

 $Lab\ for\ Software\ Engineering$ 

# Cinema Management Application

Ifrat Jahan (3098878) Jennifer Maxisch (3106694) Georgios Adamos (3093306) Thomas Klimek (3067855) Melvin van der Linde (3106762)

November 15, 2022

## **Contents**

1	Ana	lysis iv
	1.1	A1 iv
		1.1.1 Requirements & Domain-Knowledge iv
		1.1.2 Contextdiagram
	1.2	A2
	1.3	A3
	1.4	A4
	1.5	A5
	1.6	A6
2	Desi	ign xii
	2.1	D1 xii
	2.2	D2
	2.3	D3
	2.4	D4 xii
3	lmp	lementation & Testing xiv
-	•	I xiv
	3.2	T1
	3.3	T2
	3.4	T3
4	Glos	ssary x

# **List of Figures**

1.1	Contextdiagram
1.2	Problem diagram for R1
1.3	Mapping diagram for R1
1.4	Problem diagram for R5
1.5	Mapping diagram for R5
1.6	Problem diagram for R4 / R8 vii
1.7	Mapping diagram for R4 / R8 vii
1.8	Problem diagram for R7
	Mapping diagram for R7
2.1	Zustandsdiagramm Person 1 xiii

## 1 Analysis

### 1.1 A1

### 1.1.1 Requirements & Domain-Knowledge

#### Requirements

- R1 Customers can create an account by providing an e-mail address and a password. If an e-mail address which is already associated with an account is provided, account creation fails.
- R2 Customers can log in by providing their e-mail address and their password.
- R3 A logged in customer can log out.
- R4 A customer can browse available showings, ascendingly sorted by date.
- R5 A logged in customer can book tickets by selecting the showing from the browsing list and selecting the desired seats. A showing can only be booked up to 15 minutes before it starts.
- R6 Staff can add new showings to the database by providing the required data.
- R7 Once a showing starts it is marked as "archived".
- R8 Archived showings are visible to staff, but not to customers.
- R9 Staff can cancel showings. When a show is cancelled all customers who booked tickets for it are notified via e-mail and the showing is then deleted.
- R10 Showings which took place a year ago or longer are automatically removed from the database.
- R11 When a showing is deleted its associated bookings are also deleted.

#### **Facts**

- F1 A showing consists of the title of the movie, its duration, the date date, the hall number and unique ID.
- F2 A hall consists of a number of rows, a number of seats per row and a unique hall number.
- F3 Only one person at a time can sit in a seat.

#### **Assumptions**

- A1 A web application is a good choice for implementing the desired functionality and all customers are able to use it.
- A2 Customers only provide e-mail addresses they can access.
- A3 Customers will stay up to date with the list of available showings.
- A4 Every booking is paid via an external service.
- A5 Staff will only add showings which take place in the future.

