POLITECNICO DI MILANO
SOFTWARE ENGINEERING 2

Requirements Analysis and Specification Document

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Milan, April 2015

Contents

Chapter 1

Introduction

1.1 Purpose

The purpose of this document is to provide a comprehensive description of the GuessBid system. It's aim is to communicate what the software should do and identify the capabilities and characteristics of the system being developed. This document is meant for everyone included in the production of the software.

1.2 Scope

The aim of this project is to develop and implement GuessBid, an inverse auction system which works like a regular auction, only difference being the way the winner is determined. The winning bid in an inverse auction is the lowest unique bid, as opposed to being the highest one.

The developed system should allow new users to register. Users, once logged in, should be able to:

- Read the FAQ (Frequently asked questions)
- Check his/her virtual credit balance
- Create an auction for any good he/she has, defining an expiration date after which the auction finishes
- Inquire the system about the current status of created and participating auctions
- Browse/Search on-going auctions
- Bid on an existing auction, with the exception of the auctions the users themselves created
- Receive and read notifications about his/her rankings and outcomes of auctions user has created or participated in

Each newly created auction should have a name, short description, end time and the optional picture. Once created, auction details should be immutable. This is a design choice made to protect users who have already placed a bid and thus spent credit on an item which they may have no interest in should the details change.

Whenever a new bid is placed on an auction, the system should update user rankings in regards to the auction in question and send notifications to all participating users in case their rank changed.

1.3 Glossary

The following are the definitions of some commonly used phrases throughout the document:

Auction a public sale in which goods or property are sold to the highest bidder

Bid an offer to pay (a particular amount of currency) for something that is being sold

Bidder (w.r.t an auction) a user who has placed one or more bids on a specific auction

Bid cost the cost of placing a bid, in this case the cost is two units of virtual money (credit)

Creator (of an auction) a user who created that particular auction

Credit GuessBid's currency. The positive balance or amount of virtual money remaining in a user's account.

Guest a person accessing a system that has either never registered or hasn't logged in yet. Guest has only two available options, to log in or to register for the first time

Inverse auction also known as unique bid auction, is a type of strategy game related to traditional auctions where the winner is the individual with the lowest unique bid

Participant (of an auction) a user who has placed one or more bids on that specific auction[1]

Rank a number specifying position or standing relative to other bidders in an auction

Seller (w.r.t an auction) a user who created that particular auction [2]

[1] Bidder and participant will be used interchangeably throughout the document
[2] Seller and creator will be used interchangeably through the document

User a person already registered and logged into the system.

Virtual money GuessBid's currency

Winner a bidder with the lowest unique bid at auction's end time

Chapter 2

Overall description

2.1 Product perspective

GuessBid is a web application that provides users a service described in section 1.2. The software will be developed using a server-client model. The server side contains the application's logic and is used to interact with permanent storage, serve pages to the client and process user input. The web client consists of dynamic web pages which provide an easy-to-use graphical interface and the web browser through which they are accessed. Considering GuessBid is a web application, it is platform independent. The only requirement is users having a web browser installed on a device of their choice.

2.2 Identifying stakeholders

There are tree distinct interest groups of people regarding this project:

Professors who have assigned the project and who expect it to be developed in a way which satisfies the given requirements while respecting the given deadlines. Their interests go beyond just working software, they are interested in conveying an thorough understanding of the underlying development process

Users who will use the application for buying and selling their goods using the inverse auction paradigm

Developer group, in this case one person, responsible for the actual design and development of the software

2.3 User Characteristics

GuessBid is expected to have users across a wide range of demographics, meaning users of any age, gender and educational background. Still, given of the

ubiquitous nature of internet and social media, it is assumed that people using our software do have the basic web browsing skills.

2.4 Actors identifying

Two possible actors interacting with our system are the following:

Guest person accessing a system that has either never registered of hasn't logged in yet. Guest can only access the initial page from where he has only two available options, to log in or to sign up for the first time.

User a person already registered and logged into the system. User can use all of the features offered by the application

2.5 Goals

Having possible users in mind, GuessBid should have these features:

- registering new users
- managing user's virtual money balance
- managing bids and user rankings for all auctions
- sending notifications regarding ranking and outcomes for auctions to all of its bidders and the seller
- for each user it should provide
  - initial credit of 100 units of virtual money
  - functionality of creating new auctions
  - functionality of bidding on existing auctions given he/she is not the seller
  - an interface for reading and receiving system generated notifications

2.6 Domain properties

It is supposed that these conditions hold in the analyzed world:

- the seller has the goods he is putting up for auction
- the details of the goods provided by the seller are accurate
- the goods exchange arrangements between the seller and the winner of an auction are made independently from the GuessBid platform
- both parties (seller and the winner) act honestly, fairly and in good faith
-

2.7 Assumptions

Considering that there were some ambiguities in the specification document, the following facts are assumed:

- users register with their email and password
- users can change their email and password
- auctions have a category to make finding goods of interest easier
- bidders are unaware of the current lowest unique bid for the entire duration of an auction
- after winning an auction, system automatically withdraws the amount of credit (as stated in the winning bet) from the winning user's account and deposits it into the seller's account
- there is a *Terms & Conditions* section to indicate clearly the rules of conduct which, if not followed, will result in account deactivation
- there is a *Frequently Asked Questions* section to provide:
  - explanation of the logic behind the concept of inverse auction
  - contact information for reporting user violation of the *Terms & Conditions*
  - reasons behind some more restricting parts of users functionality (*e.g.* not being able to change the details of an active auction)

Chapter 3

Requirements

Assuming the domain properties stated in section 2.6 hold, we can derive software requirements from the goals defined in section 2.5.

3.1 Functional requirements

Functional requirements are defined for the system and for each actor identified in section 2.4.

For a **Guest** the system has to provide two functionalities:

sign up: a guest will have to provide some basic information (email, username and password) in order to be registered as a user

log in: after entering correct identification information (username and password) the guest will be logged in and redirected to the homepage

For a **User** the system has to provide the following functionality:

- Option to sign out
- Manage settings:
  - change email
  - change username
  - change password
- Create a new auction
- Browse active auctions
- Place a bid to active auctions which he/she did not create
- View own ranking for each participating auction

- View received notifications regarding created or participating auction outcomes and ranking
- The system should:
  - Manage users virtual money balance
  - Keep track of all auctions and generate notifications regarding their outcome and ranking change

3.2 Non-functional requirements

User Interface of the web application should be intuitive so even the non-technically savvy users can use the system as simply and efficiently as possible.

