
Laboratory 10**Instructions**

- To better benefit from the work in this lab, it is recommended to work in groups of two or three (not more). Your answer document should contain the names of all the group members.
- To receive credit you have to show you solution to the TA and to submit your work to cuLearn.
- For those who don't finish early, the TA will ask you to show whatever you have completed, starting at about 15 minutes before the end of the lab period.

Problem summary

Consider the Real Estate Agency problem description given below. Assume that we are at the point where we have already performed Requirements Elicitation and Analysis, as well as the initial part of the Analysis phase; so we have the use case model, a description of some use cases and an initial class diagram (see below).

What to do

You are asked to continue the analysis phase for this software system, given the result of the requirement elicitation/analysis phase and the initial class diagram (see below).

Specifically, your tasks are:

- Update the initial class diagram with one or more of the following: additional entity classes, control and boundary classes. Indicate the category of each class (i.e., *Entity*, *Boundary* and *Control* classes) by using the heuristics taught in class.
- Produce sequence diagrams for the use case *Respond to offer*. While building the sequence diagrams, you may need to update the initial class diagram with additional classes and/or attribute and operations. Also, apply the heuristics discussed in class for the construction of sequence diagrams.

Your answer should include:

1. An updated class diagram
2. Sequence diagram(s) with combined fragments (alt, opt, loop, ref, etc.) describing the interactions for the realization of the use case *Respond to offer*.

Problem Description: Real Estate Agency

A real estate agency, Acreage-to-City, requires an application that acts as a mediator between the buyer and the seller. The agency provides expertise through its agents and links the customers with other institutions, such as banks or money lenders, for the purpose of assisting the buyer in obtaining a loan.

The Acreage-to-City agency is looking for a way to leverage technology to gain a strategic advantage in the marketplace. The Internet seems to provide a good way to unite buyers and sellers of real estate, providing both parties with as much information as possible. The executives at the agency are very aware that they need to put something in place quickly to avoid being eclipsed by one of the larger real estate companies. Therefore, they have limited the scope of this first effort to residential sales only.

The web application essentially provides a communication conduit and meeting place for buyers and sellers of residential real estate. It automates and logs the transactions that occur between buyer and seller to speed up the process and match the right property to the right buyer effectively.

In addition to buyers and sellers, the application is intended to be used by the employees of the Acreage-to-City agency (mainly the agents) and by contracted vendors of services: bank loan providers, legal analysts, and financial analysts. All users who request entry to the system must be authenticated. If the user identification and password combination is not valid, the system warns the user and provides him three attempts before suspending his session.

Users of the application should be able to list and search properties on sale. Buyers and sellers can select the agent they wish to assist them with their sale/purchase; however an agent is not required to buy/sell a house using this application. The agents are there for assistance if required, however once a buyer/seller has selected an agent they will use the same agent for the duration of their transactions with the application. Sellers provide information about the property to sell, such as photos, square footage, price, location, age, etc. and add it to the system. Buyers make offers after reviewing listings with their agent. Sellers respond to offers based on their

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agent's advice by accepting or declining the offers. The parties can then negotiate the terms of the contract with a legal analyst and a financial analyst who provide assistance and advice.

Once the terms of the contract have been agreed on, the buyer, his agent (if there is one) and a loan provider work out the terms of the loan if the buyer requires one. If the buyer does not require a loan, the buyer and seller can proceed directly to the closing process. Terms for the loan include the interest rate, points, terms, escrow, insurance, and so on. The loan provider can then decide whether the buyer is eligible for any loan based on the buyer's loan requirement or not. If the buyer is refused a loan, the deal falls through and seller waits for offers from other buyers. Once a loan is processed, the buyer, seller, their agents, the loan provider and the financial analyst close the deal as the last step in the process.

