

# Synthesis Assignment, Week 12

## 1. Introduction

This document describes the synthesis assignment you will be working on during weeks 12-16. This is an individual assignment where you can show your current proficiency level of all seven (7) learning outcomes (LOs).

## 2. Case description

The company *'t Sloepke B.V.* wants a software system to allow them to manage rentals of their boats. *'t Sloepke B.V.* has one main-office located in Eindhoven and multiple rental locations, distributed over the Netherlands, for customers to rent a boat with optional item(s).

Currently, each location has at least the following 2 types of boats available:

- Kayak
- Canoe

Some of the locations, which are located at a big lake or the sea, offer additional types of boats:

- Sailboat *Laser*
- Sailboat *Valkf*

In addition to boats, items, such as, life jackets, waterproof containers, cool boxes, navigation devices, etc. can also be rented.

See Appendix A: Catalogue for more detailed information about the boats and items.

### 2.1. Rental process

The highest priority for *'t Sloepke B.V.* is to have a system to support their rental process. For customers, the current rental process exists out of three steps/phases:

#### Step 1: Placing a reservation

Firstly, the customer places a reservation by supplying the following information:

- Contact information
- Address information
- When and for how long; the duration is always in multiples of 2 hours (e.g., for 2 hours, 10 hours, 24 hours, etc.) and is made for a minimum of 2 hours and a maximum of 2 full weeks.
- At which location
- Which boat(s) and item(s)<sup>1</sup>; note that it should only be possible to reserve available boats and items.

This information is put into a quote; see Appendix B: Two rental quote for examples. To finalize the reservation, the customer must sign/agree with the rental quote. After finalizing the reservation, the customer should have access to their own rental reservation(s).

Up until seven (7) days before the start of the rental, customers are allowed to change their reservation. When they do this, they also must re-agree with the new rental quote.

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<sup>1</sup> Items are optional

### Step 2: Using the reserved boat and items

On the rental day and before the start-time of the rental, the customer goes to the selected location to first pay a deposit. The amount of the deposit is dependent on the boat type; see Appendix A: Catalogue for the deposits.

After the deposit is paid, an employee will take the customer to their boat with, if any, items. The employee explains how to use the boat and the customer can then depart.

### Step 3: Returning the boat and items

When the customer returns, an employee performs an inspection and any damage to the boat(s) and/or item(s) are noted down. To finalize everything, the customer then must pay for the rental. This is done as following:

- Subtract the rental price from the deposit
- When the boat(s) and/or items were damaged, subtract the damage costs from the deposit

The remaining amount is then settled with customer.

For example, when the deposit was €50, rental price €20 and there was no damage, the customer will receive €30 euros back. When the deposit was €800, rental price €740 and there was damage for €500, the customer will pay €440.

Currently, 't Sloepke B.V does not have any software system to support their day-to-day work and this assignment is about creating a robust start of this software system.

## 3. Assignment

Your assignment is to create the following deliverables:

- URS
- Test plan and test report
- UML Class diagram
- Software system
  - Source code
  - Unit tests
  - Database

Make sure you come to an agreement with your tutor when you make assumptions; the 'openness' of the requirements is by design and is to give you the freedom/flexibility to show us your proficiency towards the LOs.

A 'waterfall' schedule is proposed in Canvas for this assignment, but you are encouraged to create your own. For example, you can decide to speed things up by doing the URS and UML Class diagram in week 12 and start working on the test plan and implementation in week 13 while awaiting your feedback for your URS.

You may also decide to follow an iterative method by first focussing on the core requirements, then the major requirement(s) and finally the minor requirement(s).

Just make sure that you can deliver everything at the predefined deadline and that your tutor approves your planning before the end of week 13 (e.g., whether it is feasible).

In the remainder of this document, you can find the constraints and requirements.

### 3.1. Constraints

	Description
<i>Employee types</i>	Certain functional requirements (FRs) mention to which employee types they are accessible. If you do not have to implement <i>FR-03</i> , you can ignore the employee types and assume it is any (authenticated) employee.
<i>Mocking data</i>	The case is simulated and there is no real data. Do make sure that you make use of any data you can find in this document. Everything else can be your own 'fake' data.
<i>Payments</i>	Processing actual payments are out of scope. Instead, you can keep track of whether something has been paid or not.
<i>UX</i>	Make sure the software system is as expected for modern applications; e.g., proper UX, user feedback, common practices (for example, hide sensitive data such as password), etc.
<i>Technologies</i>	C# with Windows Forms and ASP.Net Core Razor Pages; for a web application you may use a layout framework but not an ORM. The database must be a MySQL database.
<i>Meetings</i>	Weekly meetings with tutor are mandatory.
<i>Source control</i>	FHICT GitLab ( <a href="https://git.fhict.nl">https://git.fhict.nl</a> ). Make sure you invite your OOD, WAD and WKS teachers with the appropriate access rights.
<i>Submission</i>	Final submission with all deliverables must be submitted on Canvas before the deadline.
<i>Deadline</i>	Friday 24 <sup>th</sup> of December 2021 before 16.00.