Availability the application should be available handle user's request at all times using any device with an installed web browser

Chapter 4

Scenarios

User registration

Jolene is a university student looking to graduate in month's time. She just found out she had gotten her dream job and is starting right after graduation date. After the initial emotional response, she started planning the details of her move out of the college dorm. Looking around she realized she had accumulated a lot of things over the past 5 years. Things that aren't practical to take with her (like her futon), things she won't be needing anymore (like her collection of colorful pencil cases) and even things she never needed (one sombrero is fine, but three is pushing it). The way she sees it is, she has three options. First one, throw it all away. Second, organize a yard sale and third, put it all up for an online auction. After careful consideration she decided not to go with the first option because after acing her environmental studies test last semester, it wouldn't feel right to just throw it all away. The yard sale just seemed too much work, so she was left with the online auction option. She decided to go with the GuessBid platform because she heard it was popular among the students at her university. Given she didn't not have an account, she navigated for the first time to the GuessBid's web site and was shown a *Log in* and a *Sign up* form. She inputs her chosen username, her email address and password in the form and clicks the *Sign up* button. System verifies the input information is valid and she is redirected to Guess Bid's home page.

Auction creation

On the GuessBid's home page Jolene sees a personalized toolbar with the *Create new auction* option. She clicks it and is shown a form containing input fields for *Name*, *Description*, *Category*, *End Time*, and an optional *Picture* upload. She first decides to tackle the sombrero situation. In the *Name* input field she types "Sombrero", in the *Description* field she puts in "3 sombreros in mint condition", for *Category* she chooses "Fashion" from the dropdown menu. As for *End Time* she picks the day after tomorrow using the DayPicker tool. Lastly, she quickly

snaps a photo of the three colorful wide-brimmed hats, uploads it and presses the *Create Auction* button. She is then redirected to the newly generated page showing her, now active, auction.

Bidding on an auction

Luca was just invited to a theme party. Being wholly devoted to his fraternity, ingeniously named Kappa-Tau, he knows missing a party is not an option. The theme? Mariachi, of course. Given he has nothing to wear, he turns to GuessBid. He fires up his browser and navigates to GuessBid's website. After successfully logging in, he is redirected to the site's homepage containing a search box. He inputs "sombrero" in the search box and is returned all active auctions containing the word sombrero either in their *Name* or *Description*. After skimming through his options he decides to bid on Jolene's auction, because three sombreros are apparently better than one. By clicking on Jolene's listing, Luca is redirected to that auction's page containing all the details and an input box to place his bid. He inputs 2.11 and clicks on the *Bid* button. The system automatically withdraws the cost of placing a pic, 2 credits, from his account and generates a notification with his current ranking.

Winning an auction

After two days, the auction automatically closes with Lucas's 2.11 credits being the winning bid. The system automatically withdraws 2.11 credits from Luca's account and deposits them in Jolene's account. Luca and Jolene both get a notification regarding the ended auction and its winner, along with each others email addresses so the can make arrangements on how to handle the exchange of goods in question. After emailing each other, they were both pleased to learn they attend the same college so the exchange of goods turned out to be a breeze.

Chapter 5

UML models

5.1 Use case

After stating all the desired features, goals and requirements, and describing possible scenarios we can identify some use cases. The diagrams are shown and described bellow

5.1.1 Accessing the application

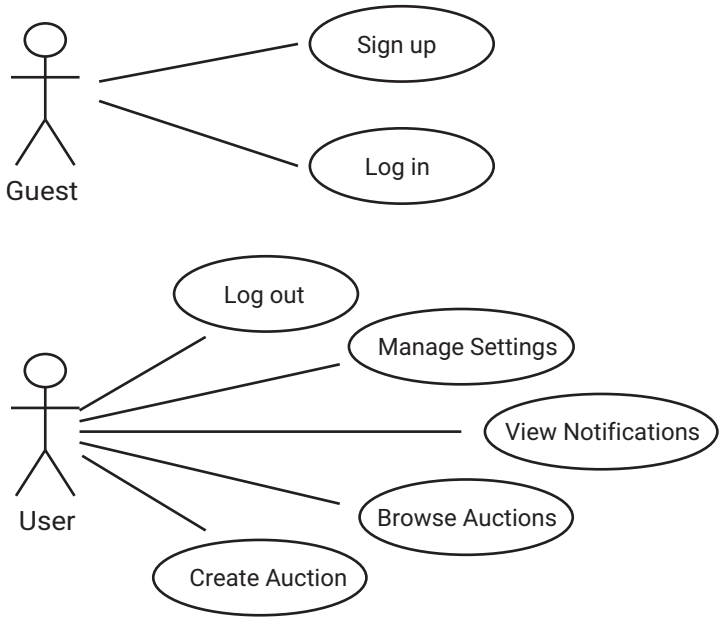


Figure 5.1:

Name	Registration
Actors	Guest
Entry conditions	The guest has never registered to the system
Event flow	• Guest navigates to the GuessBid's home page containing a form asking him to enter basic information, his email, his desired username and password • Upon form submission the system checks if the information entered is valid. *i.e.* all the fields are filled and the username or email entered are not already in use by an existing user • If the entered information is valid, the user is automatically logged in to the system and redirected to his personal home page
Exit conditions	The information about the new user is correctly stored, a welcome email is sent and the user is assigned a virtual credit of 100
Exceptions	If the information the user entered is not valid, an appropriate message is displayed and the guest is asked to enter his username, email and password again

Name	**Log in**
Actors	Guest
Entry conditions	The guest has already registered in the system and knows his username and password
Event flow	• After navigating to GuessBid's home page containing a form asking him to enter his email his password • Upon form submission the system checks if the username and the password match an existing user • If the entered information is valid, the user is logged in to the system and redirected to his personal home page
Exit conditions	The user is granted access to all of the GuessBid's functionalities
Exceptions	If he information the user entered is not valid, an appropriate message is displayed and the guest is asked to enter his username and password again