## 1.1.2 Contextdiagram

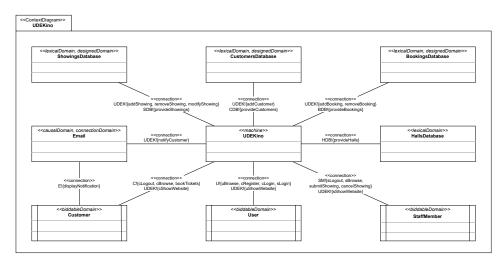


Figure 1.1: Contextdiagram

### 1.2 A2

We can derive the following problem diagrams

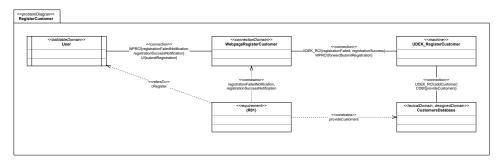


Figure 1.2: Problem diagram for R1

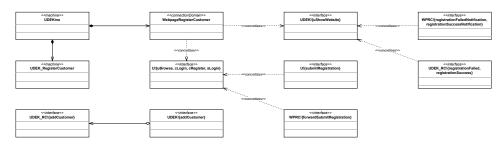


Figure 1.3: Mapping diagram for R1

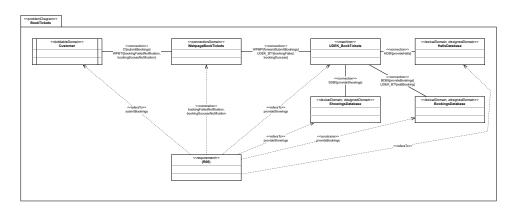


Figure 1.4: Problem diagram for R5

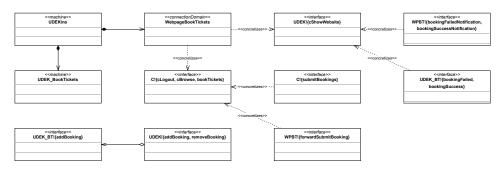


Figure 1.5: Mapping diagram for R5

9,6

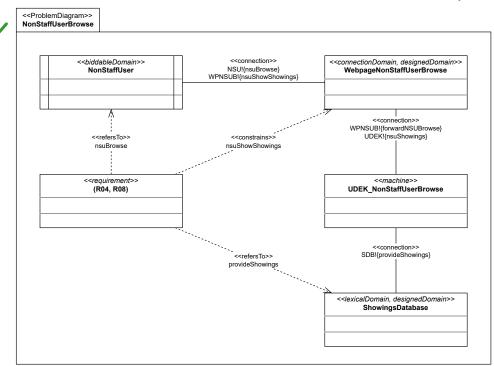


Figure 1.6: Problem diagram for R4 / R8  $\,$ 

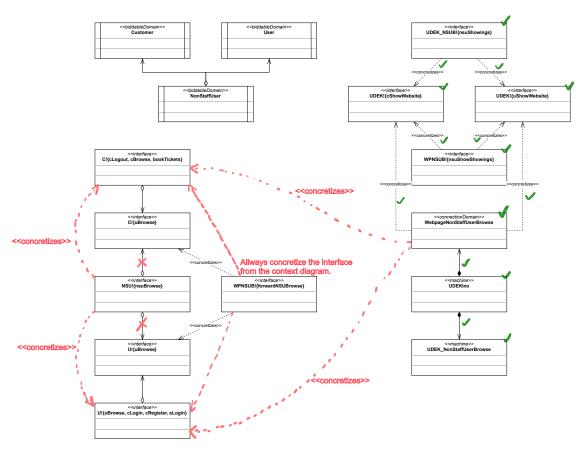


Figure 1.7: Mapping diagram for R4 / R8  $\,$ 



Figure 1.8: Problem diagram for R7

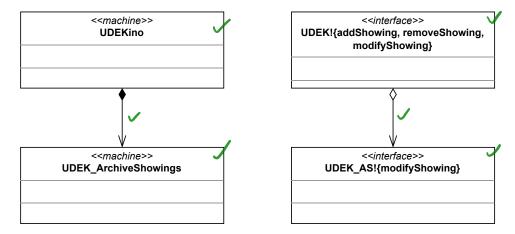


Figure 1.9: Mapping diagram for R7

### **Frames**

- ullet R1 fits to update 2
- $\bullet$  R5 fits to update 2
- $\bullet\,$  R4 / R8 fits to query 2  $\checkmark$
- R7 fits to simple transformation  $\checkmark$

## 1.3 A3

## 1.4 A4

## 1.5 A5

A short OCL example:

```
context Person inv: self.alter >=0
pre alter>30
post alter=alter@pre+1
```

## 1.6 A6

Examples of a life-cycle using the math-environment:  $LC_{guest} = (Browse^+; [Book])^*$ 

# 2 Design

- 2.1 D1
- 2.2 D2
- 2.3 D3
- 2.4 D4

State diagrams with tikZ:

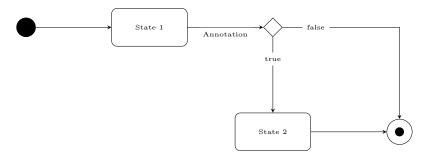


Figure 2.1: Zustandsdiagramm Person 1

# 3 Implementation & Testing

- 3.1 I
- 3.2 T1
- 3.3 T2
- 3.4 T3

# 4 Glossary

Table 4.1: Glossary

Name	Type	Description	Source
A			
addBooking	phenomenon	the machine adds a new booking to the bookings database	CD
addCustomer	phenomenon	the machine adds a new customer to the customers database	CD
addShowing	phenomenon	the machine adds a new showing to the customers database	CD
В			
bookingFailed	phenomenon	the machine notifies the webpage that a booking has failed	PD R5
booking Failed Notification	phenomenon	the webpage displays a notifica- tion to the customer that a book- ing has failed	PD R5
bookingSuccess	phenomenon	the machine notifies the webpage that a booking has succeeded	PD R5
booking Success Notification	phenomenon	the webpage displays a notifica- tion to the customer that a book- ing has succeeded	PD R5
BookingsDatabase	lexical domain, designed domain	a database containing the bookings made by customers	CD
bookTickets	phenomenon	a customer books tickets for a showing	CD
C			
Customer	biddable domain	a customer of UDEKino; a user who has logged into a customer account	CD
CustomersDatabase	lexical domain, designed domain	a database containing customer data	CD
cBrowse	phenomenon	a customer browses available showings	CD
cLogin	phenomenon	a user attempts to log into a customer account	CD
cLogout	phenomenon	a customer attempts to log out	CD
cRegister	phenomenon	a user attempts to create customer account on UDEKino	CD
cShowWebsite	phenomenon	the machine shows a website to the customer	CD
D			
displayNotification	phenomenon	the customer's e-mail client dis- plays a notification e-mail to the customer	CD
E	•	,	1

Table 4.1: Glossary

Name	Type	Description	Source
Email	causal domain, con-	an e-mail service offering to de-	CD
	nection domain	liver e-mails	
F			
forwardBookings	phenomenon	the webpage forwards a request	PD R5
<u> </u>		to book tickets to the machine	
forwardNSUBrowse	phenomenon	the website sends a request for a	PD R4 / R8
		list of upcoming showings to the	
		machine	
forwardSubmitRegistration	phenomenon	the webpage forwards a request	PD R5
		to register a customer account to	
		the machine	
G			
Н			
HallsDatabase	lexical domain	a database containing the cinema	CD
		halls, provided by the cinema op-	
		erator	
I		T	Γ
T			
J		T	I
T.			
K		T	I
т			
L		I	I
M			
modifyShowing	phenomenon	the machine modifies a showing	CD
modifybhowing	phenomenon	in the showings database	CD
N		in the showings database	
NonStaffUser	biddable domain	either of Customer or User	PD R4 / R8
notifyCustomer	phenomenon	the machine notifies the cus-	CD
	phonomon	tomer via e-mail	
nsuBrowse	phenomenon	either of cBrowse or uBrowse	PD R4 / R8
nsuShowings	phenomenon	the machine sends a list of up-	PD R4 / R8
0	1	coming showings to be displayed	,
		by the website	
nsuShowShowings	phenomenon	the website displays a list of up-	PD R4 / R8
Ţ.		coming showings to the user	,
O			
P			
provideBookings	phenomenon	the bookings database provides	CD
		the bookings data to the machine	
provideCustomers	phenomenon	the customers database provides	CD
		the customers data to the ma-	
		chine	
provideHalls	phenomenon	the halls database provides the	CD
		halls data to the machine	
provideShowings	phenomenon	the showings database provides	CD
	1	the showings data to the machine	I