RESULTS OF REQUIREMENTS ELICITATION ANALYSIS

List of Actors and their role

- User: An external entity that interacts with the real estate application. Represents the general user
- Customer: Extends User. Uses the system to sell or buy a property.
- Buyer: Extends Customer. An external entity that interacts with the real estate application by selecting an agent, searching for property to buy, making offers, negotiating the offers, applying for a loan and discussing the terms with a loan provider, and finally buying a property.
- Seller: Extends Customer. An external entity that interacts with the real estate application by selecting an agent, providing information about a property to sell, responding to offers, negotiating offers, and finally selling the property.
- Advisor: Extends User. Uses the system to advice and help customers and provides service.
- Agent: Extends Advisor. An external entity that interacts with the real estate application as an employee of the real estate company providing services to buyers and sellers.
- Buyer Agent: Extends Agent. A specific type of Agent providing service to Buyers.
- Seller Agent: Extends Agent. A specific type of Agent providing service to Sellers.
- Legal Analyst: Extends Advisor. An external entity that interacts with the real estate application by providing advice on legal issues and approves the contract.
- Financial Analyst: Extends Advisor. An external entity that interacts with the real estate application by helping the buyer understands the extent to which the buyer's finances will stretch.
- Loan Provider: Extends Advisor. An external entity that interacts with the real estate application by discussing loan contract terms with the buyer and processing the loan.

