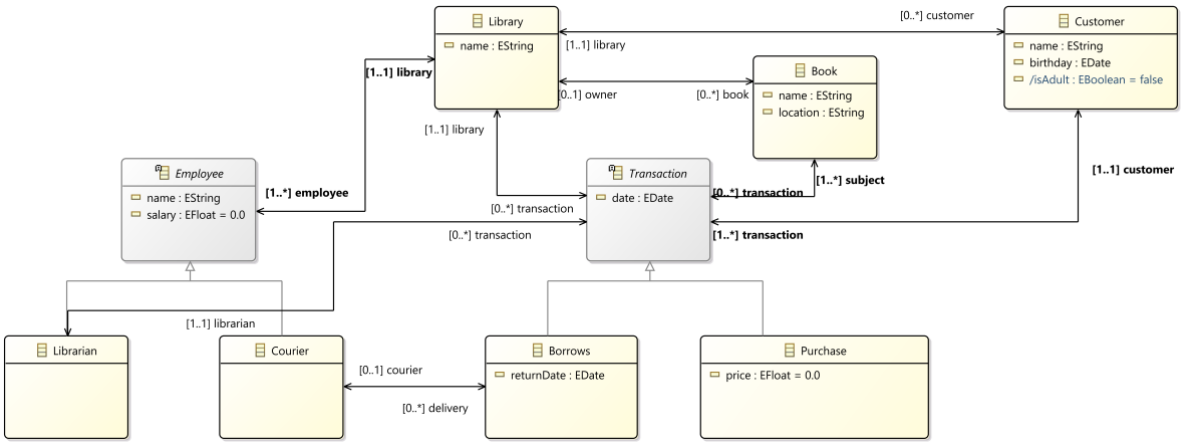
Task 3a: Class Diagram



Marking: This diagram would receive full marks (note that the marker is generous and has taken inherited attributes into account).

Task 3b: Business Constraints

- Sold books are either owned by a library or purchased by a customer.
- A book can only be in one purchase transaction.
- When a customer borrows a book she must be a customer of the library that owns the book.
- When a driver delivers a book the driver must work for the library that rents the book.
- If a book is not owned by a library, then it takes part in a purchase transaction.

```
context Book inv:
  this.owner->isEmpty() implies
    book.transaction.exist(t : Transaction | t->isTypeOf(Purchase));
```

Marking: This answer receives 12.5 of 15 marks because the second OCL constraint is missing (all required OCL features are already used in the first OCL constraint).

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