Table 4.1: Glossary

R registrationFailed phenomenon the machine notifies the webpage that the registration has failed registrationSuccess phenomenon the webpage displays a to the user that the registration has failed registrationSuccess phenomenon the machine notifies the webpage displays a to the user that the registration has failed registrationSuccess phenomenon the machine notifies the webpage displays a notification of the user that the registration has succeeded registration has succeeded removed.  PD R1 registrationSuccessNotification phenomenon the webpage displays a notification has succeeded removed. The webpage displays a notification has succeeded removed. The webpage displays a notification has succeeded removed a booking database removed. The machine removes a booking from the bookings database removed. The machine removes a customer from the customers database removed. The machine removes a showing from the showings database removed. The machine removes a showing removed has showing a staff member browses available showings. The machine removes a showing showings. The machine removes a showing removed has showing a staff member browses available showings. The machine showing database removed has showing a staff member browses available showings. The machine showing database removed has showing a staff member a staff member a staff member a staff member and showing a database removed has a staff member and showing and staff member submit button and password and hits the submit button register a new customer account, containing an e-mail address and a password.  SubmitShowing phenomenon a staff member submits a new showing to the machine for entry into the database.	Name	Table 4.1: G	Description	Source
registrationFailed phenomenon the machine notifies the webpage that the registration has failed phenomenon the webpage displays a to the user that the registration has failed user that the registration has failed user that the registration has failed the user that the registration has failed sailed the user that the registration has succeeded the user that the registration has succeeded the machine notifies the webpage that the registration has succeeded the machine removes a booking the machine removes a booking from the bookings database the machine removes a booking from the bookings database the machine removes a showing from the customers database removeShowing phenomenon the machine removes a showing from the showings database the machine removes a showing from the showings database the machine removes a showing from the showings database the machine removes a showing from the showings database the machine removes available showings at a staff member browses available showings and a staff member attempts to cancel a showing showings.  ScancelShowing phenomenon a staff member attempts to cancel a showing showings showings and showings showings and staff member attempts to log in as a staff member attempts to log in as a staff member attempts to log out showing showings showings showings showings and showing the cinema showing showi	Q			
registrationFailed phenomenon the machine notifies the webpage that the registration has failed phenomenon the webpage displays a to the user that the registration has failed user that the registration has failed ser that the registration has failed the webpage displays a tothe user that the registration has failed great the registration has succeeded the machine notifies the webpage that the registration has succeeded the machine removes a booking the machine removes a booking from the bookings database the machine removes a booking from the bookings database the machine removes a showing from the customers database removeShowing phenomenon the machine removes a showing from the showings database the machine removes a showing from the showings database the machine removes a showing from the showings database the machine removes a showing from the showings database the machine removes a valiable showings at a staff member browses available showings and a staff member attempts to cancel a showing showing showing showing showing showings a staff member attempts to cancel a showing showing showing showings showings a staff member attempts to log in as a staff member attempts to log in as a staff member attempts to log out showing				
registrationFailedNotification phenomenon the webpage displays a to the user that the registration has failed the webpage displays a to the user that the registration has failed registration has failed the machine notifies the webpage that the registration has succeeded the webpage displays a notification to the user that the registration has succeeded the machine removes a booking from the bookings database removeShowing phenomenon the machine removes a booking from the customers database removeShowing phenomenon the machine removes a standard from the customers database removeShowing phenomenon a staff member browses available showings database removeShowing phenomenon a staff member browses available showings scanceIshowing phenomenon a staff member attempts to cancel a showing showings scanceIshowing phenomenon a staff member attempts to cancel a showing submits a staff member attempts to log in as a staff member attempts to log out the staff member attempts to log in as a staff when a submit Bookings phenomenon the user enters their e-mail address and desired password and hits the submit button the user submits a request to register a new customer account, containing an e-mail address and a password and a password and a password and staff member submits a new showing to the machine for entry showing to the m				
registrationSuccess phenomenon the machine notifies the webpage that the registration has succeeded registrationSuccessNotification phenomenon the webpage displays a notification to the user that the registration has succeeded remove a booking phenomenon the machine removes a booking from the bookings database removeCustomer phenomenon the machine removes a customer from the customers database removeShowing phenomenon the machine removes a showing from the showings database removeShowing phenomenon a staff member browses available showings as the machine removes a showing from the showings database removes a showing from the showings database removeShowing phenomenon a staff member attempts to cancel a showing showings showings as a staff member attempts to cancel a showing showings s		_	that the registration has failed	