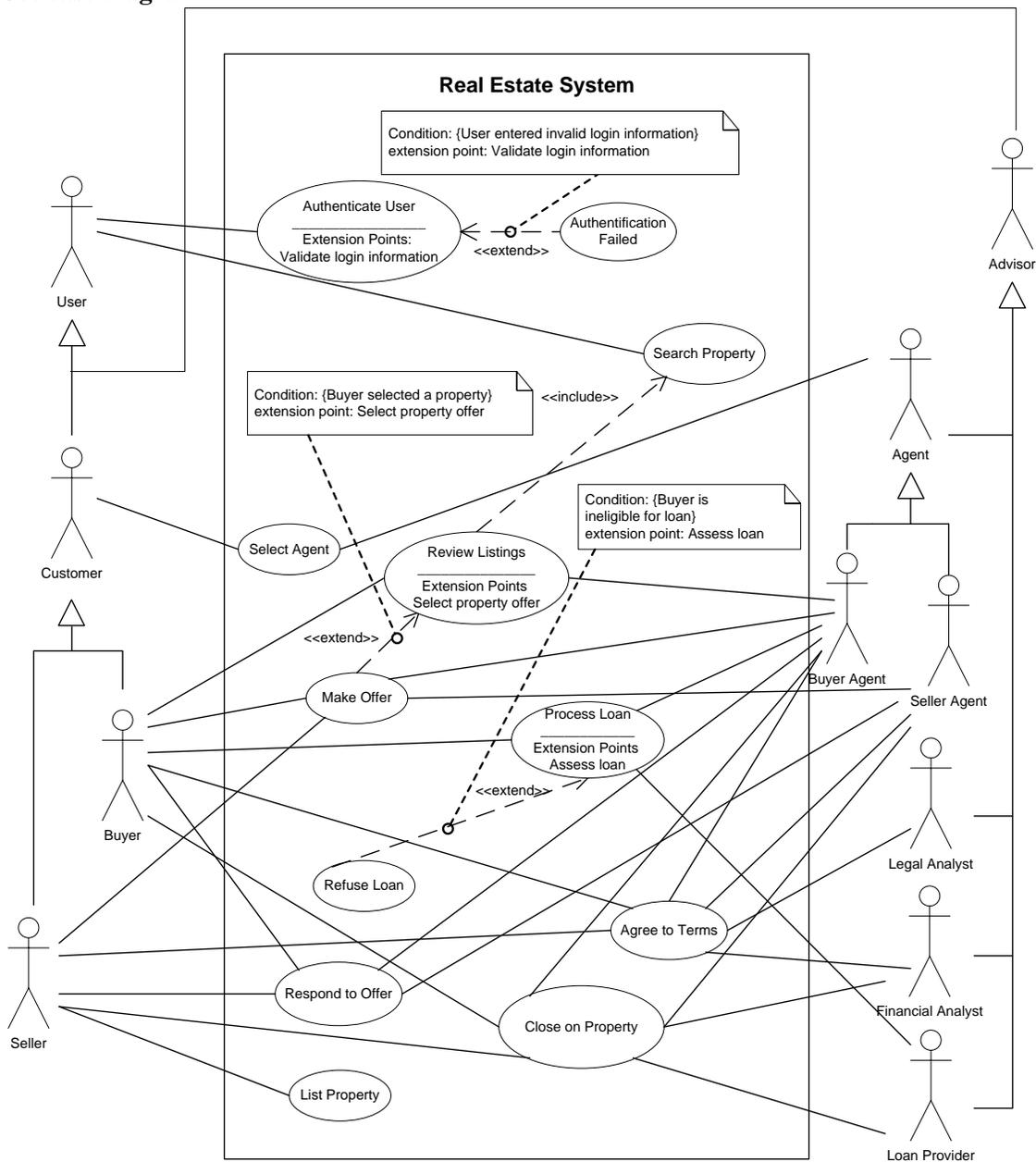
Brief Description of Use Cases

- Authenticate User: All users who request entry to the system must prove they are who they say they are (authentication).
- Authentication failed: A wrong user name or password leads to a failed authentication. After three failed attempts, the user will be disallowed from entering the system.
- Select Agent: The customer selects an agent, probably based on the agent's location and expertise and whether the customer has worked with the agent previously.
- List property: The seller puts a property up for sale, including a set of information that classifies it uniquely for prospective buyers.
- Search property: The user can search the properties based on different criteria: price, location, constructor, type ...
- Review Listings: The buyer browses through the listings of properties with the help of the buyer's agent who gives the buyer advice on selected properties.
- Make Offer: The buyer makes an offer to the seller. The seller's agent and the buyer's agent offer their respective customers advice based on their experience in real estate transactions and their knowledge of the marketplace.

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- Respond to Offer: The seller responds to the buyer's offer either by accepting it, declining it, or presenting a counteroffer. The agents help their customers by offering advice, caution, or recommendations.
- Agree to Terms: The buyer and the seller agree to the terms of the sale, including any required changes to the existing property, the items included with the property, the date of possession, the financing. And any other conditions of sale.
- Process Loan: The loan provider and the buyer work out the terms of the loan if the buyer requires one. Terms include the interest rate, term, escrow, insurance, and so on.
- Refuse Loan: The loan can be refused by the loan provider if the conditions for a loan are not all satisfied. The loan provider suggests other types of loan to buyer and his/her agent.
- Close on Property: The buyer and the seller close the transaction on the property.

Use case diagram



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Detailed Description of Respond to Offer Use Case

Use case name	Respond to Offer
Brief description	The seller responds to the buyer's offer either by accepting it, declining it, or presenting a counteroffer. The agents help their customers by offering advice, caution, or recommendations.
Precondition	An offer has been made by the Buyer and received by the Seller of the property
Primary actor	Initiated by Seller
Secondary actors	Buyer, Buyer Agent and Seller Agent
Dependency	None
Basic Flow:	
Steps	<p>The Seller views the offer and decides to discuss it with Seller Agent</p> <p>The Seller asks the system to notify the Seller Agent</p> <p>The system notifies Seller Agent of the request of Seller to respond to an offer</p> <p>Seller Agent provides advice regarding the terms of the offer and suggests a counteroffer</p> <p>The system provides Seller with the counteroffer information</p> <p>The Seller confirms the counteroffer and submits it to the system</p> <p>The system responds by presenting the counteroffer to the Buyer and the Buyer Agent</p> <p>The Buyer Agent advises the Buyer to agree on the counteroffer</p> <p>The system sends Buyer Agent's advice to the Buyer</p> <p>The Buyer responds by accepting the counteroffer</p> <p>The system responds by notifying the Seller and the Seller Agent that the counteroffer was accepted</p>
Post Condition	The Buyer has received a counteroffer and accepted it.
Bounded Alternative flow: BSF 7-11	In step 7, the Buyer Agent advises the Buyer not to accept the counteroffer.
Steps:	<p>The system sends Buyer Agent's advice to the Buyer</p> <p>Buyer submits another counteroffer to the system</p> <p>The system presents the new offer to the Seller</p> <p>Resume step 1 of the Basic Flow</p>
PostCondition	The Buyer has not accepted the Seller's counteroffer and made a new offer.
Special requirements	Customers should be able to use this use case interface without training, and Agents should be able to use it after few hours of training