### 3.2. The requirements

Below you can find the requirements for this assignment, and they are divided into three categories. Your submission must contain all the *Core requirements*, at least one (1) of the *Major requirements* and at least one (1) of the *Minor requirements*; your tutor will discuss with you which ones you should include.

After that, you can propose and discuss with your tutor which other functional requirements you want to include.

#### 3.2.1. Core requirements

##### Non-functional requirements

- *NFR-01: Maintainable and extendable*  
Proper OO principles must be applied to ensure good maintainability and extensibility of the code base.
- *NFR-02: Bug free system*  
Appropriate testing techniques must be used when implementing the system to ensure proper functioning.
- *NFR-03: Secure software*  
Only authorized people may make use of the system and can only access data they are authorized for. Passwords and user input must also be handled appropriately.

## Functional requirements

- *FR-01: Manage Catalogue with boats & items*

Employees at the main-office must be able to manage (*CRUD* operations) the boats & items of the company's inventory. Make sure you also include the quantity of boats and items.

You can decide whether this should be done via a desktop or web application.

For now, you do not have to worry about at which locations everything is located (i.e., locations are out-of-scope for this requirement).

- *FR-02: Support Rental process*

Customers must be able to place reservation(s) and have access to manage their own reservations (i.e., part of *Rental process - step 1*). Note that signing the rental quote can be done via a checkbox.

A customer must be able to do this via a web application.

In addition, employees must be able to manage (*CRUD* operations) the reservations of customers to allow them to do their job (i.e., during *Rental process - steps 2 & 3*).

A location employee must be able to do this via a desktop application.

For now, you do not have to worry about at which locations everything is located (i.e., locations is out-of-scope for this requirement).

### 3.2.2. Major requirements

#### Functional requirements

- *FR-03: Manage locations & employees* (counts for one *Major* and one *Minor* requirement)  
Extend the software system to also support the managing (*CRUD* operations) of *Employees* and *Locations*. Note that you will have to re-visit *FR-01* & *FR-02* to incorporate the locations; you can decide yourself how to distribute the inventory over the location!

Employees are either assigned to a rental location or the main office. When an employee is assigned to a rental location, that person is limited to only data related to their location. A main office employee can access all data.

This functionality is only available for employees at the main office.

- *FR-04: Inspection form*

Extend the software system to also include the *damage inspection* by an employee as (web)form (i.e., during *Rental process - step 3*). It should be possible to specify what the damage(s) are, if any, and what the costs will be. This information should be saved with the rental and be viewable by the employees and the customer.

This functionality is only available for employees at the rental locations.

- *FR-05: Support for subscriptions*

Extend the software system to allow customers to purchase a subscription. This exempts them from having to pay the rental costs and deposit for the duration of the subscription (i.e., during *Rental process - step 3*).

This subscription is active for one year and allows a customer to make use of a pre-specified boat type for a certain duration

The cost of a subscription is calculated as follows:

$$\text{subscription fee} = \text{€} <\text{boat type cost}> * <\text{rent\_duration}> * 45$$

For example, a subscription for a *Kayak* for 4 hours would result in a fee of € 1350. This is a discount of € 210 if the customer makes use of the *Kayak* once per week for the duration of the subscription.

Customers purchasing a subscription must specify their credit card information; this will be used to charge any item rental and damage costs.

- *FR-06: Coupons*

Extend the software system to allow customers to input a coupon code during reservation (i.e., during *Rental process - step 1*). A coupon code gives a percentage-based or fixed-amount discount on the rental costs. To prevent extreme couponing, at most one coupon code can be used per reservation.

For now, three types of coupons are requested: (1) usable by all customer till an end-date, (2) limited usage quantity where a coupon code can only be used *n* total times, and (3) usable by a specific customer for one time.

The creation of unique coupon codes is done by employees via the application they have access to.

- *FR-07: Business-to-business (B2B) customers*

Extend the system to also support companies as a customer (a business customer). Rental reservations of companies contain additional data: company name and VAT number. Note that the contact information of a business customer represents the contact person of the company.