registrationSuccessNotification phenomenon the webpage displays a notification to the user that the registration has succeeded removeBooking phenomenon phenomenon the machine removes a booking from the bookings database removeCustomer phenomenon phenomenon phenomenon the machine removes a customer from the customers database removeShowing phenomenon phenomenon phenomenon phenomenon phenomenon phenomenon a staff member browses available showings sCancelShowing phenomenon slowings sCancelShowing phenomenon slowings phenomenon a staff member attempts to cancel a showing sLogin phenomenon phenomenon phenomenon a user attempts to log in as a staff member slought phenomenon phenomenon a staff member attempts to log out sShowWebsite phenomenon a staff member attempts to log out sShowWebsite phenomenon a staff member cD	${\it registration} Failed Notification$	phenomenon	user that the registration has	PD R1
tion to the user that the registration has succeeded removeBooking phenomenon the machine removes a booking from the bookings database removeCustomer phenomenon the machine removes a customer from the customers database removeShowing phenomenon the machine removes a showing CD removeShowing phenomenon the showings database  S  S  SBrowse phenomenon a staff member browses available showings sCancelShowing phenomenon a staff member attempts to cancel a showing sLogin phenomenon a user attempts to log in as a staff member sLogout phenomenon a staff member attempts to log out sShowWebsite phenomenon a staff member attempts to log out sShowWebsite phenomenon the machine shows a website to the staff member StaffMember biddable domain the customer selects the tickets they wish to book and hits the submit button submitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password submitShowing phenomenon a staff member submits a new showing to the machine for entry	registrationSuccess	phenomenon	page that the registration has	PD R1
removeCustomer phenomenon the machine removes a customer from the customers database removeShowing phenomenon the machine removes a showing the machine removes a showing from the showings database removeShowing phenomenon a staff member browses available showings phenomenon a staff member attempts to cancel a showing showings  SCancelShowing phenomenon a staff member attempts to cancel a showing showings  SLogin phenomenon a user attempts to log in as a staff phenomenon a user attempts to log in as a staff member showing showings  SLogin phenomenon a staff member attempts to log in as a staff member attempts to log in as a staff member browses available showings  SLogin phenomenon a user attempts to log in as a staff member staff member attempts to log out staff member attempts to log out be staff member attempts to cancel a showing a staff member attempts to cancel a showing be a database containing an estaff log out be staff member attempts to cancel a staff member attempts to cancel a showing a staff member attempts to	registration Success Notification	phenomenon	tion to the user that the registra-	PD R1
removeShowing phenomenon the machine removes a showing from the showings database  S  SBrowse phenomenon a staff member browses available showings  SCancelShowing phenomenon a staff member attempts to cancel a showings  ShowingsDatabase lexical domain, designed domain showings  SLogin phenomenon a staff member attempts to log in as a staff member  SLogout phenomenon a staff member attempts to log in as a staff member  SLogout phenomenon a staff member attempts to log in as a staff member  SLogout phenomenon the machine shows a website to the staff member  StaffMember biddable domain a member of cinema staff; a user who has logged in as staff the customer selects the tickets they wish to book and hits the submit button  SubmitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button  submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing phenomenon a staff member submits a new showing to the machine for entry	removeBooking	phenomenon		CD
SBrowse phenomenon a staff member browses available showings  SCancelShowing phenomenon a staff member attempts to cancel a showings  ShowingsDatabase lexical domain, designed domain showings  SLogin phenomenon a staff member attempts to log in as a staff member attempts to log in as a staff member attempts to log in as a staff member attempts to log out  SLogout phenomenon a staff member attempts to log out  SShowWebsite phenomenon the machine shows a website to the staff member  StaffMember biddable domain a member of cinema staff; a user who has logged in as staff  submitBookings phenomenon the customer selects the tickets they wish to book and hits the submit button  submitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button  submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing phenomenon a staff member submits a new showing to the machine for entry		_	from the customers database	
SBrowse phenomenon a staff member browses available showings  SCancelShowing phenomenon a staff member attempts to cancel a showing  ShowingsDatabase lexical domain, designed domain showings  SLogin phenomenon a user attempts to log in as a staff member  SLogout phenomenon a staff member attempts to log out  SShowWebsite phenomenon the machine shows a website to the staff member  StaffMember browses available CD  StaffMember phenomenon a user attempts to log in as a staff member  StaffMember browses available CD  CD  SLogin a user attempts to log in as a staff member  Staff member attempts to log out  ShowWebsite phenomenon a member of cinema staff; a user who has logged in as staff member  StaffMember browses available CD  CD  SLOGIN Phenomenon the machine shows a website to the staff member of cinema staff; a user who has logged in as staff who has logged in as staff the customer selects the tickets they wish to book and hits the submit button  SubmitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button  SubmitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password  SubmitShowing phenomenon a staff member submits a new showing to the machine for entry		phenomenon		CD