Name	**Create Auction**
Actors	User
Entry conditions	The user is logged in

Event flow	• User chooses the *Create auction* option located on the navigation bar
	• User is redirected to a page where he/she is asked to provide the following information:
	  ◦ name
	  ◦ description
	  ◦ category
	  ◦ end time
	  ◦ picture of the goods put up for auction (optional)
	• User submits the filled out form

Exit conditions	New auction is created and active starting that moment.
Exceptions	If the user submits the form with at least one non-optional field empty or if the provided end time is earlier then the time of creation, an appropriate message will be displayed and the user will be asked to fill out the the missing information

5.1.2 Participating in auctions

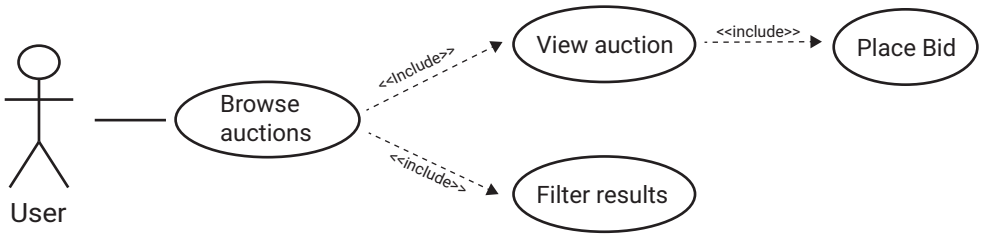
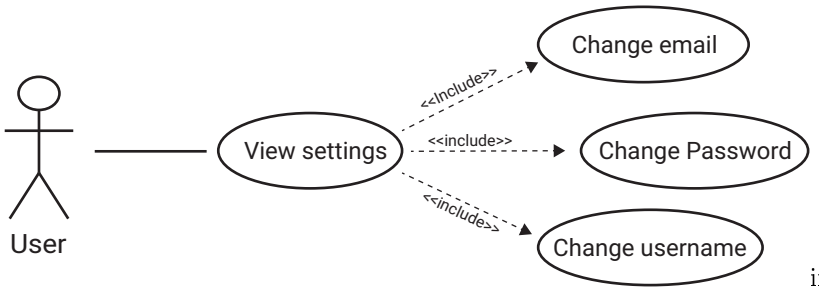


Figure 5.2:

Name	**View auctions**
Actors	User
Entry conditions	The user is logged in
Event flow	• User inputs keywords in the search box located in the middle of GuessBid's home page • The results of the search are displayed in form of a list • User has the option to filter results • User clicks on an auction he/she is interested in and is redirected to that auction's page
Exit conditions	-
Exceptions	If there are no auctions with the keywords entered in their *Name* or *Description* there will be no search results

Name	Place bid
Actors	User
Entry conditions	The user is logged in and navigated to a single auction's page
Event flow	User inputs the amount of credit he want's to bid and clicks the submit button
Exit conditions	The bid is recorded and the user is ranked w.r.t other bidders. After which the system generates notification for all the bidders with their new rankings
Exceptions	If the user doesn't have 2 credits (cost to place the bid) + whatever amount he/she entered, the request will be rejected and an appropriate message will be displayed notifying the user about insufficient funds

5.1.3 Managing settings



information

Figure 5.3:

Name	**Change email (username)**
Actors	User
Entry conditions	The user is logged in

Event flow	• User chooses the *View settings* option on the navigation bar
	• User is redirected to a page where his username and email are shown along with these options:
	  ◦ Change email
	  ◦ Change username
	  ◦ Change password
	• User selects the *Change email* (*username*) option, enters the new email, and submits the change

Exit conditions	The new email (username) is correctly stored and the old one is deleted
Exceptions	If the user submits the form leaving the email (username) field empty, an appropriate message will be displayed and the user will be asked to fill out the the missing information

Name	**Change password**
Actors	User
Entry conditions	The user is logged in

Event flow	• User chooses the *View settings* option on the navigation bar
	• User is redirected to a page where his username and email are shown along with these options:
	  ◦ Change email
	  ◦ Change username
	  ◦ Change password
	• User selects the *Change password* option, enters the new password twice, and submits the change

Exit conditions	The new password is correctly stored and the old one is deleted
Exceptions	If the user submits the form leaving the password field empty or if the two passwords entered don't match, an appropriate message will be displayed and the user will be asked to fill out the the missing information