When a business customer places a reservation, the reservation process is modified by an additional step between *Rental process - steps 1* and *Rental process - steps 2*:

*Step 1.5: Assess possibility of company discount*

An employee in the main office assesses the reservation information and then decides, based on the number of boats and items reserved, how much (if any) discount will be applied on the rental costs; this amount is expressed in euros (€); e.g., €-1500,95 or €-750.

This additional step should be performed within 4 days after the business customer placed the reservation and the business customer should be able to see this discount in their rental overview and details.

### 3.2.3. Minor requirements

#### Functional requirements

- *FR-08: Maintenance of boats*

Extend the system to also allow employees to mark a boat as *under maintenance* for a certain time period (e.g., a start- and end-date). When a boat is *under maintenance* it is unavailable for rental.

Make sure to store the maintenance history of a boat. This way an employee can view and determine when a boat should be scheduled for its next maintenance.

- *FR-09: Repeating rental reservations*

Extend the system to allow customers to place a 'repeating' rental reservation. When placing a reservation, include an option to repeat the reservation for  $n$ -number of times on 'weekly', 'monthly' or 'yearly' basis where  $n$  can at most be 5 times.

- *FR-10: Including motorized boats to the catalogue*

Extend the system to also support fuel powered boats. When a customer returns the boat, a location employee will take note of the used fuel (in litres). The costs of the used fuel must then be paid by the customer (i.e., during *Rental process - step 3*).

- *FR-11: Buying items*

Extend the system to allow customers to be able to buy products (i.e., during *Rental process - step 1*).

- end of assignment -

## Appendix A: Catalogue

<i>Boat type</i>	<i>Capacity (per boat)</i>	<i>Costs (per 2 hours)</i>	<i>Deposit (per boat)</i>	<i>Quantity available</i>	<i>Remark</i>
<i>Kayak</i>	1 person	€15	€50	100	1 peddle included
<i>Canoe</i>	1-2 persons	€20	€50	75	2 peddles included
<i>Sailboat 'Laser'</i>	1 person	€74	€800	50	Only available at certain location
<i>Sailboat 'Valk'</i>	2-5 persons	€115	€2500	35	Only available at certain location

<i>Item</i>	<i>Costs (per 2 hours)</i>	<i>Deposit (per item)</i>	<i>Quantity available</i>	<i>Remark</i>
<i>Life jacket</i>	€0	€25	500	
<i>Waterproof container</i>	€2,50	n.a.	200	Capacity of 5 litres
<i>Cool box</i>	€2,50	n.a.	50	Capacity of 25 litres
<i>Navigation device</i>	€5,00	€50	35	
<i>Spare peddle</i>	€7,50	€25	50	
<i>Tent</i>	€4,50	€100	35	2 Person tents
<i>Electric furnace</i>	€2,15	n.a.	20	

## Appendix B: Two rental quote examples



### 't Sloepke B.V.

**Rental Quote**

*Date* 9/21/2021  
*Reference no.* 2021-021234  
  
*Location* Enkhuizen  
*Start* 18/12/2021 at 10.00  
*End* 18/12/2021 at 14.00

**Customer**

*Name* John Doe  
*Address* Rachelsmolen 3  
*Zipcode & City* 5612MA Eindhoven  
*Phone* 08850 80000  
*Email* [j.doe@hotmail.com](mailto:j.doe@hotmail.com)

Description	Quantity	Duration (h)	Unit Price (2h)	Price
Kanou	1	4	€ 20.00	€ 40.00
Kayak	2	4	€ 15.00	€ 60.00
Waterproof container	1	4	€ 2.50	€ 5.00
<b>Total</b>				<b>€ 105.00</b>

**Quote terms**

Note that when retrieving the boat at the rental location you are required to first transfer a deposit of € 150.

Accepted by: \_\_\_\_\_

Signature: \_\_\_\_\_





## 't Sloepke B.V.

### Rental Quote

Date 1/3/2022  
Reference no. 2022-000004

Location Renesse  
Start 18/02/2022 at 13.00  
End 20/02/2022 at 17.00

### Customer

Name Donald Duck  
Address Webfoot Walk 1313A  
Zipcode & City 1234DB Duckburg  
Phone 0609876543  
Email [d.duck@duckburg.qak](mailto:d.duck@duckburg.qak)

Description	Quantity	Duration (h)	Unit Price (2h)	Price
Sailboat 'Valk'	1	52	€ 115.00	€ 2,990.00
Navigation device	1	52	€ 5.00	€ 130.00
Life jacket	5	52	€ 0.00	€ 0.00
Total				€ 3,120.00

### Quote terms

Note that when retrieving the boat at the rental location you are required to first transfer a deposit of € 2675.

Accepted by: \_\_\_\_\_

Signature: \_\_\_\_\_