ScancelShowing  phenomenon     a staff member attempts to cancel a showing  ShowingsDatabase  lexical domain, designed domain     showings  sLogin  phenomenon     a user attempts to log in as a staff member  slogout  phenomenon     a staff member attempts to log out  sShowWebsite  phenomenon     biddable domain  submitBookings  phenomenon  phenomenon  the customer selects the tickets they wish to book and hits the submit button  submitBookings  phenomenon  the user enters their e-mail address and desired password and hits the submit button  submitRegistration  phenomenon  the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing  phenomenon  a staff member submits a new showing to the machine for entry  CD  CD  CD  CD  CD  CD  CD  CD  CD  C				
ShowingsDatabase lexical domain, designed domain showings  sLogin phenomenon a user attempts to log in as a staff member  sLogout phenomenon a staff member attempts to log out the machine shows a website to phenomenon the machine shows a website to the staff member  StaffMember biddable domain a member of cinema staff; a user who has logged in as staff the customer selects the tickets they wish to book and hits the submit button  submitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button  submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing phenomenon a staff member submits a new showing to the machine for entry		phenomenon		
signed domain showings  sLogin phenomenon a user attempts to log in as a staff CD member  sLogout phenomenon a staff member attempts to log out  sShowWebsite phenomenon the machine shows a website to the staff member  StaffMember biddable domain a member of cinema staff; a user who has logged in as staff the customer selects the tickets they wish to book and hits the submit button  submitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button  submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing phenomenon a staff member submits a new showing to the machine for entry	Ţ.	phenomenon	_	
sLogout phenomenon a staff member attempts to log out  sShowWebsite phenomenon the machine shows a website to the staff member  StaffMember biddable domain a member of cinema staff; a user who has logged in as staff  submitBookings phenomenon the customer selects the tickets they wish to book and hits the submit button  submitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button  submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing phenomenon a staff member submits a new showing to the machine for entry	ShowingsDatabase		showings	
sShowWebsite phenomenon the machine shows a website to the staff member the staff member a member of cinema staff; a user who has logged in as staff the customer selects the tickets they wish to book and hits the submit button the user enters their e-mail address and desired password and hits the submit button submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password showing to the machine for entry showing to the machine for entry	sLogin	phenomenon		CD
StaffMember biddable domain a member of cinema staff; a user who has logged in as staff  submitBookings phenomenon the customer selects the tickets they wish to book and hits the submit button  submitBookings phenomenon the user enters their e-mail address and desired password and hits the submit button  submitRegistration phenomenon the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing phenomenon a staff member submits a new showing to the machine for entry	sLogout	phenomenon		CD
who has logged in as staff  submitBookings  phenomenon  the customer selects the tickets they wish to book and hits the submit button  submitBookings  phenomenon  the user enters their e-mail address and desired password and hits the submit button  submitRegistration  phenomenon  the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing  phenomenon  a staff member submits a new CD showing to the machine for entry	sShowWebsite	phenomenon		CD
they wish to book and hits the submit button  submitBookings  phenomenon  the user enters their e-mail address and desired password and hits the submit button  submitRegistration  phenomenon  the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing  phenomenon  a staff member submits a new SD Showing to the machine for entry	StaffMember	biddable domain	The state of the s	CD
dress and desired password and hits the submit button  submitRegistration  phenomenon  the user submits a request to register a new customer account, containing an e-mail address and a password  submitShowing  phenomenon  a staff member submits a new CD showing to the machine for entry	$\operatorname{submitBookings}$	phenomenon	they wish to book and hits the	PD R5
register a new customer account, containing an e-mail address and a password  submitShowing phenomenon a staff member submits a new showing to the machine for entry	$\operatorname{submitBookings}$	phenomenon	dress and desired password and	PD R1
showing to the machine for entry		phenomenon	register a new customer account, containing an e-mail address and	PD R1
	submitShowing	phenomenon	showing to the machine for entry	CD
T	T			

Table 4.1: Glossary

Name	Type	Description	Source
U	V I	•	
uBrowse	phenomenon	a user browses available showings	CD
UDEKino	machine	the machine to be developed	CD
UDEK_ArchiveShowings	machine	the sub-machine responsible for	PD R7
		automatically archiving show-	
		ings once they have begun	
UDEK_BookTickets	machine	the sub-machine responsible for	PD R5
		customer booking tickets	
UDEK_NonStaffUserBrowse	machine	the sub-machine responsible for	PD R4 / R8
		registered and non-registered	
		customers browsing upcoming	
		showings	
UDEK_RegisterCustomer	machine	the sub-machine responsible for	PD R1
		customer account registration	
User	biddable domain	a user of the application who is	CD
		not logged in	
uShowWebsite	phenomenon	the machine shows a website to	CD
		the user	
V			
W			
WebpageBookTickets	connection domain,	a webpage via which a customer	PD R5
	designed domain	can book tickets	
WebpageNonStaffUserBrowse	connection domain,	a webpage via which a user can	PD R4 / R8
	designed domain	browse upcoming showings	
WebpageRegisterCustomer	connection domain,	a webpage via which a user can	PD R1
	designed domain	register a new customer account	
X			I
Y			I
Z			Γ