5.2 Class Diagram

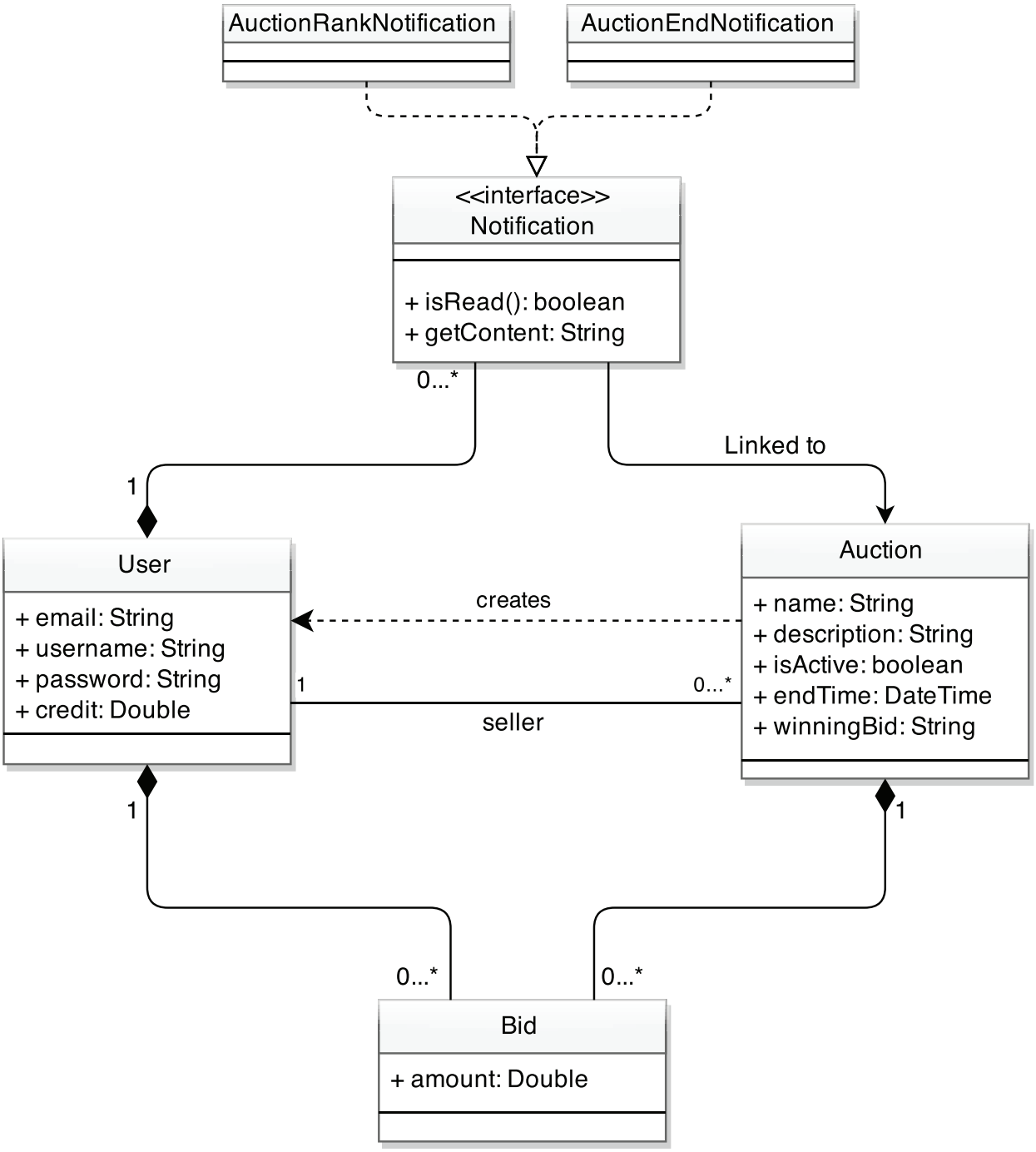


Figure 5.4:

5.3 Sequence Diagram

5.3.1 User Registration

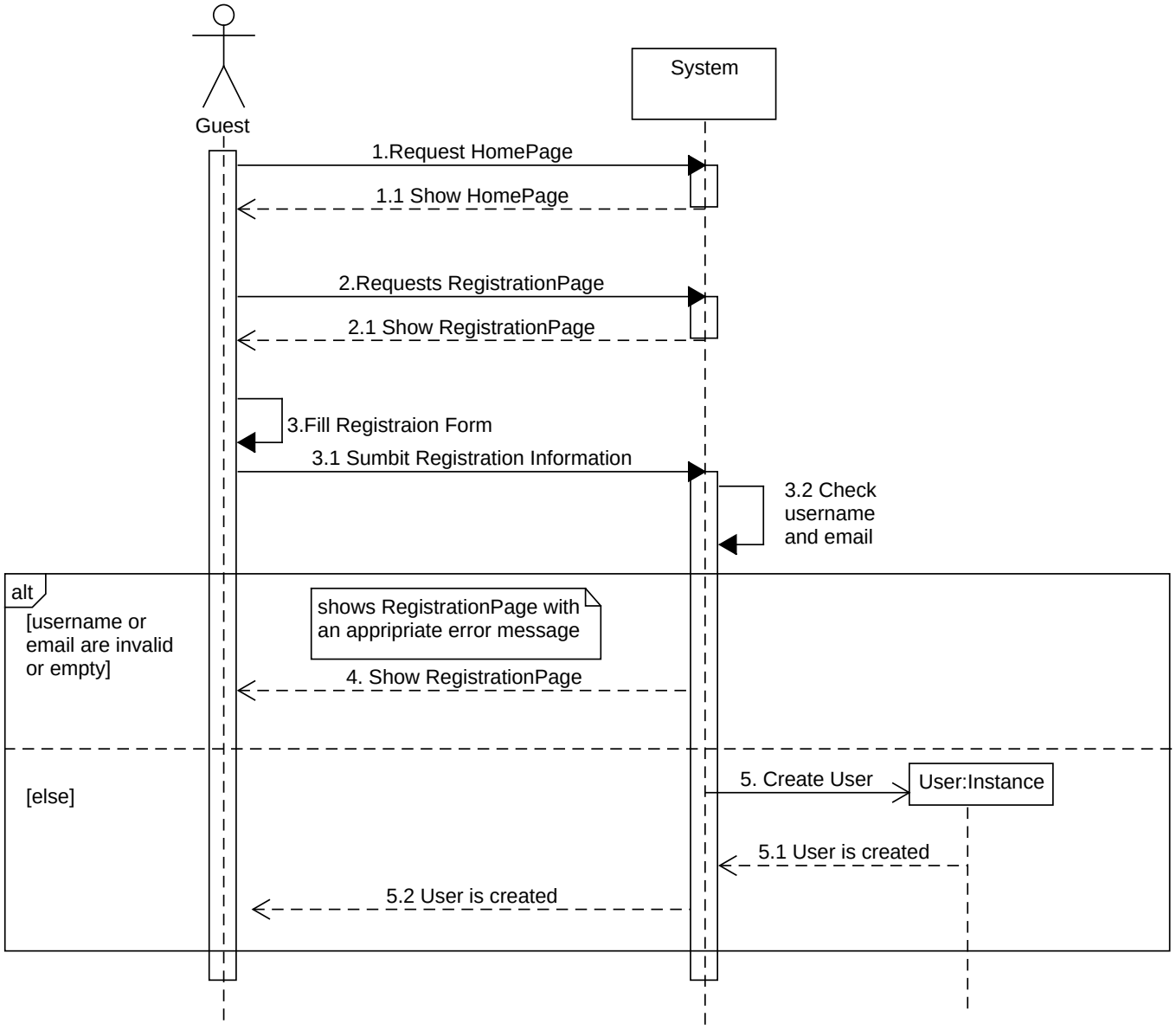


Figure 5.5:

5.3.2 User Log in

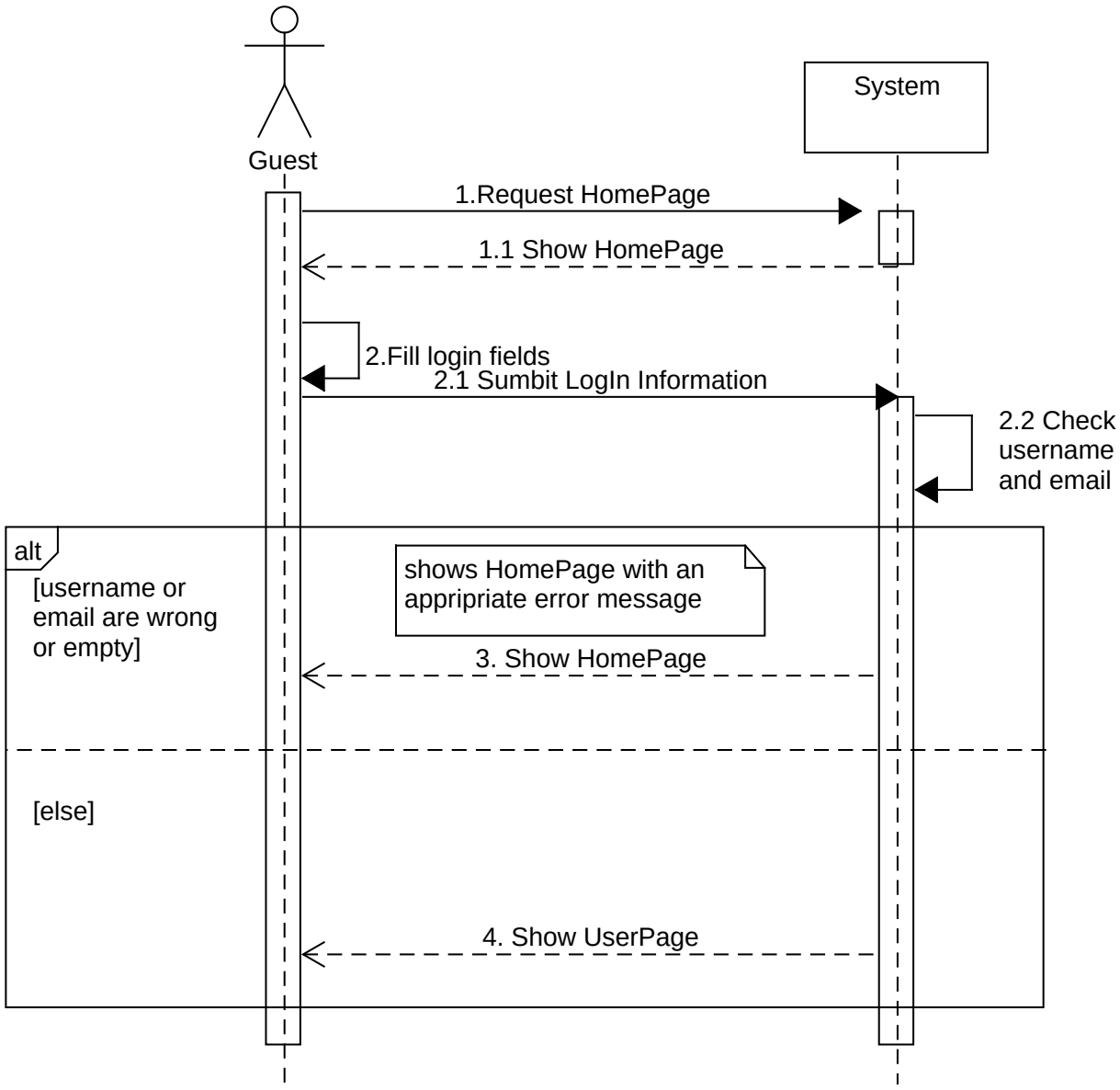


Figure 5.6:

5.3.3 Change Password

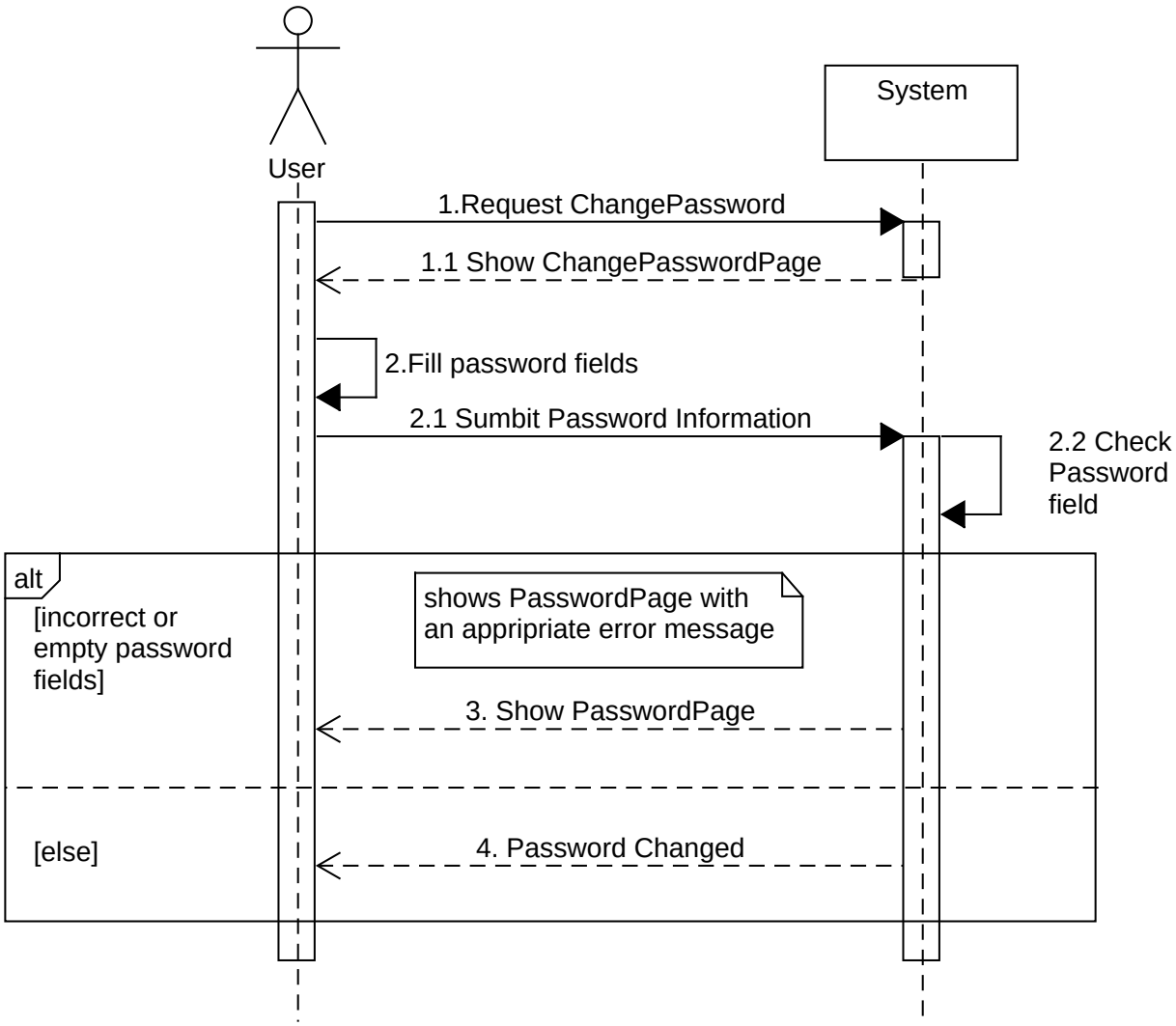


Figure 5.7:

5.3.4 Create Auction

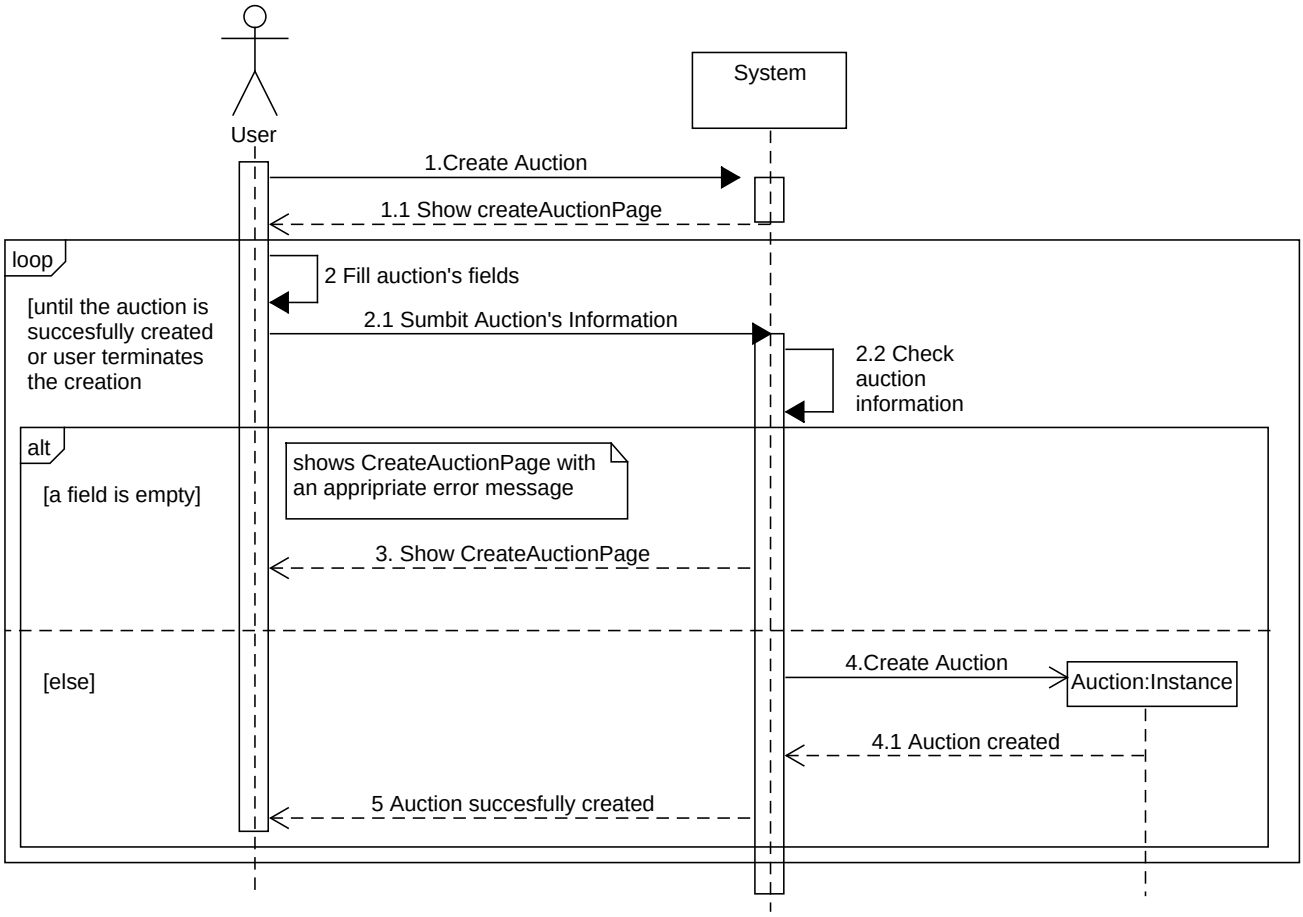


Figure 5.8:

5.3.5 Place Bid

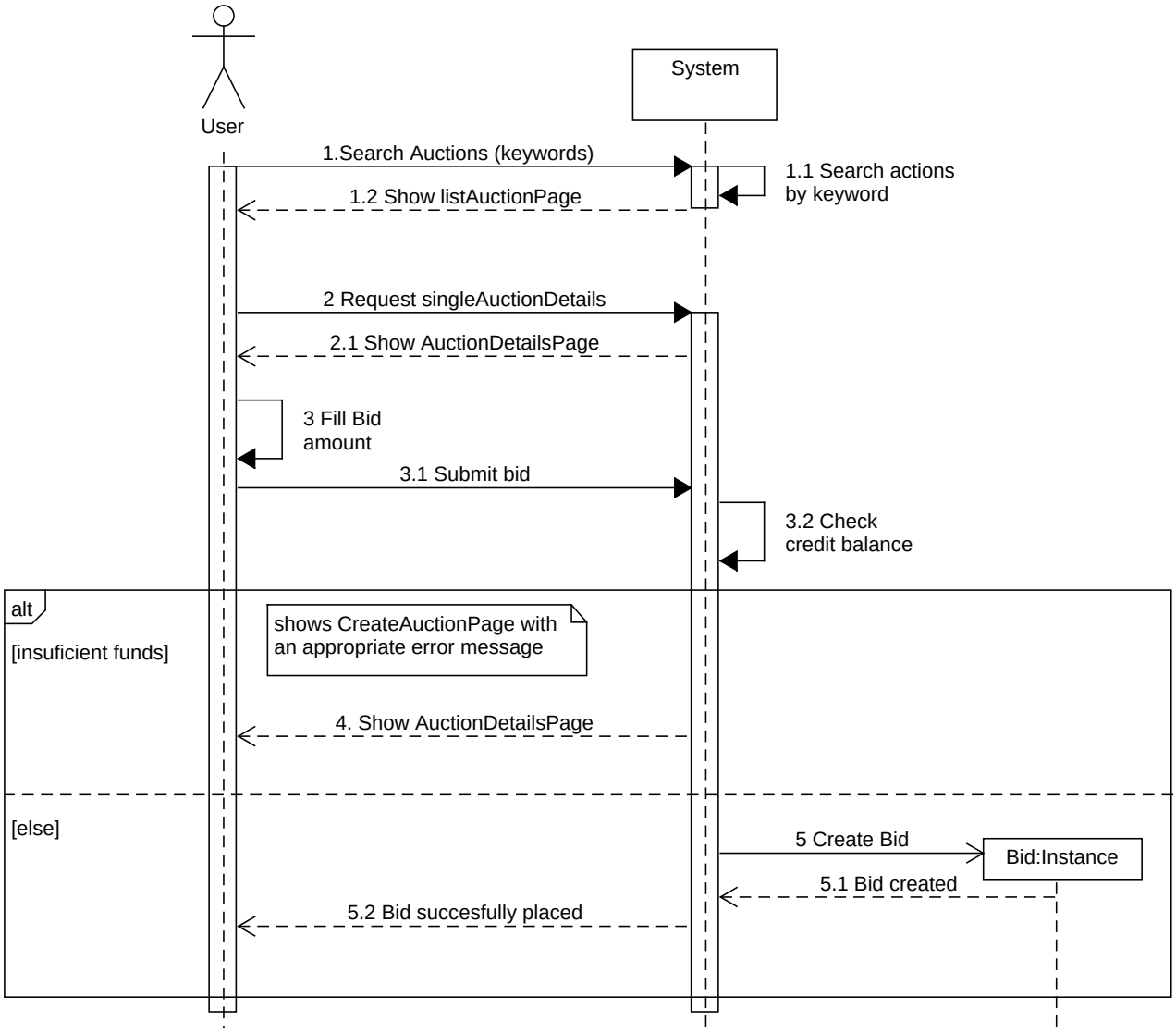


Figure 5.9:

5.4 State chart diagrams

5.4.1 Auction's lifecycle

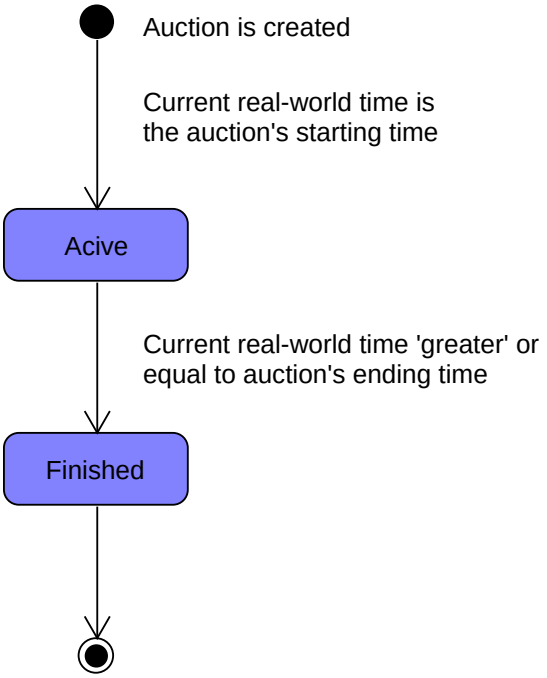


Figure 5.10:

5.4.2 Bid's lifecycle

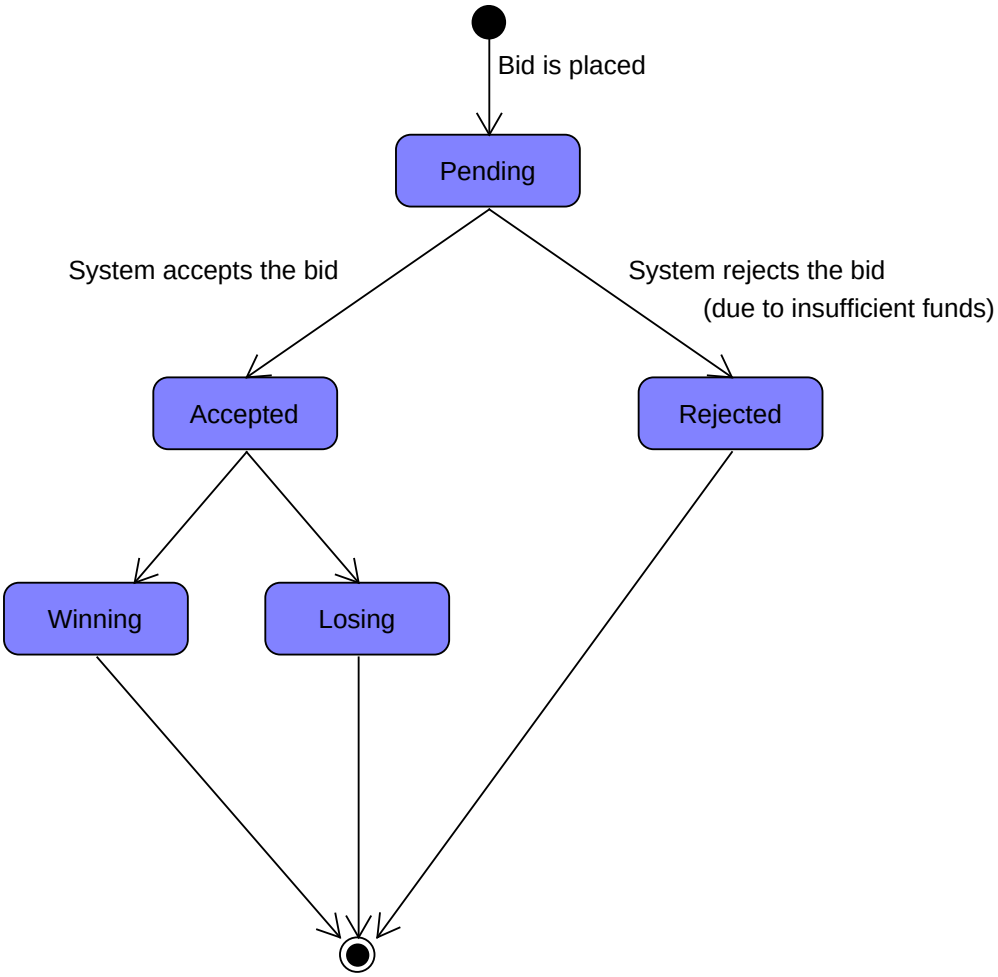


Figure 5.11:

Chapter 6

Alloy

```
sig User {}
sig Auction{

    seller: one User,
    winningBid : lone Bid

}
sig Bid{

    amount: one Int,
    auction: one Auction,
    bidder: one User

}
abstract sig Notification {

    user: one User,
    linkedTo: one Auction

}
sig AuctionRankNotification extends Notification{}
sig AuctionWinnerNotification extends Notification{}

//FACTS
fact everyAuctionHasOneSeller{

    all a: Auction | one u:User | a.seller = u

}
fact everyBidHasUniqueBidderAndAuction{

    all b: Bid | one u:User, a:Auction |

        b.auction = a and b.bidder = u

}
fact everyNofiticationHasUniqueUserAndAuction{
```

```
    all n: Notification | one u: User, a:Auction |
        n.user = u and n.linkedTo = a
}
fact noSellerCanBidonOwnAuction{
    all u: User, a:Auction, b: Bid | (

        u= a.seller  and a = b.auction ) => not( b.bidder = u )
}
fact everyAuctionHasLoneWinningNotification{

    all w1:AuctionWinnerNotification, w2:AuctionWinnerNotification |

        (w1 != w2 )=> ( w1.linkedTo != w2.linkedTo)
}
fact winningBidCanOnlyBeOneOfPlacedBids{
    all a:Auction, b:Bid |
        (b = a.winningBid ) => (a = b.auction)
}
// only a user with a winning bid can get winning notification
fact  {
    all w:AuctionWinnerNotification |
    w.user = w.linkedTo.winningBid.bidder
}
// only a bidder can get a rank notifiction
fact  {

    all r:AuctionRankNotification, u:User | some b:Bid |

        (r.user = u) =>( r.linkedTo = b.auction and b.bidder = u)
}
//all winning bids need to generate a winning notification
fact{

    all a:Auction | one w: AuctionWinnerNotification |
        (#a.winningBid =1 ) => ( w.linkedTo = a)
}
//PREDICATES
pred show() {}
run show for 3
```

6.1 Worlds generated

In this section some worlds generated by Alloy Analyzer will be display in order to prove the model's consistency.

6.1.1 General world

A world is shown in Figure 6.1 in which

- the seller cannot bid on it's own auction
- every auction that has a winning bid also has an AuctionWinnerNotification.
- only the winning user can receive an AuctionWinnerNotification.
- only a bidder can recieve AuctionRankNofitication

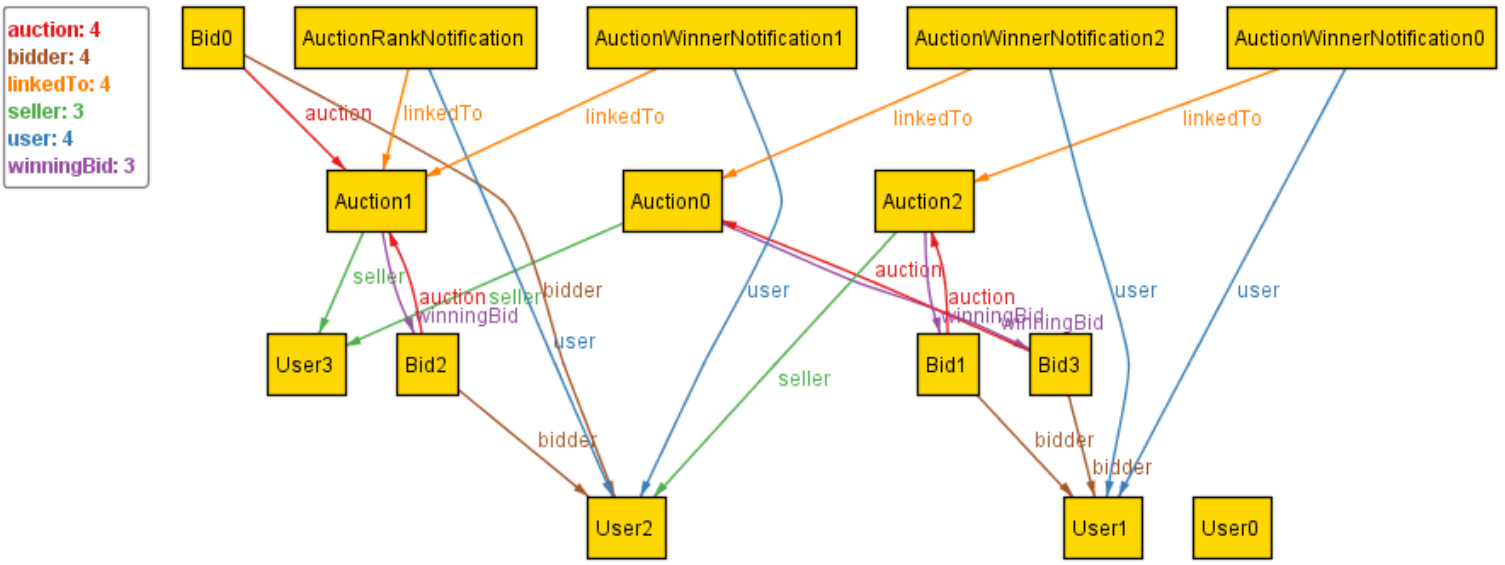


Figure 6.1: