

# TUTORIAL: Specifying electronic institutions

Carles Sierra, Bruno Rosell, Juan A. Rodríguez-Aguilar, Josep Ll. Arcos

## INTRODUCTION

This tutorial is based on the specification of a marketplace wherein buyers and sellers trade their goods via auctions. Within this market, goods can be traded under the rules of different auction protocols, namely: Dutch, English, Japanese, Vickrey. Thus, each seller owning a good is in charge of choosing the particular auction protocol to employ to auction his good. The auction market can simultaneously run multiple auctions at the same time for the different goods put at auction by sellers. The participating buyers can request the market for information concerning either scheduled or running auctions to join in at their discretion.

## EXERCISES

1. Go to the *EIDE/lib* directory on the EIDE CD and click twice on the *islander.jar* file. The Islander tool should show up on your screen at this point. If not, run the following command from the very same directory:

```
D:\EIDE\lib> java -jar islander.jar
```

2. Select *File* and *Open* in Islander to load the specification of the auction house institution example (*AuctionHouse.xml*) from the examples' directory (*EIDE\etc\examples\auctionHouse*) and (*EIDE\etc\examples\auctionHouse*).
3. What are the roles in the dialogic framework?
4. Identify external and internal roles.
5. What static separation of duties' (ssd) relationships hold? Why?
6. What is the relationship between sellers and guests?
7. Does any role have any properties? Can you think of any properties for buyers and sellers?
8. What types of elements does the dialogic framework contain?
9. What are the data types of the ontology?
10. Are the data types in the dialogic framework enough to support the auctioning of bundles of goods? And to allow buyers to bid for bundles of goods? If not, introduce the changes to the ontology that you deem as necessary.
11. What are the functions defined in the ontology? What do they stand for?
12. What is the performative structure in the *AuctionHouse* institution?
13. What are the properties of the *AuctionHouse* institution?
14. Is the *AuctionHouse* specification correct? Run the verification function () to check it out.
15. What is the dialogic framework related to *AuctionHousePS*?
16. What scenes does *AuctionHousePS* contain?
17. What are the differences between the *initial* scene, the *final* scene and the rest?
18. Click on the *Auction* scene. Can different auction protocols be employed to run this scene? Try now to add a new protocol to the *Auction* scene. Can

- AuctionHousePS* also contain performative structures as well as scenes? In other words, can performative structures be nested?
19. What types of transitions does *AuctionHousePS* contain?
  20. What are the possible paths that *buyer*, *seller*, *guest*, *staff*, and *auctioneer* agents can follow through *AuctionHousePS*?
  21. Analyse each scene in the institution, identifying:
    - its dialogic framework;
    - its properties;
    - the roles that can create each scene and participate in it;
    - the roles that can join in or leave each scene at run time;
    - its initial state and final state;
    - its illocutions, timeouts, and semantics of the constraints<sup>1</sup> attached to illocutions (if any);
    - its functionality; and
    - eventual improvements.
  22. What is the feature in the specification of the Auction node in the *AuctionHousePS* performative structure that indicates that several auctions can be simultaneously run?
  23. What properties would you add at institution level, performative structure level, scene level, and role level?
  24. Add a new scene to the institution to support single-round reverse auctions: (1) a single buyer/auctioneer starts out a reverse auction to ask sellers for a good; (2) the sellers submit their bids/offers to the buyer; (3) after a bidding time the buyer closes the auction selecting as the winning bid the lowest offer.
  25. Check out that the specification is correct using the ISLANDER verification engine.
  26. Does the specification of reverse auction support the negotiation of bundles of goods? What changes are required in the ontology? Are these changes enough to allow a buyer to request multiple units of each good and providers to bid for multiple units of multiple goods? Introduce further changes in the ontology if required.
  27. Modify the specification of the reverse auction scene to cope with the multi-unit case.

## ANNEX: AUCTION PROTOCOLS

### Dutch

The descending-price auction, commonly known in academic literature as the Dutch auction, uses an open format rather than a sealed-bid method. It is the technique used in Netherlands to auction produce and flowers (hence, a "Dutch" auction). In a Dutch auction, bidding starts at an extremely high price and is progressively lowered until a buyer claims an item by calling "mine", or by pressing a button that stops an automatic clock. When multiple units are auctioned, normally more takers press the button as price

---

<sup>1</sup> Access the *documentation* section in the EIDE CD index, click on the *Docbook html* link, and jump to the *Constraints* subsection in section I.3.

declines. In other words, the first winner takes his prize and pays his price and later winners pay less. When all goods are allocated, the bidding is over.

### **English**

The English auction is also known as the open-outcry auction or the ascending-price auction. Paul Milgrom defines the English auction in the following way. "Here the auctioneer begins with the lowest acceptable price--the reserve price-- and proceeds to solicit successively higher bids from the customers until no one will increase the bid. The item is 'knocked down' (sold) to the highest bidder."

### **Japanese**

A type of sequential, second price auction, similar to an English auction in which an auctioneer regularly raises the current price. Participants must signal at every price level their willingness to stay in the auction and pay the current price. Thus, unlike an English auction, each participant must bid at each level to stay in the auction. The auction concludes when only one bidder indicates his willingness to stay in.

### **Vickrey**

The last auction type considered here has a primary characteristic of being sealed (not open-outcry like the English or Dutch varieties) and thus hidden from other bidders. The item is awarded to highest bidder at a price equal to the second-highest bid (or highest unsuccessful bid). In other words, a winner pays less than the highest bid. If, for example, bidder A bids \$10, bidder B bids \$15, and bidder C offers \$20, bidder C would win, however he would only pay the price of the second-highest bid, namely \$15. A sealed-bid format has two distinct parts--a bidding period in which participants submit their bids, and a resolution phase in which the bids are opened and the winner determined (sometimes the winner is not announced).

### **First-price sealed bid**

The last auction type considered here has a primary characteristic of being sealed (not open-outcry like the English or Dutch varieties) and thus hidden from other bidders. A winning bidder pays exactly the amount he bid. Usually, (but not always) each participant is allowed one bid which means that bid preparation is especially important.

Speaking generally, a sealed-bid format has two distinct parts--a bidding period in which participants submit their bids, and a resolution phase in which the bids are opened and the winner determined (sometimes the winner is not announced).

An important distinction must be made as to quantity--how many goods are being auctioned--one or multiple items. The name "first-price" comes from the fact that the award is made at the highest offer when a single unit is sold. When multiple units are being auctioned, it is called "discriminatory" because not all winning bidders pay the same amount.

It works like this: In a first-price auction (one unit up for sale) each bidder submits one bid in ignorance of all other bids. The highest bidder wins and pays the amount he bid. In a "discriminatory (more than one unit for sale) auction", sealed bids are sorted from high to low, and items awarded at highest bid price until the supply is exhausted. The most important point to remember is that winning bidders can (and usually do) pay different prices.