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**SeungYong Kim**  
**Tanja F. Blackstone**

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# **Design Specifications and Instructional Manual for Job Market and Labor Allocation Model (JMLAM)**

SeungYong Kim  
University of Memphis

Tanja F. Blackstone  
Navy Personnel Research, Studies, and Technology

Reviewed and Approved by  
David L. Alderton  
Institute for Selection and Classification

Released by  
Murray W. Rowe  
Director

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Navy Personnel Research, Studies, and Technology  
Navy Personnel Command  
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## Foreword

The Job Market and Labor Allocation Mode (JMLAM) was designed and developed as a software prototype to serve as a "broker" between sellers (Sailors, who are sellers of labor) and a buyer (Detailer or fair broker, who is a buyer of labor). JMLAM attempts to model a flexible incentive system where sellers and a single buyer reveal his or her valuation for various job attributes using a competitive market setting.

JMLAM provides a bidding or auction environment that allows a single buyer and multiple sellers to participate in a competitive labor market setting. The system contains a great deal of flexibility, in that the user can choose (1) from different auction rules (first-price and a modified second-price auction), (2) up to three attributes or templates, (3) the auction parameters, and (4) from a list of Naval occupations or a hypothetical good. JMLAM is designed to allow researchers to observe behavioral outcomes of subject interactions in a multi-attribute incentive environment.

What follows is a description of the basic JMLAM model, a discussion of the design specifications and instructions for the primary users, sellers, the buyer, and the super-user.

MURRAY W. ROWE  
Director

## Basic Model

As of this writing the current incentive systems used by the Navy to combat low retention and unmanned billets are fixed, all or none offers, and targeted to specific ratings. A fixed bonus is offered to individuals in pre-determined ratings to induce reenlistment. What is not known prior to the enlistment decision is if the bonus offered is sufficient to induce reenlistment or if the individual would have reenlisted in the absence of the bonus. Further, the Navy may be losing highly skilled Sailors who, while not eligible for a bonus under the existing incentive structure, could have been induced to reenlist if offered a bonus. In either case, the Navy incurs substantial costs.

Unlike the private sector the Navy cannot offer individually tailored compensation packages. Institutional constraints mandate that the Navy pay Sailors of equivalent pay-grade and length of service equivalent wages. The Navy could, however, negotiate, that is offer incentives, such as bonuses, reduced sea-shore rotation, and promotion points, for example, on various job attributes.

Consider a market with one buyer (the Navy) and many sellers (Sailors). The sellers and buyer bid, not on a good (or job), but on attributes of the job. It is assumed that all the job attributes to be considered in the model are positive attributes and therefore, the values assigned to each attribute can be considered an incentive.

For simplicity only three job attributes are considered, such as bonus amount, number of months between sea-shore rotations, and promotion points. Unlike a typical labor market the sellers and buyer know that the job will be filled regardless of the incentives offered. The buyer's objective, however, is not only to fill the job, but to increase retention, and the efficient distribution of Sailors. The buyer, therefore, is not selling a job, he is selling the attributes of the job.

When a job becomes vacant the buyer announces to the market what incentives he is willing to offer to fill the vacancy. For example, this may be \$500 in bonus money, five weeks fewer of sea duty, five points towards promotion. All sellers in the market observe the buyer's offer. The offer can be rejected by all sellers in the market, accepted by one buyer, or accepted by more than one buyer. In the case where a seller accepts the buyer's offer, a match is made; the job is filled on mutually agreeable terms and the market for that particular job closes.

In the final case where all sellers reject the buyer's offer, sellers can post counteroffers, where the counteroffers exceed the value of the buyer's initial offering. The buyer either accepts an offer and the market closes or rejects all offers and posts a new offer. Successive offers and counteroffers are made until an offer is accepted and the market closes. An important aspect of this scenario is that the initial offer made by the buyer may have been too low. Allowing sellers (Sailors) to reveal the amount of incentives necessary to induce them to accept a job facilitates increased retention and efficient distribution of manpower.

It is important to note that the buyer has an incentive to offer incentives just necessary to induce the seller to accept his offer and conversely the seller has an incentive to require incentives with infinite values. A constraint imposed on the seller is that the per attribute asking bid/offer must be within the feasible region. That is, any offer must be less than the buyer's reservation price. This serves two functions, sellers cannot ask for, or expect, infinite incentives

and the market converges relatively quickly to equilibrium. Buyers and sellers may or may not have full information as to the distribution of incentive values and offers and counteroffers are made in light of the constraint. The experimenter or super-user determines dissemination of such information.

It is theoretically possible that the market will not converge. This is likely to be particularly true for highly undesirable jobs or in the case of experimental trials where the payoff for accepting an offer is very low. In order to facilitate convergence in the market the super-user can impose an additional constraint; a limited number of offers and counteroffers can be posted. If the market does not converge then a seller is randomly selected to take the job. While JMLAM has no automated mechanism to insure market convergence, the super-user can manually impose auction rules to test for market convergence. New rules can be posted in the Special Instructions section in the buyer and seller's instructions.

The objective of the Job Market Labor Allocation Model is to ascertain (1) how valuing job attributes (incentives) can induce the Navy and Sailors to reveal their true reservation prices, and (2) how a market mechanism can allocate scarce labor resources efficiently, that is placing the right Sailor in the right job at the right time.

### **Job Market Labor Allocation Model (JMLAM) Specifications**

The Job Market Labor Allocation Model is designed to provide a bidding environment where a buyer and multiple sellers can submit offers and/or counteroffers on the attributes of a hypothetical good. The model is designed to allow flexibility for experimental testing, where the buyer and sellers can interact in an auction environment.

The experimenter or super-user sets the session, auction, and buyer and seller's parameters. Parameters include auction rules, number of sellers, reservation prices, maximum number of bidding rounds allowed per auction, time constraint, type of job (hypothetical or otherwise), number of attributes, userids, passwords, and the exchange rate. It is important to note that each session consists of one or more auctions and auctions can consist of one or more rounds. Auctions always consist of one buyer and at least one or more sellers. Once the super-user has set all the required parameters, a session can be initiated. The buyer always initiates sessions.

Auction rules consist of either a first-priced auction or a modified second-price auction. The winning bid in the first-price auction is determined by the seller(s) with the lowest bid for all three attributes. The winning bid in a second-price auction is determined by the lowest bid for attribute A1. However, the seller receives earnings based on the highest losing feasible bid. Calculation of the winner's (seller's) earnings and the buyer's earnings under the separate auction rules are discussed in the instructions.

The auction is designed so that each seller can sell a single unit of a hypothetical good, while the buyer can purchase one or more units of the good. Therefore, it is necessary that the number of sellers exceed the number of units available for purchase by the buyer.

It is important to note that for purposes of experimental testing/observing of behavior and market outcomes, jobs are assigned generic names and the incentive attributes are referred to as templates or attributes. This is done in order to prevent individuals from bringing in egalitarian, altruistic, or such other preferences from everyday social life into the experiment. However, the

super-user function will allow changing of the generic names and incentives to specific job titles, locations and/or incentives.

### **Design Limitations**

A possible weakness in the current system is that sellers may tend to accept/submit offers based on the summation of the values of the attributes and not accept/submit offers based on the individual valuation of each attribute. The researcher is interested in capturing the sellers/buyers marginal rates of substitution between the three attributes. There is no automation in the current system to capture this information. Procedures for manually capturing marginal rates of substitution may or may not be feasible given the limitations of the current design.

Another potential adverse behavioral result may occur in the case of second-price auctions. Sellers may make counteroffers that maximize the probability of winning and not the joint objective of maximizing earnings and the probability of winning. For example, sellers could bid their reservation price on the first attribute and bid substantially higher on the other attributes. In pilot tests of the system this behavior has not been observed.

### **Instructions**

What follows are the instructions for the super-user, seller, and buyer.

## Contents

<b>Chapter 1: Super-User Instructions.....</b>	<b>1-0</b>
Welcome to the Auction Experiment Instructions .....	1-1
How to Enter the Auction Program .....	1-1
Greeting Screen and Main Menus.....	1-2
How to Set Up User Accounts .....	1-4
Values of Template A1, A2, A3, and Exchange Rate .....	1-6
How to Set Up Sessions and Auctions .....	1-8
How to Set Up Sessions .....	1-10
How to Set Up Auctions.....	1-12
Some Flaws to Avoid in Auction Setting.....	1-15
To Check Auction Status.....	1-17
Auction Types and Earnings Calculation	
First-Price Auction.....	1-20
Earning Calculation in a First-Price Auction .....	1-21
Second-Price Auctions.....	1-22
Case 1: Lowest A1 Wins.....	1-22
Case 2: Lowest A1 Does Not Win .....	1-24
<b>Chapter 2: Seller Instructions.....</b>	<b>2-0</b>
Welcome to Auction Experiment Instructions .....	2-1
What Does the Auction Look Like?.....	2-1
How to Play the Auction Game.....	2-4
The meaning of A1, A2, and A3 .....	2-6
How to Check Your History.....	2-10
How to Check Your Earnings .....	2-12
How to Maximize Your Earnings.....	2-14
First-Price Auction.....	2-14
An Example.....	2-14
How to Maximize Earnings in First-Price Auctions .....	2-15
Second-Price Auctions.....	2-16
Case 1: Lowest A1 Wins.....	2-16
Case 2: Lowest A1 Does Not Win .....	2-18
Special Instructions .....	2-21
<b>Chapter 3: Buyer's Instructions .....</b>	<b>3-0</b>
Welcome to Auction Experiment Instructions .....	3-1
What Does the Game Place Look Like?.....	3-2
How to Initiate an Auction .....	3-5
The Meaning of A1, A2, and A3 .....	3-7
How to Negotiate with Sellers.....	3-10
Ending an Auction.....	3-16
How to Check Auction History .....	3-17
How to Check Earnings.....	3-19
Auction types and Rules.....	3-21
First-Price Auction.....	3-21
How to Maximize Earnings in First-Price Auctions .....	3-22



Second-Price Auctions.....	3-23
Case 1: Lowest A1 Wins.....	3-23
Case 2: Lowest A1 Does not Win.....	3-25
Special Instructions .....	3-28

**Chapter 1**  
**Super-user Instructions**

## Welcome to the Auction Experiment Instructions

This experiment is part of a study that explores how individuals in a market setting make decisions and negotiate with other market participants. This experiment employs an auction environment, in which a buyer and one or more sellers negotiate the price of the attributes of a job or, alternatively, a hypothetical good.

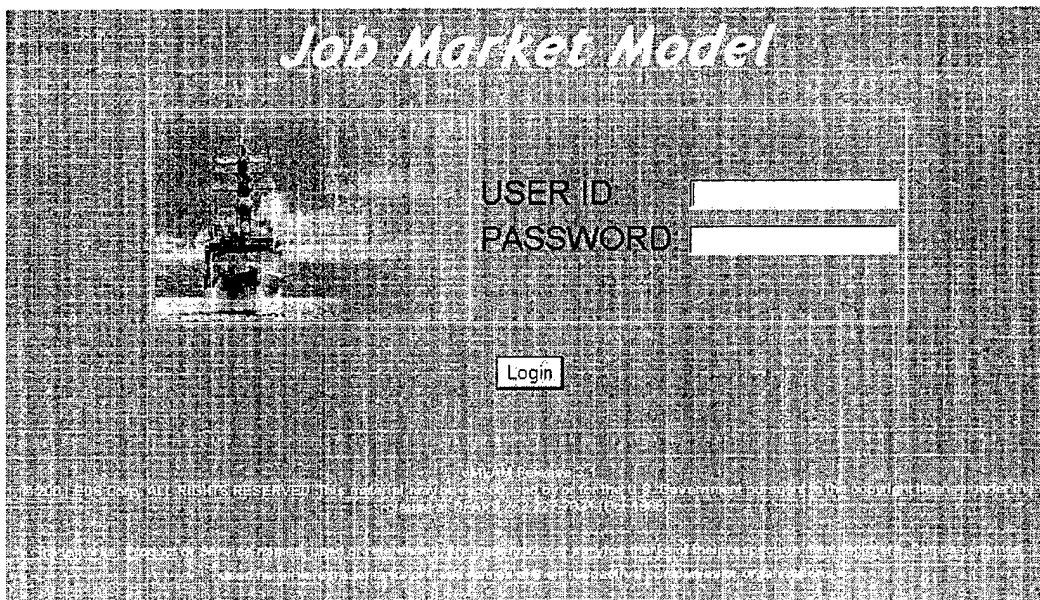
In this auction experiment, you play the role of a **super-user**. The super-user controls the overall environment of the experiment. More specifically, your role involves:

- setting up the accounts of buyers and sellers who participate in the experiment,
- setting up sessions and auctions, and
- monitoring and maintaining the entire experimental auction process.

These instructions provide information to the super-user so that he or she can set up various experimental auctions. To continue, click on the **NEXT** button. If you are already familiar with the auction instruction, you can skip this instruction and enter the program by clicking the **Enter** button.

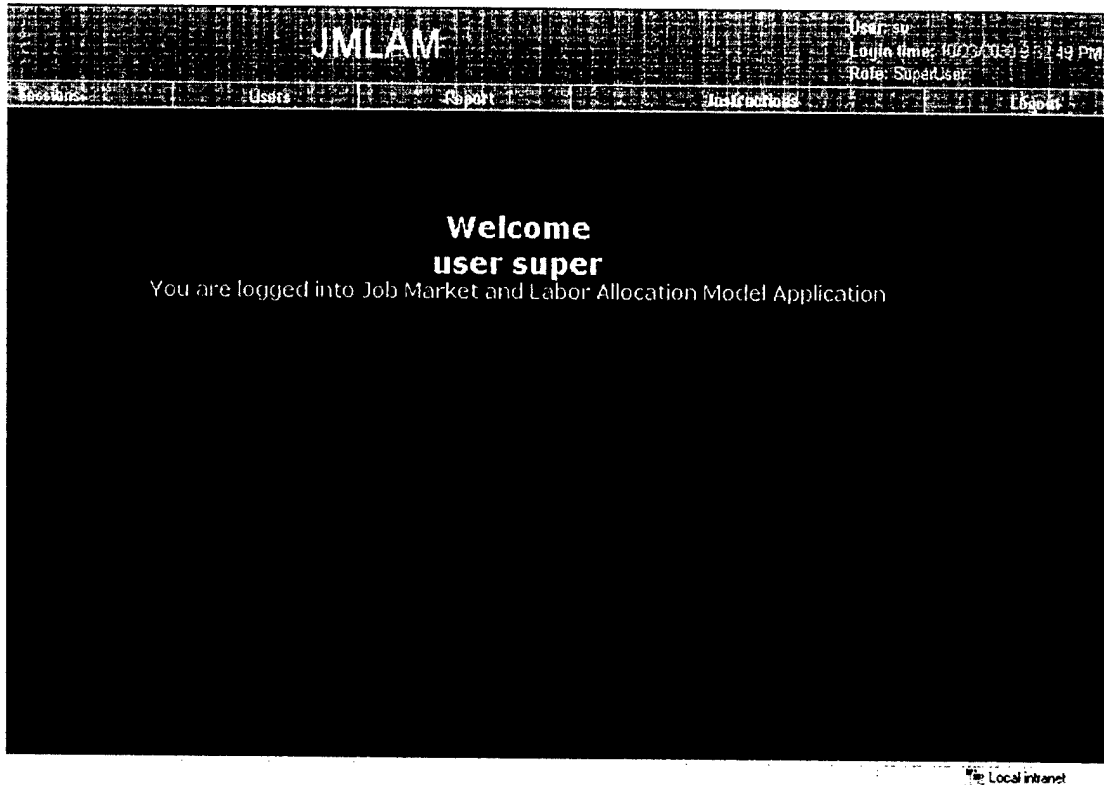
### How to Enter the Auction Program

To enter the auction program, you first need to log in the game by entering your **USER ID** and **PASSWORD**. The default user ID and password for a super-user are **SU** and **SU123**. The log-in screen looks like the following screen.



When you click the "Login" button after entering your ID and password, you will get a greeting screen. To see the greeting screen, click on the **NEXT** button.

## Greeting Screen and Main Menus



This screen displays the current user, login time, the role of the user (in the upper-right hand corner), and a list of menus that you will need to use to manage the environment of various auction experiments. The menus include "**Sessions**," "**Users**," "**Report**," "**Instructions**," and "**Logout**."

Following are brief explanations of each of the menus:

- Sessions:** By using this menu, you can set up sessions and auctions, including multiple auctions in any given session.
- Users:** This menu allows you to set up all types of new user accounts (for example, buyers, sellers, and super-users). If you do not like the default super-user ID and password, you can customize an ID and password using this window.
- Reports:** By using this menu, you can check the current status of open and inactive auctions. You can also access various types of data on closed or completed auctions.
- Instructions:** Allows you to access the auction set-up instructions.
- Logout:** You **MUST** use this menu to log out. If you simply close the auction program screen by clicking the close button ( **×** ) of the Internet Explorer located at the upper-right hand side corner of the screen, you will receive an error message and be unable to log-in with the same ID.

Let us review each of these menus one at a time. In order to activate an auction, the super-user must set up (1) the buyers information, (2) the sellers information, (3) the session information, and (4) the auction information. The current software is designed so that the Super-user can set up multiple sessions, with each session containing one or more auctions. Each auction contains one or more rounds. The software is designed so that multiple auctions can be active simultaneously and so that the buyer and/or sellers can participate in one or more auctions simultaneously.

Please click on the **NEXT** button to see how to set up user accounts.

## How to Set Up User Accounts

As mentioned earlier, you can set up all types of user accounts by using the **Users** menu. When you click the **Users** menu, the following screen will pop up.

The screenshot displays the 'Browse Users' interface. At the top, the system name 'JMLAM' is visible. Below it, the 'Users' menu is selected. The main area contains a table with the following data:

User ID	Last Name	First Name	Role	Template A1	Template A2	Template A3	Exchange Rate
SU	super	user	SuperUser				

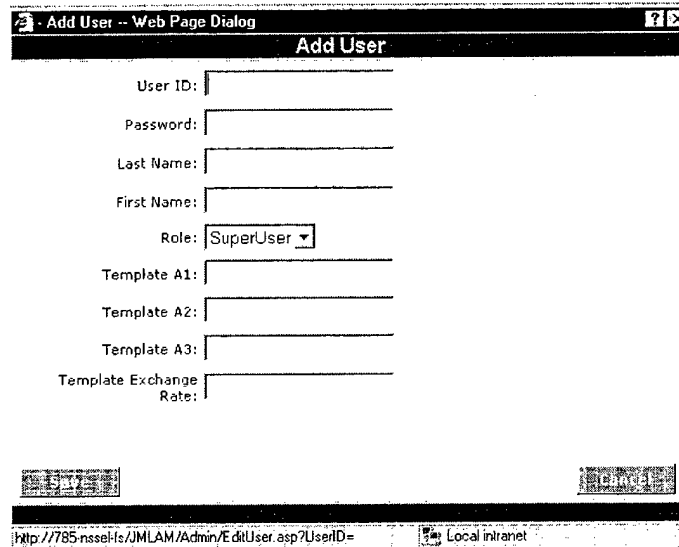
On the right side of the screen, there are several buttons for managing user accounts: **New**, **Edit**, **Delete**, **Retrieve**, and **Logoff**.

As shown above, no other user account except the default super-user account (SU) is currently shown. Note that there are several buttons that you can use to manage the user accounts on the right-hand side of the screen. They include **New**, **Edit**, **Delete**, **Retrieve**, and **Logoff**. The following are brief explanations for each of the buttons.

- New:** You can create any type of new user accounts by using this button. Clicking this button will open the **Add User** window.
- Edit:** By using this button, you can edit the parameters of existing accounts.
- Delete:** You can use this button for deleting existing user accounts. However, you cannot delete accounts that are or were involved in any auction, even after the auction is already completed. For example, if you set up an auction in which Seller1 is set up to participate you cannot delete the Seller1 account even after the auction is completed. To delete the Seller1 account, you need to delete the auction first. **NOTE:** Deleting an auction or seller will also delete any captured information, including data written to the database.
- Retrieve:** You can use this button to update the user information listed in **Browse Users** window.
- Logoff:** You can use this button to manually log off other users. You may need to do so from time to time, especially when buyers and/or sellers inadvertently shut down their auction programs by clicking the close button ( **X** ) of the Internet

Explorer instead of logging out. In such cases, they cannot log in again by using their user IDs until you manually log-off the users.

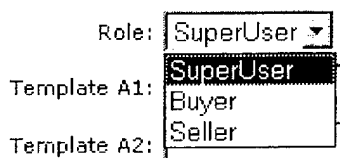
To set up a new user account you need to click on the **New** button, and then open the **Add User** window. Please click on the **NEXT** button to see the **Add User** window. When you click the **New** button in the **Browse Users** window, the following dialog window for setting up a new user will pop up.



In this window, you can set up all types of user accounts by entering appropriate texts and values. While some of the items shown in the dialog window are self-descriptive, others are not. Here are some explanations.

First, user ID and password can be alphanumeric. However, user ID, password, and first name can hold only up to 12 letters, while up to 16 letters can be used for last name.

Second, you can choose the role of a user by clicking the down arrow of the role item. When you click it, you should see three roles: super-user, buyer, and seller, as shown below. Select one of them.



Third, you should use only numbers for the last four items, including Template A1, Template A2, Template A3, and Template Exchange Rate. For a super-user account, these items are not required. The following are examples of setups for sellers and buyers. You are not required to input values for all three templates. The super-user can determine how many templates to activate for a given buyer or seller.

User ID:	Buyer1	User ID:	SELLER1
Password:	XXXXXXXXXX	Password:	XXXXXXXXXX
Last Name:	buyer	Last Name:	seller
First Name:	1	First Name:	1
Role:	Buyer	Role:	Seller
Template A1:	5000	Template A1:	1000
Template A2:	20	Template A2:	5
Template A3:	10	Template A3:	3
Template Exchange Rate:	.01	Template Exchange Rate:	0.01

To learn more about template A1, A2, A3, and the exchange rate, please click on the **NEXT** button.

**Values of Template A1, A2, A3, and Exchange Rate**

The templates A1, A2, and A3 should be viewed as the buyers' or sellers' reservation price for a given good or attribute. Let us take a job market as an example. In a job market, each job opening has several attributes, such as salary, bonus, vacation days, credits toward promotion, stock options, etc. The templates A1, A2, and A3 represent these job attributes.

In a job market, the buyers are recruiters or employers; the sellers are job applicants. In the case of the buyer, the templates represent the buyers' maximum reservation price. In the case of the sellers, the templates represent the sellers' minimum reservation price. Reservation prices are set by the super-user and can vary across sellers and buyers.

While you can adjust the reservation price gap between buyers' maximums and sellers' minimums, you should remember two points. First, the values of templates A1, A2, and A3 of buyers who participate in a given auction must be higher than the values of sellers who participate in the same auction. Otherwise, there is no leeway for buyers and sellers to negotiate, and therefore, the auction will be invalid. Second, the current auction program is designed to accept up to 4-digit values (e.g., 9999).

The value of the template exchange rate is needed for converting buyers' and sellers' experimental earnings into actual earnings. Earnings are paid out to sellers and buyers at the end of the auction session. While both sellers and buyers are instructed and encouraged to maximize their experimental earnings, experimental earnings will be converted by the auction program into actual earnings by multiplying experimental earnings by the exchange rate. For example, given that the exchange rate for a seller is .01, if a seller receives experimental earnings of \$771 from his or her participation in an auction, his or her actual earnings from the auction will be \$7.71 ( $\$771 \times .01$ ).

Once you enter all the necessary information for an account, you need to save the information by clicking the **Save** button. You will see the newly created accounts, as shown below.



User ID	Last Name	First Name	Role	Template A1	Template A2	Template A3	Exchange Rate
SELLER3	seller	3	Seller	1000	5	3	.01
SELLER2	seller	2	Seller	1000	5	3	.01
SELLER1	seller	1	Seller	1000	5	3	.01
BUYER1	buyer	1	Buyer	5000	20	10	.01
YOURID	Your	Name	SuperUser				
SU	super	user	SuperUser				

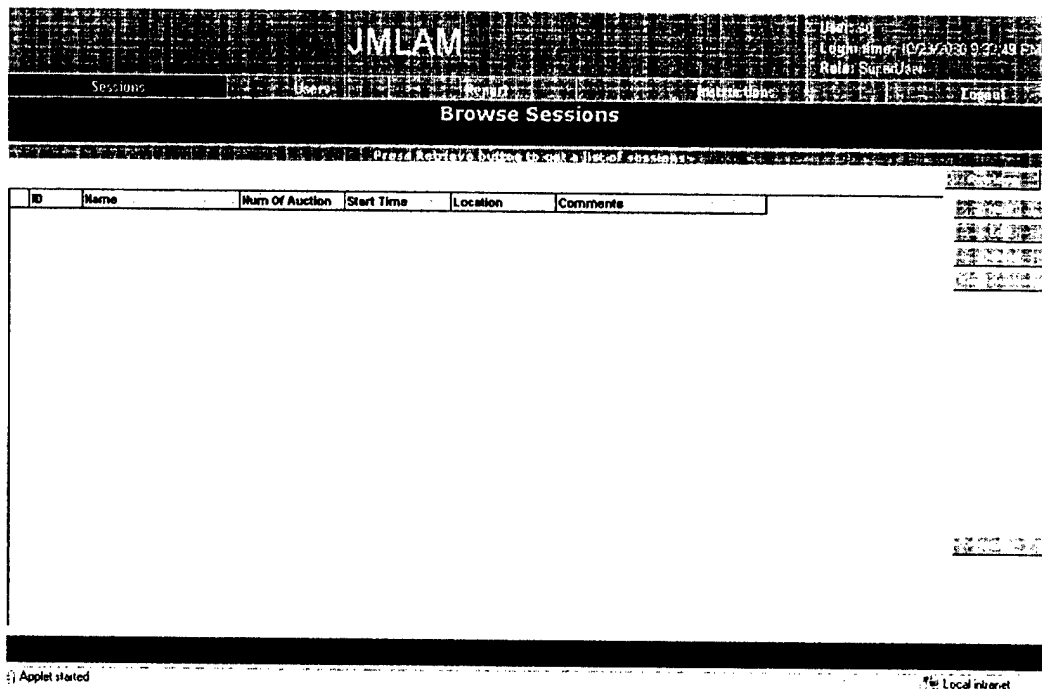
Although the **Browse Users** window lists the users in the order you create them, you can sort the user accounts in an alphabetical order by clicking the **Retrieve** button, as shown below.

User ID	Last Name	First Name	Role	Template A1	Template A2	Template A3	Exchange Rate
BUYER1	buyer	1	Buyer	5000	20	10	0.01
SELLER1	seller	1	Seller	1000	5	3	0.01
SELLER2	seller	2	Seller	1000	5	3	0.01
SELLER3	seller	3	Seller	1000	5	3	0.01
SU	super	user	SuperUser				
YOURID	Your	Name	SuperUser				

Now it is time to set up sessions and auctions. Please click on the **NEXT** button to view auction setups.

## How to Set Up Sessions and Auctions

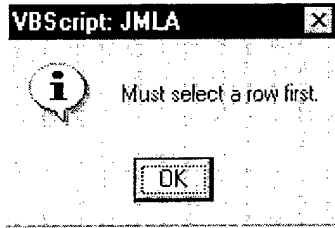
Auctions are embedded in sessions. Therefore, before setting up an auction, you need to set up at least one session. To do so, you need to open the **Browse Sessions** window by clicking the **Sessions** menu.



Like the **Browse Users** window, several buttons for creating and managing sessions and auctions are located on the right-hand side of the screen. The following are brief explanations for each of the buttons.

- Retrieve:** Update the session information listed in the Browse Sessions window.
- New:** Create a new session
- Edit:** Edit the parameters of existing sessions.
- Delete:** Delete existing sessions. You cannot delete sessions that have active auctions.
- View Auctions:** Open the **Browse Auctions** window. Recall auctions are created or edited through the Browse Auctions menu.

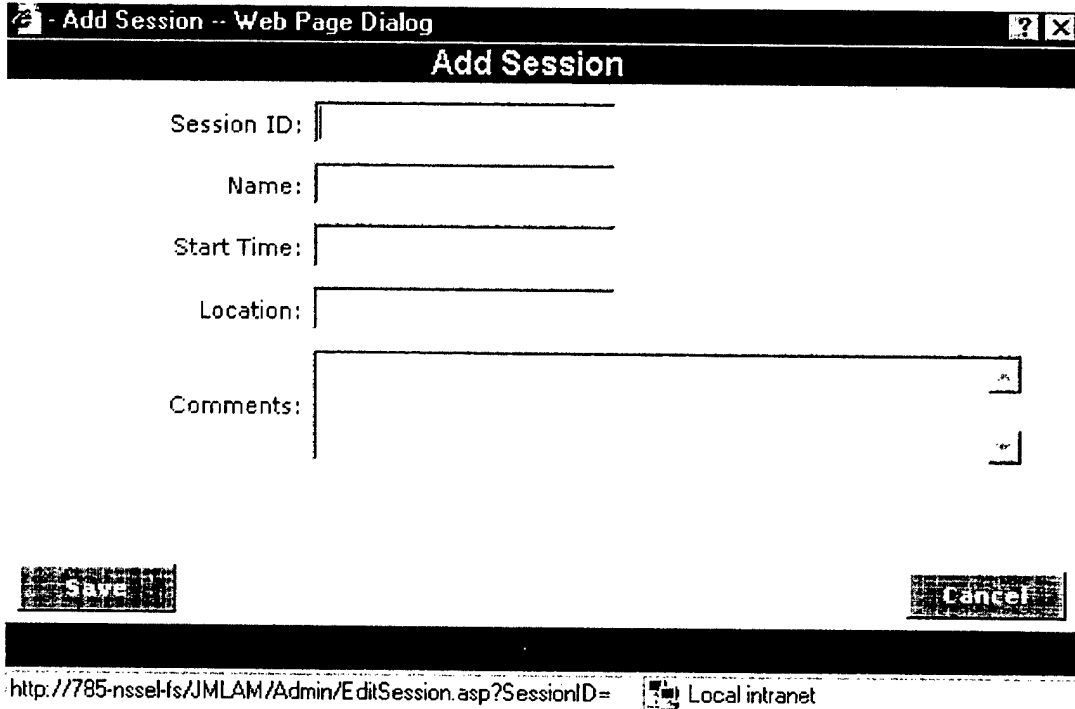
To set up a new session, you must click on the **New** button. You cannot setup or view auctions, unless a session has been created. When at least one session has not been setup or when the ID number of the session that you want to browse has not been specified, if you click **View Auction**, you will get the following error message.



To create a new session, you need to click the **New** button to open the **Add Sessions** window. To see the window, please click on the **NEXT** button.

## How to Set Up Sessions

Once you click the **New** button in the **Browse Sessions** window, you will get the following window.

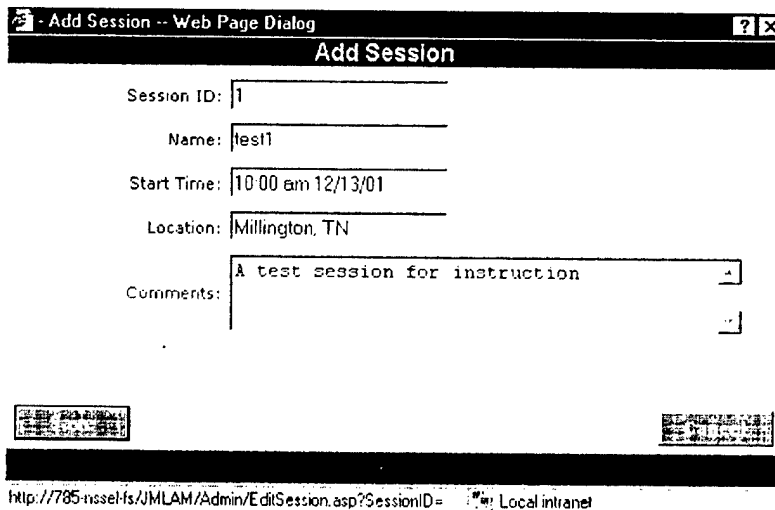


The screenshot shows a dialog box titled "Add Session" with the following fields:

- Session ID: [Empty text box]
- Name: [Empty text box]
- Start Time: [Empty text box]
- Location: [Empty text box]
- Comments: [Empty text area]

At the bottom, there are "Save" and "Cancel" buttons. The status bar at the bottom shows the URL: <http://785-nssel-fs/JMLAM/Admin/EditSession.asp?SessionID=> and "Local intranet".

Unlike the **Add Users** window, this window looks quite simple and all the items sitting inside the window are also self-explanatory. One minor thing you should note is that some items have limitations on the length of text that you can enter. While **Session ID** can only hold up to 16 alphanumeric letters, **Start Time** can hold up to 24 letters. Also, **Location** and **Name** can accept only up to 32 letters. The following graphic shows an example.



The screenshot shows the same "Add Session" dialog box, but with the following data entered:

- Session ID: 1
- Name: test1
- Start Time: 10:00 am 12/13/01
- Location: Millington, TN
- Comments: A test session for instruction

The "Save" and "Cancel" buttons are visible at the bottom. The status bar at the bottom shows the URL: <http://785-nssel-fs/JMLAM/Admin/EditSession.asp?SessionID=> and "Local intranet".

Once you enter all the necessary information for a new session, you should click the **Save** button. This will automatically return you to the **Browse Session** window. The **Browse Session** window will list the session that you have just created, as shown below.

Browse Sessions					
ID	Name	Num Of Auction	Start Time	Location	Comments
1	test1	0	10:00 am 12/13/01	Wilmington, TN	A test session for instructio
2	test2	0	Never	Wilmington, NoState	Dutymy session for instructio

Once a session has been created, you can create auctions under the session. To create an auction, first choose one of the sessions you created and then click on the **View Auctions** button to open **Browse Auctions** window.

Click on the **NEXT** button to see the **Browse Auctions** window.

# How to Set Up Auctions

**JMLAM**  
 User: Super User  
 Login Time: 12/27/2007 7:32:49 PM  
 Role: Super User

Sessions    Users    Openings    Auctions    Reports

**Browse Auctions**

Auction ID	Type	Job ID	Job Title	Location	Max Rounds	Secs Per Round	# of Openings	Status	Completion Status	Start Time	Cr

Done    Local Intranet

The buttons (**Retrieve**, **New**, **Edit**, and **Delete**) shown in the **Browse Auctions** window above are identical in function to those in the **Browse Sessions** window.

To create an auction, you must click on the **New** button to open **Add Auctions** window. To see the **Add Auctions** window, please click on the **NEXT** button.

**Add Auction**

Auction ID:  Job ID:

Auction Type:  Job Title:

Maximum Rounds:  Location:

No. Of Openings:

Seconds Per Round:

Start Time:

Comments:

Buyer ID	Maximum A1	Maximum A2	Maximum A3	Exchange Rate
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Seller ID	Minimum A1	Minimum A2	Minimum A3	Exchange Rate
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

The following are brief explanations for each of the items included in the **Add Auction** window.

- Auction ID:** A numeric figure is needed for identifying each individual auction. For the convenience of identification, the use of sequential numbers (e.g., 1, 2, 3, 4...) may be desirable.
- Auction type:** Each auction must be specified either as a **First-Price** or as a **Second-Price auction**. The manner in which the auction winners' and buyers' earnings are calculated depends on the type of auction chosen. Although the difference between these auction types does not directly affect the super-user's activities, more detailed descriptions of the auction types, rules, and earnings will be given in a later instruction menu.
- Maximum rounds:** Each auction can contain one or more rounds. You can specify how many rounds can be played in each auction.
- No. of openings:** This item refers to the number of available hypothetical goods. In this auction program, a seller can sell only ONE good in an auction, but buyers can purchase multiple units, that is, accept offers from one or more sellers. It is important to note that the number of offers accepted by a buyer must be less than or equal to the number of openings. For example, if this number is set at 2, then a buyer can accept offers from two different sellers, and therefore, there can be two winners in the auction.

<b>Seconds per round:</b>	With this element, you can specify the duration that a round of an auction lasts (in seconds).
<b>Start time:</b>	Provides information as to the expected initiation time of an auction. This is for information purposes only and has no bearing on the auction's actual initiation time.
<b>Job ID:</b>	Currently, only one choice, <b>Exp. Market</b> , is available in this list menu. Simply select it.
<b>Job Title:</b>	When you select Job ID, this item is automatically selected and disabled.
<b>Location:</b>	When you select Job ID, this item is automatically selected and disabled.
<b>Comments:</b>	Type in any specific comment needed for describing a given auction. There is no limit in the text length.
<b>Buyer Detail:</b>	In this section, you can select a buyer to participate in a given auction. Only one buyer is allowed to participate in any given auction. To select a buyer, click the empty cell right below the <b>Buyer ID</b> . A list of available buyers will be dropped down in the <b>Buyer ID</b> column. Once you select one of the buyers from the list, the Maximum A1, A2, A3, and Exchange rate for the buyer will automatically be filled in with the default values already set up in the <b>User</b> menu. However, you can still change the default values across auctions.
<b>Seller Detail:</b>	In this section, you can select sellers. Multiple sellers can participate in an auction. That is why this section has separate buttons for adding sellers and removing sellers. To add a seller, click the <b>Add sellers</b> button. A list of available sellers will be dropped down in the <b>Seller ID</b> column. When you select one of the sellers, the minimum A1, A2, A3, and Exchange Rate for the seller will automatically be filled in with the default values already set up in the <b>User</b> menu. However, you can still change the default values across auctions.

On the following pages, you will be presented with some auction examples. In particular, these examples highlight “flaws” that you should try to avoid. Please click on the **NEXT** button to continue.



## Some Flaws to Avoid in Auction Setting

The following screen shows a sample auction setup in which all necessary information seems to be given. However, it has a flaw. Please take a close look at it.

**Add Auction**

Auction ID:  Job ID:

Auction Type:  Job Title:

Maximum Rounds:  Location:

No. Of Openings:

Seconds Per Round:

Start Time:

Comments:

Buyer ID	Maximum A1	Maximum A2	Maximum A3	Exchange Rate
BUYER1	1	20	10	0.01

Seller ID	Minimum A1	Minimum A2	Minimum A3	Exchange Rate
SELLER1	12	5	3	0.01
SELLER3	1000	5	3	0.01
SELLER2	1000	5	3	0.01

Did you notice the buyer's maximum A1 and the seller1's minimum A1?

You are right. With these values, this auction is invalid from the beginning. An auction is invalid if the buyers' reservation price for any template is less than the sellers' reservation price.

On the following page, another flaw, yet more explicit and preventable in setting auction parameters will be presented. Please click on the **NEXT** button to advance to the next instruction.

**Add Auction**

Auction ID:  Job ID:

Auction Type:

Maximum Rounds:  Job Title:


No. Of Openings:  Location:

Seconds Per Round:

Start Time:

Comments:

**VBScript: JMLA**

 Number of openings is greater than number of sellers. Please review.


Buyer ID

Seller ID	Minimum A1	Minimum A2	Minimum A3	Exchange Rate
<input type="text" value="SELLER2"/>	<input type="text" value="1000"/>	<input type="text" value="5"/>	<input type="text" value="3"/>	<input type="text" value="0.01"/>
<input type="text" value="SELLER1"/>	<input type="text" value="1000"/>	<input type="text" value="5"/>	<input type="text" value="3"/>	<input type="text" value="0.01"/>

The above screen is another example of errors that may occur in setting the auction parameters. As indicated by the error message centered at the middle of the screen, only two sellers are currently added to participate in this auction, whereas the **No. of openings** is three.

As mentioned earlier, the **No. of openings** refers to how many goods a buyer can purchase from sellers in an auction. The **No. of openings** must be less than or equal to the number of sellers participating in an auction.

**VBScript: JMLA**

 Please select a Job from the list.

If you set up an auction with no flaws, then you can save the auctions by clicking the **Save** button of the **Add Auctions** window. And, the auction that you have created will be listed in the **Browse Auction** window as shown in the following page. Please click on the **NEXT** button to continue.

## To Check Auction Status

Auction ID	Type	Job ID	Job Title	Location	Max Rounds	Secs Per Round	# of Openings	Status	Completion Status	Start Time	Ct
1	First Priced	Exp. Mark	Experimental M Exp Lab	Exp. Lab	1	60	1	Auction Not Started		10:00 am 12/13/01	A
2	First Priced	Exp. Mark	Experimental M Exp Lab	Exp. Lab	2	250	1	Auction Not Started		11:00 am 12/13/01	Zr

After you have successfully set up an auction, the **Browse Auctions** window will display the auction with the parameter information

You may need to use the horizontal scroll bar located at the bottom of the window to display some hidden columns on the right-hand side. Or, you can simply adjust the column widths by dragging the dividing lines between column headers (e.g., Auction ID, Type, Job ID, etc.) to show all columns as you do with spreadsheet programs. The result of the column width adjustment would look as follows:

Auction ID	Type	Job ID	Job Title	Location	Max Round	Secs Per Round	# of Openin	Status	Completi	Start Time	Comments
1	First Priced	Exp. Market	Experimental Market	Exp. Lab	1	60	1	Auction Not Started		10:00 am 12/13/01	A test auction for m
2	First Priced	Exp. Market	Experimental Market	Exp. Lab	2	250	1	Auction Not Started		11:00 am 12/13/01	2nd test auction for

On closer inspection of the screens above, you will notice that some items that were not visible in the **Add Auctions** window are now displayed in the **Browse Auction** window. They are **Status** and **Completion**. **Status** column shows the current status of a given auction and the **Completion** column shows whether a completed auction is valid or invalid. The following screen shows some examples of the **Status** and **Completion**.

Auction ID	Type	Job ID	Job Title	Location	Max Round	Secs Per Round	# of Openings	Status	Completion Status	Start Time	Comr
3	Second Priced	Exp. Mark	Experimenta	Exp. Lab	2	80	2	Auction Complete	Partially Invalid-Euwer Choice	4 pm 12/13/01	3rd au
2	First Priced	Exp. Mark	Experimenta	Exp. Lab	2	250	1	Auction Complete	Valid Auction	11:00 am 12/13/01	2nd te
1	First Priced	Exp. Mark	Experimenta	Exp. Lab	1	60	1	Auction Complete	Valid Auction	10:00 am 12/13/01	A test
4	Second Priced	Exp. Mark	Experimenta	Exp. Lab	2	80	2	Auction Not Started		5 pm 12/13/01	4th au

All the auctions successfully set up will be immediately available for buyers to review and to start the auction process. Once the buyer starts an auction, the status of the auction becomes "Auction in progress." However, the current design of this auction program does not automatically update the **Status** and **Completion** information as they change. To update the information, use the **Retrieve** button.

Valid auctions are those for which the buyer accepted offers to fill all openings. Partially invalid auctions are those in which the buyer filled at least one opening but failed to fill all openings. Invalid auctions are those in which the buyer failed to fill any opening.

In addition to the **Browse Auction** window in which auction status is displayed, you can check the current status of auctions as well as the results of auctions by using the **Report** menu. Please click on the **NEXT** button to review the **Report** menu.

### Checking Auction Status Using the Report Menu

The screenshot shows a window titled "JMLAM" with a "Report" menu. The "View Session Report" option is highlighted. Below the menu is a "Session ID:" input field with a "Retrieve" button to its right. At the bottom of the window is a table with the following columns: Auction ID, Type, Completion Status, Job ID, Buyer ID, Round ID, Buyer A1, Buyer A2, Buyer A3, Seller ID, Seller A1, Seller A2, Seller A3, Buyer Earning, Seller Earning, and Acc.

Auction ID	Type	Completion Status	Job ID	Buyer ID	Round ID	Buyer A1	Buyer A2	Buyer A3	Seller ID	Seller A1	Seller A2	Seller A3	Buyer Earning	Seller Earning	Acc

After clicking the **Report** menu, a screen will appear, which looks like the one above. To retrieve auction status information, enter the **Session ID** (for example, 1) desired and click the **Retrieve** button. Then, the program will retrieve all the auction information of the session, as shown below.

**JMLAM**

Date: 10/26/2008 10:10 PM  
 Report: 10/26/2008

Report  
**View Session Report**

Session ID: 1

Auction ID	Type	Completion Status	Job ID	Buyer ID	Round ID	Buyer A1	Buyer A3	Seller ID	Seller A1	Seller A2	Seller A3	Buyer Earning	Seller Earning	Accepted By	
1	Second	Partially Invalid	Exp. Mark	Buyer1	1	2000	4	3	SELLER1	3000	8	2			
									SELLER2	4000	10	10			
									SELLER3	1000	5	3			
					2	3000	6	5	SELLER1	3000 (4000)	8 (10)	6 (10)	\$10.1	\$30.12	Buyer
									SELLER2	4000	10	10			
									SELLER3	1000	5	3			
2	First Pric	Valid Auction	Exp. Mark	Buyer1	1	1000	4	3	SELLER1	3000	7	5			
									SELLER2	3600	9	7			
					2	2500	5	5	SELLER1	2500	5	5	\$25.2	\$15.02	Seller
									SELLER2	3600	9	7			
3	First Pric	Valid Auction	Exp. Mark	Buyer1	1	1500	2	1	SELLER1	1500	5	4	\$35.21	\$5.01	Buyer
									SELLER2	1000	5	3			
									SELLER3	1000	5	3			

Like the **Browse Auctions** window, the **View Session Report** window does not automatically update the information displayed. Click the **Retrieve** button to update the information. However, unlike the **Browse Auctions** window, this **View Session Report** window, as shown above, provides very detailed information about all auctions. The information displayed involves not only auction types and completion status but also who won which auction and provides an earnings report for the buyers and sellers.

In the following pages a discussion of auction types and earnings calculations are provided. Please click on the **NEXT** button to proceed.

## Auction Types and Earnings Calculation

As briefly mentioned earlier, there are two types of auctions: a **first-price auction** and a modified **second-price auction**. Understanding each of these auction types is important, because both the conditions of a valid auction and the way of calculating buyers' and sellers' earnings are slightly different depending on the auction type.

In the following instructions, each of these auctions will be described in more detail with examples. Please click on the **NEXT** button to continue.

### First-Price Auction

There are three conditions for a first-price auction to be valid. A first-price auction will be valid, if and only if:

- there is at least one seller who accepts a buyer's offer, and
- the sellers' bids on A1, A2, and A3 are less than the buyers' reservation price for A1, A2, and A3, and
- the buyer is willing to accept the bid.

For example, consider a job opening that is being auctioned. Assume that there are three job applicants (Seller1, Seller2, and Seller3) who want to apply for the job, and a recruiter (a buyer) who can afford only up to 1300 for A1, 130 for A2, and 13 for A3. In this specific example, A1, A2, and A3 represent some attributes of a job, such as vacation days, bonus, salary, promotion credits, etc. Assume that the bids from the three sellers are as follows.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1300)	100 (Max=130)	10 (Max=13)
Seller 1	1000 (Min=500)	100 (Min=50)	10 (Min=5)
Seller 2	2000 (Min=550)	200 (Min=45)	20 (Min=6)
Seller 3	3000 (Min=600)	300 (Min=10)	30 (Min=7)

Note: The display of the sellers' minimum reservation prices and the buyer's maximum reservation price is for instructional purposes only. Auction participants only see their own reservation prices and not those of other players.

In this specific case, Seller1 has a better chance to win this auction than other sellers, because the seller's bid is better (less than) than the other sellers' offers and the aggregate bid is less than the buyer's reservation price. However, note that not all buyers who can afford the best available bid would be willing to accept the bid. If the buyer does not want to accept the bid, even if he or she could afford the bid, the auction will be invalid.

Why does a buyer who can afford a feasible bid not accept the bid? This is because the buyer is also trying to maximize his or her earnings.

Click on the **NEXT** button to learn how the winner's (Seller1's) earnings as well as the buyer's earnings are calculated in a first-price auction.

## Earning Calculation in a First-Price Auction

The graphic shown below is a part of the winner's **Earnings** window. As shown in the graphic actual earnings from a valid first-price auction are directly determined by experimental earnings. That is,

$$\text{the winner's actual earnings} = \text{experimental earnings} \times \text{conversion rate (for example, 0.01),}$$

where the conversion rate is preset by a super-user in the **User** menu.

Session ID: 1

Auction ID	Type	Job ID	Round Assigned	Experimental Earning	Actual Earning
2	First Priced	Exp. Market	2	0	\$0
3	First Priced	Exp. Market	2	1003	\$10.03
				<b>Total Earnings:</b>	<b>\$10</b>

In turn,

$$\text{the winner's experimental earnings} = \sum (\text{the winner's bid} - \text{your minimum prices}).$$

The following table is what you saw in the previous page.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1300)	100 (Max=130)	10 (Max=13)
Seller 1	1000 (Min=500)	100 (Min=50)	10 (Min=5)
Seller 2	2000 (Min=550)	200 (Min=45)	20 (Min=6)
Seller 3	3000 (Min=600)	300 (Min=10)	30 (Min=7)

Assume that the buyer accepts Seller1's bid. This means that the buyer is willing to pay Seller's prices on A1, A2, and A3. Then, this auction is valid and Seller1's experimental earnings are calculated as follows:

	<u>Seller1's bid</u>		<u>Seller1's minimums</u>		
A1	1000	-	500	=	500
A2	100	-	50	=	50
A3	10	-	5	=	5
Total					<u>555</u>

After applying the conversion rate, Seller1's earnings are \$5.55.

The buyer's experimental earnings are calculated as follows:

$$\text{Buyer's experimental earning} = \sum (\text{buyer's maximum prices} - \text{a winner's bid})$$

The buyer's earnings in this case are:

	<u>Buyer's maximum</u>		<u>Seller's bid</u>		
A1	1300	-	1000	=	300
A2	130	-	100	=	30
A3	13	-	10	=	3
Total					<u>333</u>

Given that the buyer's conversion rate is set at .01, the experimental earnings are \$3.33 (333 × .01). It is important to note that while one or more sellers' bids may be below the buyer's reservation price, the buyer does not have to accept any offer.

Now let us turn our attention to the second type of auction. Click on the **NEXT** button to learn about a second-price auction and how to calculate the buyers' and sellers' earnings.

### Second-Price Auctions

In a first-price auction, a seller whose bid is the lowest bid usually wins the auction and earnings are directly determined by the winning bid. In a second-price auction, this is not the case.

There are two different cases of second-price auctions. In the first case, a buyer selects a winner based on the lowest feasible A1 value. In the second case, a buyer's selection is not based on the value of A1. The following is the general description for each case.

#### Case 1: Lowest A1 Wins

If a buyer selects a seller with the lowest A1 bid, the earnings of the winner will be computed as described below:

- The winner's A1
  - Remove the winner's A1 and compare A1 values of remaining bids.
  - The winner gets the lowest A1 of all remaining bids.
  - If the lowest A1 of all remaining bids is higher than the buyer's maximums for A1, then it is an invalid auction.
- The winner's A2
  - Remove the winner's A2 and compare A2 values of remaining bids.
  - The Winner gets lowest A2 of all remaining bids.
  - If the lowest A2 of all remaining bids is lower than the winner's A2 minimum, then the winner gets his or her minimum value for A2 and hence zero earning on this.
  - If the lowest A2 of all remaining bids is higher than the buyer's maximum for A2, then it is an invalid auction.
- Determine the winner's A3 credit as A2



Complicated? Let us take an example.

Assume that the sellers' bids, the buyer's offer, and their maximums and minimums are as depicted below, and that the buyer decided to select a winning bid based on the A1, as described above. Then, Seller1 is the winner.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1300)	100 (Max=130)	10 (Max=13)
Seller 1	<del>1000</del> (Min=500)	<del>100</del> (Min=50)	<del>10</del> (Min=5)
Seller 2	<b>1200</b> (Min=550)	<b>120</b> (Min=45)	20 (Min=6)
Seller 3	3000 (Min=600)	300 (Min=10)	<b>9</b> (Min=7)

However, the prices (A1, A2, & A3) that will be used for calculating Seller1's earnings are not what he or she bid (1000, 100, & 10). Instead, they will be 1200 for A1, 120 for A2, and 9 for A3 in accordance with the rules described above. In this case, the values of A1 and A2 come from Seller2's bid; while the value of A3 comes from Seller3's bid. Since each of these values are lower than the buyer's maximum, the buyer can afford these prices. If he or she accepts Seller1's bid, then Seller1's earnings will be:

	<u>Prices taken for earning calculation</u>		<u>Seller1's minimums</u>		
A1	1200	-	500	=	700
A2	120	-	50	=	70
A3	9	-	5	=	4
Total					<u>774</u>

With a conversion rate of .01, actual earnings are \$7.74.

What this example shows is that the winner's earnings in a second-price auction can be less than what he or she bids, because the values used for calculating the earnings are affected by how other sellers bid.

However, there is still a possibility that the buyer will not accept Seller1's bid. Let us take a look at the buyer's earnings below in case where Seller1's bid is accepted.

	<u>Buyer's maximum</u>		<u>Prices taken for earning calculation</u>		
A1	1300	-	1200	=	100
A2	130	-	120	=	10
A3	13	-	9	=	4
Total					<u>114</u>

With a conversion rate of .01, the buyer's actual earnings are just \$1.14. If the buyer thought that earnings were unsatisfactory from selecting Seller1, he or she could decide not to accept any bid.

It is also possible for the buyer not to select a winner based on the lowest A1 value. If the buyer does not accept the lowest bid based on the A1 value, the method in which the earnings are calculated is slightly different.

Click on the **NEXT** button below to see this case.

**Case 2: Lowest A1 does not win**

To see the case in which a buyer may not select a winner based on the lowest A1 value, please look at the following table.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1500)	100 (Max=230)	10 (Max=15)
Seller 1	1200 (Min=700)	60 (Min=50)	10 (Min=5)
Seller 2	<b>1100</b> (Min=550)	200 (Min=45)	15 (Min=5)
Seller 3	1450 (Min=600)	300 (Min=55)	11 (Min=6)
Seller 4	3000 (Min=800)	110 (Min=50)	5 (Min=5)

In this case, Seller2 offers the lower A1 (1100). However, the buyer maximizes his or her earnings by accepting Seller1's bid rather than Seller 2's. Please look at the comparison of the buyer's potential earnings with each seller's bid.

	<u>With Seller 1's bid</u>				<u>With Seller 2's bid</u>			
A1:	1500	-	1200	= 300	1500	-	1100	= 400
A2:	230	-	60	= 170	230	-	200	= 30
A3:	15	-	10	= <u>5</u>	15	-	15	= <u>0</u>
Buyer's potential earnings:	475				430			

If a buyer does not select the winner with the lowest A1 value, the earnings of the winner will be computed as described below:

- The winner's A1
  - Remove the winner's bid and all bids with lower A1 values than the winner's.
  - If there is no remaining bid, then it is an invalid auction. Note that the deciding factor in the case of second-price auctions is A1. An auction is only invalid in a second-price auction, if after removing the winner's bids and all bids with lower A1 bids, there are no remaining A1 bids. This rule only applies to A1.
  - Otherwise, compare A1 values of all remaining bids.
  - The winner gets the lowest A1 of all remaining bids.
- The winner's A2
  - Remove the winner's bid and all bids with lower A1 values than the winner's.
  - Compare A2 values of all remaining bids.

- The winner gets the lowest A2 of all remaining bids.
- If the lowest A2 of all remaining bids is lower than the winner's A2 minimum, then the winner gets his minimum value for A2 and hence zero earning.
- If the lowest A2 of all remaining bids is higher than the buyer's maximum for A2, then it is an invalid auction.
- The winner's A3
  - Determine the winner's A3 credit as A2.

Assume that the sellers' bids, the buyer's offer, and their maximums or minimums are like the example below, and that the buyer selects Seller1 as the winner, ignoring the lower A1 bid of Seller2. Then earnings are calculated as follows:

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1500)	100 (Max=230)	10 (Max=15)
Seller 1	<del>1200</del> (Min=700)	<del>60</del> (Min=50)	<del>10</del> (Min=5)
Seller 2	<del>1100</del> (Min=550)	<del>200</del> (Min=45)	<del>15</del> (Min=5)
Seller 3	<b>1450</b> (Min=600)	300 (Min=55)	11 (Min=6)
Seller 4	3000 (Min=800)	<b>110</b> (Min=50)	<b>5</b> (Min=5)

As described above, Seller1's bid is removed from consideration, because Seller1 is the winner. Also, all the bids with A1 prices below Seller1's A1 price should be struck out. So, all the prices of Seller2's bid should be struck out. Then, the lowest prices of remaining A1, A2, and A3 are 1450 (A1) from Seller3, 110 (A2) and 5 (A3) from Seller4. These values will be used to determine Seller1's earnings.

Seller1's earnings will be:

	<u>Prices taken for earning calculation</u>		<u>Seller1's minimums</u>		
A1	1450	-	700	=	750
A2	110	-	50	=	60
A3	5	-	5	=	0
Total					<u>810</u>

Note that the seller's actual earnings are higher than what the seller would get from his or her own bid. However, the opposite case is always possible. That is, the earnings can be less than the seller expects, depending on the other sellers' bid.

This completes the super-user instructions. If you would like to review some parts of the instructions, you can do so by clicking on the **Instruction** menu after logging into the auction program.

Clicking on the **Enter** button will connect you to the log-in screen for the auction program.

**Chapter 2**  
**Seller Instructions**

## Welcome to Auction Experiment Instructions

Thank you for participating in this auction game!!

This experiment is part of a study that examines how people make decisions under given constraints and negotiate their decisions with other people. This experiment employs an auction environment, in which a buyer and a group of sellers continuously negotiate the price of a hypothetical good or service. In this auction experiment, you play the role of a seller. The objective of the seller is to maximize earnings by bidding on the attributes of a hypothetical good. Earnings are determined by the decisions you make. Earnings will be paid to you in cash at the end of the experiment. This research is funded by research grants so we encourage you to make as much money as possible.

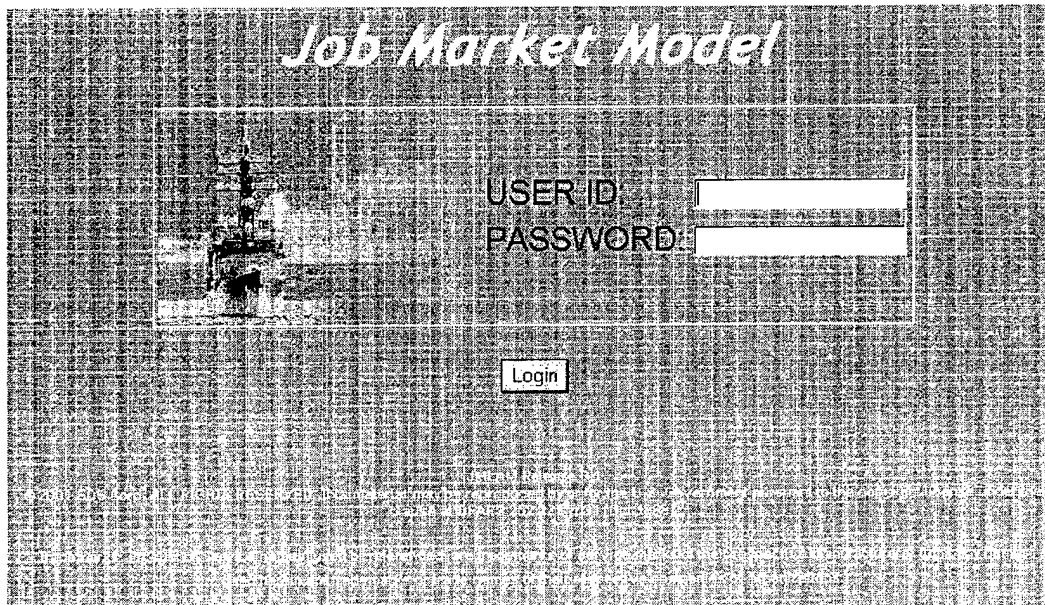
As you read through these instructions, you will learn:

- how to play the auction game,
- how earnings are calculated, and
- how to maximize earnings.

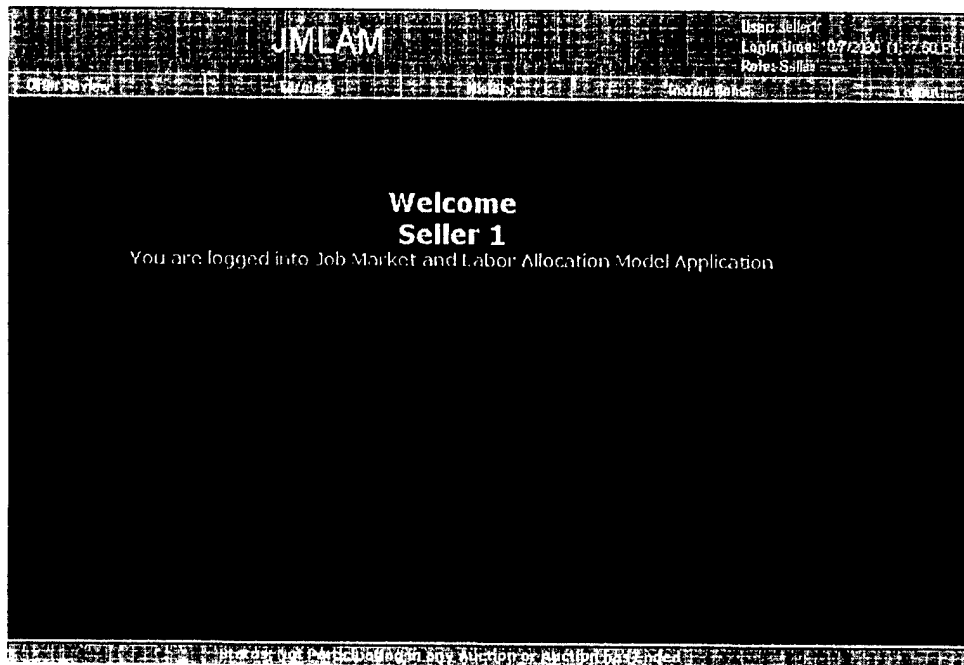
To continue, click on the **NEXT** button. If you are already familiar with the instructions, you can skip the instructions and start playing the auction by clicking the **PLAY** button.

### What Does the Auction Look Like?

To enter the auction, first log in by entering your **USER ID** and **PASSWORD**. The **USERID** and **PASSWORD** will be provided prior to the start of an auction session. The log-in screen looks like the following:



Clicking the "Login" button after entering USER ID and PASSWORD, will automatically connect to a greeting screen. To see the greeting screen, click on the **NEXT** button.



This screen shows the current **USERID**, in this case "Seller1", the login time, and the role of the user (upper-right hand corner). In addition, this screen also provides a list of menus needed for reference throughout the course of the auction. These menus include "**Offer Review**," "**Earnings**," "**History**," "**Instructions**," and "**Logout**."

The following are brief explanations of each of the menu functions:

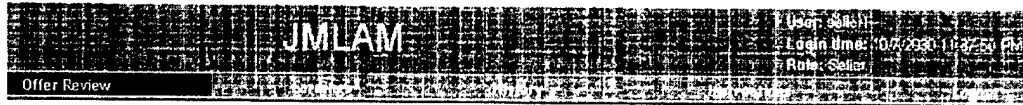
- |                     |   |
|---------------------|---|
| <b>Offer Review</b> | Allows participation in an auction and review of the buyers' offer, <ul style="list-style-type: none"><li>• negotiate with a buyer by submitting a bid in response to the buyer's offer</li><li>• accept a buyer's offer, or</li><li>• decide not to participate in the auction.</li></ul> It is important to note that it is through the offer-review menu that seller interacts with the buyer. |
| <b>Earnings</b>     | Displays current earnings for a given active session. Each session can have one or more auctions. This menu does not provide historical earnings information on closed sessions. It is important to note that earnings are only paid to auction winners. There can be multiple winners for a given auction.   |
| <b>History</b>      | Displays earnings information on all auctions completed or closed. It also displays the winning seller and winning offer for each auction.  |
| <b>Instructions</b> | Click on "Instructions" at any time to review the auction rules.  |
| <b>Logout</b>       | You <b>MUST</b> use this menu to LOGOUT. If you simply close the auction game screen by clicking the close button ( ✕ ) of the Internet Explorer located at the upper-right hand corner of the screen, you may  |

not be able to login with the same user ID and password. Failure to logout properly can potentially disqualify you from an active session.

Particular attention should be paid to the "Status Bar," located at the bottom of the screen. Note the narrow bar, in which the following message appears, "Status: Not participating in any auction or auction has ended." This provides information as to the status of a given auction. As each auction can contain one or more rounds in which sellers and buyers can make bids and counterbids, it is particularly important to monitor the "Status Bar", while participating in an auction. It will signal when a round has begun and when a round has ended. Rounds start when the buyer initiates a bid. Rounds end when a buyer either accepts an offer made by one or more sellers or ends the auction.

Please take a look at the greeting screen again and familiarize yourself with the locations of the menus and the status bar. When you are ready to move on to learn how to play the auction, click on the **NEXT** button.

## How to Play the Auction Game



You are not currently bidding in any active Auction.

OR

The auction in which you were participating has ended.

---

To participate in an auction, you must first review the buyer's offer. As mentioned earlier, this can be done by clicking on the **Offer Review** button. When you click the menu, a screen like the one shown above will pop up.

Note that the message at the center is exactly the same as one shown in the Status Bar. This is because no buyer has initiated an auction. In other words, no auction is available for you to participate in at the moment. If an auction is available, that is a buyer has initiated an offer, the status bar will read "New round has started and is in progress." At this point if you click the **Offer Review** button, you will get a **Seller Offer Review** window.

To see the **Seller Offer Review** window, click on the **NEXT** button.



**JMLAM**

Home Auctions  
Real Estate

**Offer Review**

**Seller Offer Review**

Session ID: 1 Remaining Time: 222 seconds  
 Auction ID: 3 Job ID: Exp. Market  
 Auction Type: First Priced Job Title: Experimental Market  
 Status: Auction In Progress Location: Exp. Lab  
 Current Round: 1

Round ID	User ID	A1 (Min = 1500)	A2 (Min = 3)	A3 (Min = 5)
1	BUYER OFFER	1300	4	4
1	SELLER1			

There are several things you should note about this screen.

First, the message in the **Status Bar** has changed. Please take a look at the **Status Bar**. It now says, "New round has started and is in progress." Second, information about the current auction is displayed. Brief explanations of the dialog boxes are provided below:

- Session ID** Recall, each session may consist of several auctions. You will need the session ID in order to check current earnings and earnings history.
- Auction ID** Each auction consists of at least one round. In other words, **an auction may have multiple rounds**. You will need the auction ID to identify earnings received for a given auction. The auction ID is needed to access the "Earnings" and "History" menus.
- Auction Type** There are two types of auctions: First Priced and Second Priced. Each of these auction types has different rules for determining a winner and their respective earnings. This will be discussed in detail in the section on how to "Maximize Your Earnings."
- Status** This shows the current status of a given auction, whether active or inactive. Sellers can participate only in active auctions. Unlike the **Status Bar** at the bottom of the screen, this status information applies only to the current auction.

- Current Round** As mentioned above, an auction can involve more than one round. It is important to note that the number of bidding rounds in a given auction is only revealed to the buyer. See Special Instructions for changes to this rule.
- Remaining time** Indicates how much time (in seconds) you have to submit your bid. You cannot submit your bid after the time hits 0.

Third, as you see, you have an embedded window, entitled **Round Details**, which looks like an Excel spreadsheet. In this window, you can actually review a buyer's offer and respond to it with your own offer. This window basically consists of four components: header, buyer's offer, seller's offer, and decision buttons. In turn, the header includes Round ID, User ID, A1 (Min =1500), A2 (Min =3), and A3 (Min = 5). The first row below the header shows the buyer's current offer. In this case, the buyer offers 1300 for A1, 4 for A2, and 4 for A3.

### **The meaning of A1, A2, and A3:**

The displayed minimum values of A1, A2, and A3 are the seller's minimum reservation values price, that is the minimum price the seller is willing to accept for the sale of a hypothetical good.

Let us take a job market as an example. In a job market, each job opening has several attributes, such as salary, bonus, vacation days, credits toward promotion, stock options, etc. The templates A1, A2, and A3 represent such attributes of a job. In a job market, the buyer is a recruiter or employer; the seller is a job applicant. In this example, you are trying to sell your services to the employer by bidding on the attributes of the job.

The minimum values or reservation prices in this auction game will be preset and given to you by the program. It is important to note that:

- You cannot change the minimum values.
- Your offers or counterbids should be greater than or equal to preset reservation prices for A1, A2, and A3.

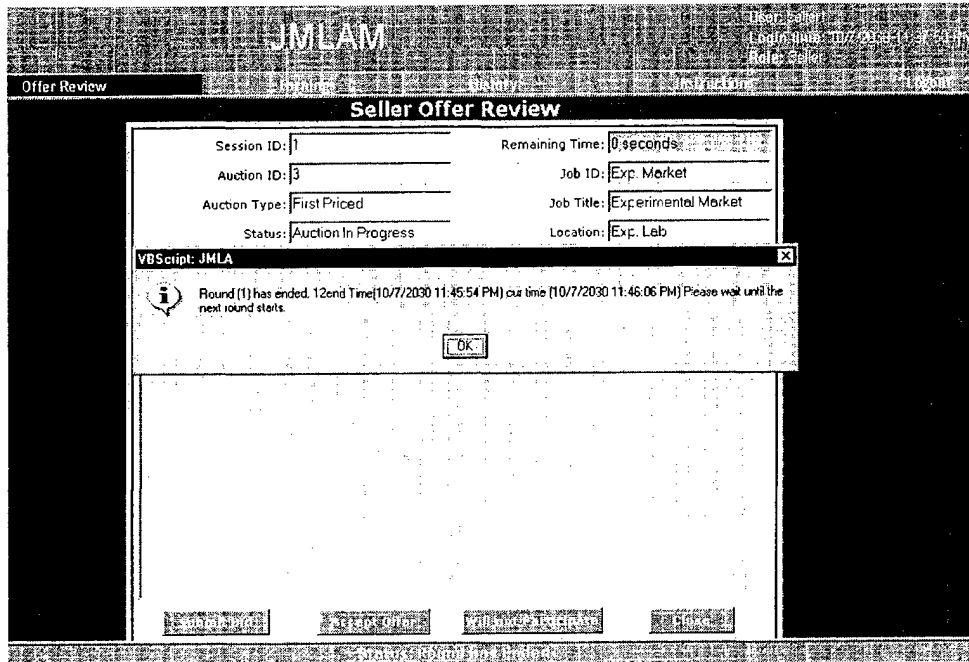
In fact, this is good news for a seller, because the objective is to extract as high a price as possible from the buyer. You should remember, though, that there are multiple sellers in the market. If the other sellers' offers are more attractive than yours, the buyer will accept their offers and you will receive zero earnings for a given auction.

Now, let us take a look at the **Round Detail** window again. Currently, the buyer's offer consists of 1300 for A1, 4 for A2, and 4 for A3 respectively, while your minimum for those are 1500, 3, and 5. While the minimum values are given as default in your offer row, you can change them to higher figures, if desired. You can change your offer by clicking on the seller's offer row and tabbing over to A1, A2, and A3 cells or simply by clicking on the value you wish to change in the seller's offer row.

Once you review the buyer's offer, you can either 1) submit a counter bid, 2) simply accept the bid, or 3) decide not to participate in the auction. However, if you choose not to participate in the auction, you forfeit any chance to win the auction.

Assume that you have decided to participate in this auction, and countered with an offer as follows: A1= 3100, A2= 6, and A3= 7, and now hit the **Submit Bid** button.

Click on the **NEXT** button to see the result.



Unfortunately, you got an error message as shown above.

Recall you cannot submit a bid after the **Remaining Time** hits 0, as in the case illustrated above. Note the **Status Bar** at the bottom of the screen. It says that round has ended.

If you get this message, click the **OK** button in the dialog box and then click on the **Close** button of the **Seller Offer Review** window. You must now wait until either another round or auction begins. You can see if another round or auction is available for you either by looking at the **Status bar** at the bottom of the game screen or by regularly clicking the **Offer Review** menu.

Now let us return to our example. Click on the **NEXT** button to continue.

**JMLAM**

Login: seller  
Login time: 30/11/2011 1:37:50 PM  
Role: seller

Offer Review

### Seller Offer Review

Session ID: 1      Remaining Time: 152 seconds

Auction ID: 3      Job ID: Exp Market

Auction Type: First Priced      Job Title: Experimental Market

Status: Auction In Progress      Location: Exp Lab

Current Round: 2

Round ID	User ID	A1 (Min = 1500)	A2 (Min = 3)	A3 (Min = 5)
2	BUYER_OFFER	1300	4	4
2	SELLER1			
1	BUYER_OFFER	1300	4	4
1	SELLER1	1500	3	5

As shown in the screen, the buyer's second offer is listed in the first row and your default figures are listed on the second row (with a pencil mark). Again, you can change these default figures to higher numbers, if you want.

Now, let us try again to submit your bid. Click on the **NEXT** button below to see the result of your submission.

**JMLAM**

Login: seller  
Login time: 30/11/2011 1:37:50 PM  
Role: seller

Offer Review

### Seller Offer Review

Session ID: 1      Remaining Time: 07 seconds

Auction ID: 3      Job ID: Exp Market

Auction Type: First Priced      Job Title: Experimental Market

Status: Auction In Progress      Location: Exp Lab

Current Round: 2

**You cannot make further bids in this auction or round.**  
**Reason:** You have already submitted your Bid or have declined to participate in this round.  
 Click on "History" from the option bar above to see your bids from this auction and previous auctions

This is the window that will appear if you submit your bid before your bidding time is expired. In fact, you will see the exact same screen when you click other decision buttons, such as **Accept Offer** or **Will Not Participate**.

Note that all the decision buttons (**Submit**, **Accept Offer**, and **Will Not Participate**) are now disabled.

In summary, to play the auction successfully, you must continuously

- check the status bar and click the **Offer Review** button,
- review the buyer's offer,
- submit the bid, or
- accept, or
- opt out of the auction by clicking on the “**Will not participate**” button.

To see how to check the history of your auction participation, click on the **NEXT** button.

## How to Check Your History

User: Salar  
 Login time: 10/7/2010 11:27:51 AM  
 Role: Salar

Home History Instructions

### Browse History

Session ID:

Auction ID	Type	Completion Status	Job ID	Round ID	My A1 Bid	My A2 Bid	My A3 Bid	Winning A1 Bid	Winning A2 Bid	Winning A3 Bid

**Legend:**  
 ( ): Price  
 \*: Won by me

You can check the history of your auction participation by clicking the **History** menu. The screen shown above is what you will see after clicking the menu. Currently, no information is displayed. To retrieve the history information, enter the ID of a session that you want to see (for example, 1) and click the **Retrieve** button.

Click on the **NEXT** button to continue.

**JMLAM**

Job: Job  
 Confirmed: 07/23/05  
 Role: Seller

History

**Browse History**

Session ID: 1

Auction ID	Type	Completion Status	Job ID	Round ID	My A1 Bid	My A2 Bid	My A3 Bid	Winning A1 Bid	Winning A2 Bid	Winning A3 Bid
3	First Priced	Valid Auction	Exp. Mark	1	1500	3	5			
				2	2500	6	5	2500	6	5
2	First Priced	Partially Invalid	Exp. Mark	1	1500	3	5			
				2	1500	3	5	1500	3	5

Legend:  
 ( ): Price  
 \*: Won by me

In order to browse the history for a particular auction you must specify the session ID number. This is the retrieval result screen for session ID #1. This screen shows bidding information for a given auction and what winner, if any, bid for the auction. You may want to take a quick look at this history information during the game so you can change your bidding strategy in subsequent auctions.

One thing you may notice from this screen is the **Completion Status**. As you see, the completion status of auction #2, for example, is partially invalid, while that of auction #3 is a valid auction. The meanings of these terms will be described in detail in the section of how to maximize your earnings. For now keep in mind that earnings can be derived only from "valid auctions" and not from "invalid auctions."

Please click on the NEXT button to advance to instructions for the "Earnings" menu.

## How to Check Your Earnings

JMLAM

Admin: Seller  
Login time: 10/2/2020 11:32:40 AM  
Role: Seller

Home Earnings History Instructions

### Browse Earnings

Session ID:

Auction ID	Type	Job ID	Round Assigned	Experimental Earning	Actual Earning
				Total Earnings:	\$0

You can check your earnings by clicking the **Earnings** menu. The screen shown above is what appears after clicking the **Earnings** menu. To retrieve earnings information for a given session, enter the session ID (for example, 1) and click the **Retrieve** button. This menu only provides **your** earnings information and only after an auction has ended.

Once you enter a Session ID, your earnings information will be displayed. Please click on the **NEXT** button to see the earnings information.



JMLAM

Earnings

**Browse Earnings**

Session ID: ]

Auction ID	Type	Job ID	Round Assigned	Experimental Earning	Actual Earning
2	First Priced	Exp. Market	2	0	\$0
3	First Priced	Exp. Market	2	1003	\$10.03
<b>Total Earnings:</b>					<b>\$10</b>

The earnings retrieval result window shows the earnings information of the auctions in Session #1. This example depicts the earnings of Seller1. Note that the seller earned \$10.03 from auction #3, but received zero earnings for auction #2. The reason is that the auction #2 is partially invalid, as noted earlier. Earnings are received only for valid auctions.

In the next sections, valid auctions, invalid auctions, and how to maximize your earnings are discussed. Please click on the **NEXT** button to advance to the next menu.

## How to Maximize Your Earnings

There are two types of auctions that you may participate in: a first-price auction and a second-price auction. Winning bids and the type of auction being conducted determine earnings. The “Offer Review” screen indicates which type of auction is being conducted. It is important to note that the auction type does not change for a given auction, but can change across auctions.

Click on the **NEXT** button to learn about what a valid (or an invalid) first-price auction is and how you can maximize earnings from this type of auction.

### First-Price Auction

There are three conditions that must be met in order to be a winner of a valid first-price auction. You can win a first-price auction, if and only if:

- you offer a better bid (lower bid for a given set of attributes) than any other sellers, and
- the buyer can afford your bid, and
- the buyer is willing to accept your bid.

All of these conditions, not one or two must be met. The first condition is needed to identify a likely winner. The second and the third conditions are needed for an auction to be valid.

#### An Example:

Consider a job opening that is being auctioned. Assume that there are three job applicants including you (you as Seller1, Seller2, and Seller3) who want to apply for the job, and a recruiter (a buyer) who can afford only up to 1300 for A1, 130 for A2, and 13 for A3. In this specific example, A1, A2, and A3 represent some attributes of a job, such as vacation days, bonus, salary, promotion credits, etc. Assume that the bids from the three sellers are as follows.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1300)	100 (Max=130)	10 (Max=13)
You	1000 (Min=500)	100 (Min=50)	10 (Min=5)
Seller 2	2000 (Min=550)	200 (Min=45)	20 (Min=6)
Seller 3	3000 (Min=600)	300 (Min=10)	30 (Min=7)

Note: Although the table above shows all the sellers' minimum reservation prices and the buyer's maximum reservation price, it is just for instruction sake; you will be informed neither of the buyers' maximum nor of other sellers' minimum in actual auction games.

Given that you are Seller1 in the above example, you have a better probability of winning this auction than other sellers, because your bid is better than other sellers and the buyer can afford the bid. However, you should remember that not all buyers who can afford your bid would be willing to pay your price. Given the sellers' offers, the buyer has options of accepting one or more offers or counter offering. It is possible that the sellers' offers exceed the buyer's maximum reservation price. In the case where all the sellers' offers exceed the buyer's reservation price, the

auction is deemed invalid. Auctions can also be deemed invalid if no offer is accepted after some predetermined number of bidding rounds has been completed. Recall that each auction consists of one or more rounds. Unless otherwise indicated in the **Special Instructions** at the end of this instruction, the buyer knows the number of rounds in a given auction, whereas the sellers do not.

A buyer may not accept feasible bids as he or she is also trying to maximize his or her earnings.

Click on the **NEXT** button below to learn about how sellers' earnings as well as the buyer's earnings are calculated in a first-price auction.

### How to Maximize Earnings in First-Price Auctions

The graphic shown below is a part of the **Earnings** window seen earlier. As shown in the graphic, your experimental earnings and a conversion rate determine actual earnings from a valid auction as follows:

$$\text{actual earnings} = \text{experimental earnings} \times \text{conversion rate (for example, 0.01)}$$

where the conversion rate is preset by the program.

Session ID: 1

Auction ID	Type	Job ID	Round Assigned	Experimental Earning	Actual Earning
2	First Priced	Exp. Market	2	0	\$0
3	First Priced	Exp. Market	2	1003	\$10.03
<b>Total Earnings:</b>					<b>\$10</b>

In turn, experimental earnings are the difference between winning bids and sellers' reservation price:

$$\text{experimental earnings} = (\text{winning offer} - \text{reservation price}).$$

The following table is was shown on the previous page.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1300)	100 (Max=130)	10 (Max=13)
You	1000 (Min=500)	100 (Min=50)	10 (Min=5)
Seller 2	2000 (Min=550)	200 (Min=45)	20 (Min=6)
Seller 3	3000 (Min=600)	300 (Min=10)	30 (Min=7)

Assume that the buyer accepts your bid. This auction is valid. Earnings are determined as follows:

	Your bid		Your minimums	=	
A1	1000	-	500	=	500
A2	100	-	50	=	50
A3	10	-	5	=	5
Total					<u>555</u>

As you may have already noticed, the greater the difference between your offer and your reservation prices, the greater your earnings. Similarly, the buyer's earnings are the difference between reservation price and the winning bid. While sellers wish to obtain the highest possible price, the buyer's objective is to obtain the good at the lowest possible price. That is,

$$\text{Buyer's experimental earning} = (\text{buyer's maximum prices} - \text{a winning bid})$$

The buyer's earning in this specific case is:

	<u>Buyer's maximum</u>	-	<u>Your bid</u>	=	
A1	1300	-	1000	=	300
A2	130	-	100	=	30
A3	13	-	10	=	<u>3</u>
Total					<u>333</u>

Given that the conversion rate is .01, this experimental earning is equal to \$3.33 ( $333 \times .01$ ).

Click on the **NEXT** button to learn about a second-price auction.

### Second-Price Auctions

In a first-price auction, the seller with the lowest bid is generally the winner and earnings are determined by the difference between the winning bid and the seller's reservation price. This is not the case in a second-price auction. In a second price auction, the winner of the auction is determined by the lowest accepted A1 bid. However, earnings are determined by considering the next highest losing A1, A2, and A3 bids.

There are two different cases of second-price auctions. In the first case, a buyer selects a seller based on A1 value. In the second case, a buyer's selection is not based on the A1 value. Below is a general description for each case.

#### Case 1: Lowest A1 wins

If a buyer selects a seller whose A1 price is the lowest, the winner's earnings will be computed as described below:

- The winner's A1
  - Remove the winner's A1 and compare A1 values of remaining bids.
  - The winner gets the lowest A1 of all remaining bids.
  - If the lowest A1 of all remaining bids is higher than the buyer's maximums for A1, then it is an invalid auction.
- The winner's A2
  - Remove the winner's A2 and compare A2 values of remaining bids.
  - The Winner gets lowest A2 of all remaining bids.

- If the lowest A2 of all remaining bids is lower than the winner's A2 minimum, then the winner gets his minimum value for A2 and hence zero earning on this.
- If the lowest A2 of all remaining bids is higher than the buyer's maximum for A2, then it is an invalid auction.
- Determine the winner's A3 credit as A2

Complicated? Let us take an example.

Assume that the sellers' bids, the buyer's offer, and their maximums and minimums are as follows, and that the buyer decided to select a winning bid based on the notebook prices (A1), as described above. Then, you are the winner.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1300)	100 (Max=130)	10 (Max=13)
You	<del>1000</del> (Min=500)	<del>100</del> (Min=50)	<del>10</del> (Min=5)
Seller 2	<b>1200</b> (Min=550)	<b>120</b> (Min=45)	20 (Min=6)
Seller 3	3000 (Min=600)	300 (Min=10)	<b>9</b> (Min=7)

However, the prices (A1, A2, & A3) that will be used for calculating earning are not what was bid (1000, 100, & 10). Instead, they will be 1200 for A1, 120 for A2, and 9 for A3 in accord with the rules described above. In this case, the values of A1 and A2 come from Seller2's bid; while the A3 value comes from Seller3's bid. Since each of these values is lower than the buyer's maximum, the buyer can afford these prices. If he or she accepts your bid, then your earning will be:

	<u>Prices taken for earning calculation</u>		<u>Your minimums</u>		
A1	1200	-	500	=	700
A2	120	-	50	=	70
A3	9	-	5	=	4
Total					<u>774</u>

With a conversion rate of .01, actual earnings are \$7.74.

What this example shows is that the winner's earnings in a second-price auction can be less than what was bid, because the values used for calculating the earnings are affected by how other sellers bid.

It is still possible that the buyer does not accept a bid if he or she thinks that the earning from this auction is insufficient. Let us take a look at the buyer's earnings below in the case in which the buyer accepted your bid.

	<u>Buyer's maximum</u>		<u>Prices taken for earning calculation</u>		
A1	1300	-	1200	=	100
A2	130	-	120	=	10
A3	13	-	9	=	4
Total					<u>114</u>

With a conversion rate of .01, the buyer's actual earnings are just \$1.14. If the buyer thought that these earnings were unsatisfactory, he or she would decide not to accept any bid.

A couple of points to remember:

1. For an auction to be considered valid, the winning bids A1, A2, and A3 must be less than the buyer's reservation price.
2. Seller reservation prices are predetermined; to this extent it is possible that different sellers may have different reservation prices. It is possible, therefore, to win the auction and receive earnings for a bid on A1 but zero earnings for bids on A2 and A3 bids.
3. In the case of a second-price auction, actual earnings can be less than what was bid, depending on how other sellers bid.

It may be the case that the buyer does not select the lowest A1 bid. If the buyer does not accept the lowest A1, bid earnings are calculated slightly differently. This is the second case of a second-price auction.

Click on the **NEXT** button for an example of Case #2.

### Case 2: Lowest A1 Does Not Win

To see the case in which a buyer may not select the winner with the lowest A1 value, take a look the following table.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1500)	100 (Max=230)	10 (Max=15)
You	1200 (Min=700)	60 (Min=50)	10 (Min=5)
Seller 2	<b>1100</b> (Min=550)	200 (Min=45)	15 (Min=5)
Seller 3	1450 (Min=600)	300 (Min=55)	11 (Min=6)
Seller 4	3000 (Min=800)	110 (Min=50)	5 (Min=5)

In this case, Seller 2 offers a lower A1 bid (1100) than you do (1200). However, the buyer can maximize earnings by accepting your offer rather than Seller2's. Take a look at the comparison of the buyer's potential earnings with your offer and with Seller2's.

	<u>With your offer</u>				<u>With Seller 2's offer</u>					
A1:	1500	-	1200	=	300	1500	-	1100	=	400
A2:	230	-	60	=	170	230	-	200	=	30
A3:	15	-	10	=	<u>5</u>	15	-	15	=	<u>0</u>
Buyer's potential earnings:					475					430

If a buyer does not select the winner with the lowest A1 value, the earnings of the winner will be computed as described below:

- The winner's A1
  - Remove the winner's bid and all bids with lower A1 values than the winner's.
  - If there are no remaining bids, then it is an invalid auction.
  - Otherwise, compare A1 values of all remaining bids.
  - The winner gets the lowest A1 of all remaining bids.
- The winner's A2
  - Remove the winner's bid and all bids with lower A1.
  - Compare A2 values of all remaining bids.
  - The winner gets the lowest A2 of all remaining bids.
  - If the lowest A2 of all remaining bids is lower than the winner's A2 minimum, then the winner gets his minimum value for A2 and hence zero earning.
  - If the lowest A2 of all remaining bids is higher than the buyer's maximum for A2, then it is an invalid auction.
- The winner's A3
  - Determine the winner's A3 credit as A2.

Assume that the sellers' bids, the buyer's offer, and their maximums or minimums are as depicted below, and that the buyer selected you as the winner, although your A1 price is higher than Seller2's price.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
Buyer 1	1000 (Max=1500)	100 (Max=230)	10 (Max=15)
You	<del>1200</del> (Min=700)	<del>60</del> (Min=50)	<del>10</del> (Min=5)
Seller 2	<del>1100</del> (Min=550)	<del>200</del> (Min=45)	<del>15</del> (Min=5)
Seller 3	1450 (Min=600)	300 (Min=55)	11 (Min=6)
Seller 4	3000 (Min=800)	110 (Min=50)	5 (Min=5)

As described above, you should first strike out your prices, because you are the winner. Also, strike out all A1 bids lower than your A1 price, therefore all the prices of Seller2's bid should be struck out. Then, the lowest prices of the remaining A1, A2, and A3 are 1450 (A1) from Seller3, 110 (A2) and 5 (A3) from Seller4. These values will be credited for your A1, A2, and A3, since these values are under the buyer's maximum.

With these credits, your earning will be:

	<u>Prices taken for earning calculation</u>		<u>Your minimums</u>		
A1	1450	-	700	=	750
A2	110	-	50	=	60
A3	5	-	5	=	0
Total					<u>810</u>

Note that actual earnings in this specific case are higher than what you would get from your own bid. However, the opposite case is always possible. That is, earnings from a second-price auction can be less than expected with your bid, depending on the other sellers' bid.

In summary, remember that earnings can be maximized by considering two factors: attractiveness of the bid and potential earnings. In fact, there is a trade-off between bids and earnings. In order to increase the chances of winning an auction, make the bid attractive to buyers by offering lower prices on A1, A2, and A3 than other sellers. However, the very same strategy costs potential earnings. In contrast, if you try to maximize your earnings, your bid is less likely to be successful.

Click on the **NEXT** button to see **Special Instructions**.



## Special Instructions

This completes the auction instruction. If you want to review some parts of this instruction, you can do so by clicking **Instruction** menu after logging in to the auction program.

Click on the **PLAY** button to start playing the auction.

**Chapter 3**  
**Buyer's Instructions**

## Welcome to Auction Experiment Instructions

This experiment is part of a study for understanding how people make decisions under given constraints and negotiate their decisions with other people. This experiment employs an auction environment, in which a group of buyers and sellers negotiate the price of attributes of a hypothetical good.

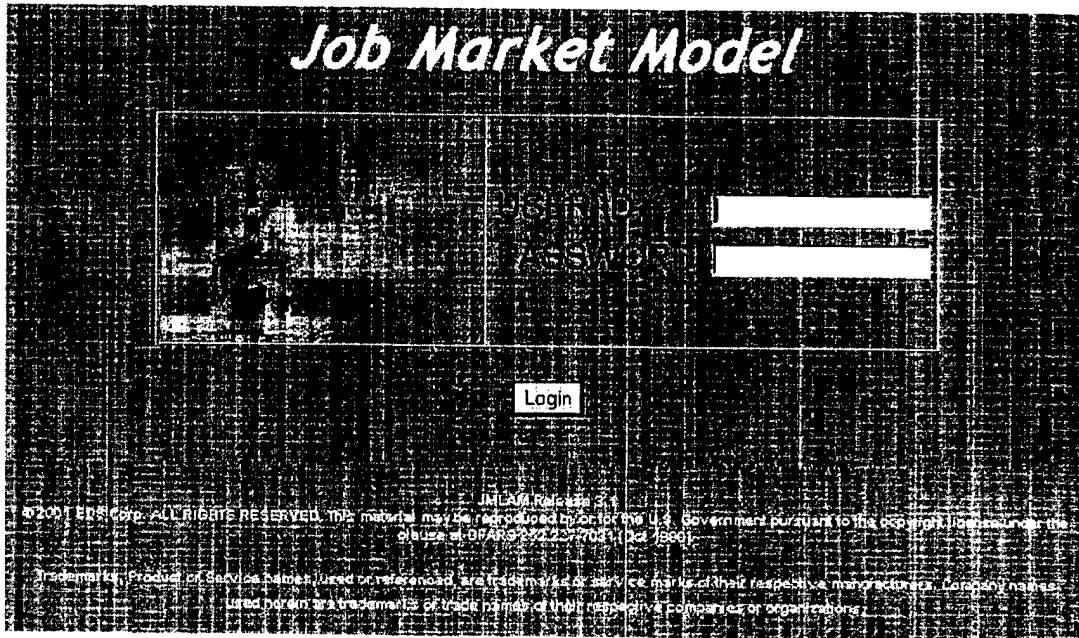
In this auction experiment, you play the role of a buyer. As you read through the instructions, you will learn:

- how to initiate auctions,
- how to play the auction game,
- how earnings are calculated, and
- how to maximize earnings

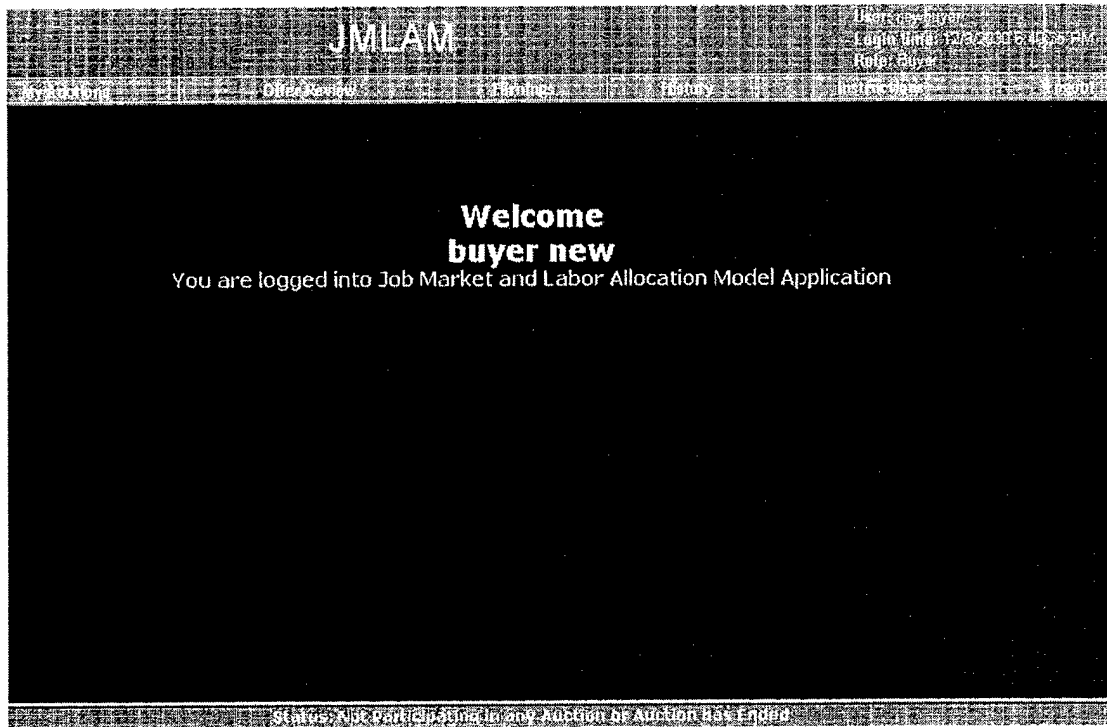
To continue, click on the **NEXT** button. If you are already familiar with the instructions, you can skip the instructions and start the game by clicking the **PLAY** button.

## What Does the Game Place Look Like?

Before talking about the auction game itself, let us familiarize you with the layout of the auction place. To enter the auction, log in by entering **USER ID** and **PASSWORD**. **USERID** and **PASSWORD** will be provided at the start of the auction. The log-in screen looks like the following.



When you click the "**Login**" button after entering **USER ID** and **PASSWORD**, you will automatically be connected to a greeting screen. To see the greeting screen, click on the **NEXT** button.



This screen shows the current **USER ID**, in this case "NewBuyer," the login time, and the role of the user (at the upper right-hand corner). In addition, this screen also provides a list of menus needed throughout the course of the auction. These menus include "My Auctions," "Offer Review," "Earnings," "History," "Instructions," and "Logout."

The following are brief explanations of each of the menu functions:

**My Auctions**            Initiate auctions set up by the super-user. All negotiation processes between a buyer and sellers occurs only after the buyer initiates an auction.

**Offer Review**            Allows review of your offer and sellers' counter-offers. You can

- negotiate with sellers,
- accept sellers' offer,
- end the current auction.

It is important to note that this is the menu through which you interact with sellers.

**Earnings**                Displays your current earnings for a given active session. Each session can have one or more auctions. This menu does not provide historical earnings information on closed sessions. It is important to note that you can generate earnings only from valid auctions. Auctions are valid if and only if the buyer's bid and at least one seller's bid is less than the buyer's maximum allowable offer.

**History**                 Displays earnings information on all auctions. It also displays the winning seller and winning offer for each auction.

- Instructions** Click on "Instructions" to review the auction rules at any time.
- Logout** You **MUST** use this menu to LOGOUT. If you simply close the auction game screen by clicking the close button ( X) of the Internet Explorer located at the upper-right hand side corner of the screen, you may not be able to login with the same **USER ID** and **password**, potentially disqualifying you from an active session.

Finally, the **Status Bar**, located at the bottom of the screen, provides you with some useful information during the auction process. Currently, it displays a message, "Status: Not participating in any auction or auction has ended," because you have not initiated any auction yet. Once you initiate an auction, then the status bar will confirm your initiation and signal sellers to participate in the auction by displaying relevant messages on their screens.

Please take a look at the greeting screen again and familiarize yourself with the locations of the menus and the **Status Bar**. When you are ready to move on to learn how to initiate an auction, click on the **NEXT** button

## How to Initiate an Auction

To initiate an auction, browse auctions by clicking the **My Auctions** menu. The following screen is what appears after clicking the menu.

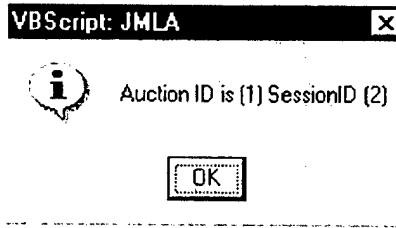
This screen not only browses auctions available to you, but also displays relevant information, such as session #, auction #, auction type, etc. This information can be readily displayed by dragging the horizontal scroll bar of the **My Auctions** screen to the right or by adjusting the column width, as shown below.

Session	Auction	Auction Type	Job ID	Job Title	Location	Max	Secs	# of	Status	Completo	Start Time
2	1	First Priced	Exp. Mark	Experimental IV	Exp. Lab	2	240	1	Auction Not Started		whenever
2	2	First Priced	Exp. Mark	Experimental IV	Exp. Lab	3	240	2	Auction Not Started		whenever

The relevance of this information will be discussed in the next set of instructions, since all the same information, except the maximum number of rounds, will be displayed again in the **Buyer's Offer Review** window. The maximum number of rounds will not be available in the **Offer Review** window. It is important to note that the number of bidding rounds in a given auction is only revealed to the buyer. The seller may or may not have this information. See Special Instructions for changes to this rule.

The **Retrieve** button located on the right- can be used for updating the auction list. You may need to do this, because new auctions that experimenters might set up while you are viewing this screen are not automatically displayed on this screen.

To initiate an auction, select an auction to initiate by clicking one of the listed auctions, and then press the **Start Auction** button. You will get a screen displaying the auction # and Session #, as shown below. Click **OK** to proceed.



The following screen appears after clicking the **OK** button of the previous notification box.

### Buyer Offer Review

Session ID: <input type="text" value="2"/>	Time Remaining: <input type="text" value="0 seconds"/>
Auction ID: <input type="text" value="1"/>	Job ID: <input type="text" value="Exp. Market"/>
Auction Type: <input type="text" value="First Priced"/>	Job Title: <input type="text" value="Experimental Market"/>
Status: <input type="text" value="Auction Not Started"/>	Location: <input type="text" value="Exp. Lab"/>
No. Of Openings: <input type="text" value="1"/>	Current Round: <input type="text" value="0"/>
Remaining Openings: <input type="text" value="1"/>	

Round ID	User ID	A1 (Max = 4000)	A2 (Max = 400)	A3 (Max = 40)	Manual Select
▶ 1					<input type="checkbox"/>

As you see, this screen consists of two parts. The upper part of the screen shows almost the same information displayed in the **My Auction** screen in a more viewable format. The following are brief descriptions of the items shown in the upper part of the screen.



<b>Session ID</b>	<b>Each session may consist of several auctions.</b> You will need the session ID in order to check current earnings and earnings history.
<b>Auction ID</b>	Each auction consists of at least one round. In other words, an auction may have multiple rounds. You will need the auction ID to identify earnings received for a given auction. The auction ID is needed to access the “ <b>Earnings</b> ” and “ <b>History</b> ” menus.
<b>Auction Type</b>	There are two types of auctions: First Priced and Second Priced. Each of these auction types has different rules for determining a winner and earnings. This will be discussed in detail in the section called “Auction Types and Rules.”
<b>Status</b>	Shows the current status of a given auction. Unlike the <b>Status Bar</b> mentioned earlier, this status information applies only to the current auction. Currently, it is "Auction Not Started."
<b>No. of Openings</b>	The maximum number of sellers' bids acceptable in an auction. Since one seller can make only one bid in this experiment, this number also means the maximum number of winners in an auction.
<b>Remaining Openings</b>	You do not always have to accept as many bids as the number of openings. Therefore, when the maximum number of openings is three, if you accept only two sellers' bids, then there is one remaining opening.
<b>Current Round</b>	As mentioned above, an auction can involve more than one round. While the <b>My Auction</b> screen will display the maximum round, this window displays only the current round information.
<b>Time Remaining</b>	Indicates how much time (in seconds) available for the current round. While a buyer and sellers can make only one bid per round, bids cannot be submitted after this time hits 0.

The second part of the screen is an embedded window, entitled **Round Detail**, which looks like an Excel spreadsheet. In this window, you can actually make offers to sellers and review their counter-bids. This window basically consists of three components: the **header**, **buyer's offer**, and **decision buttons**. In turn, the **header** includes Round ID, User ID, A1 (Max =4000), A2 (Max =400), A3 (Max = 40), and manual select. The cells located directly below the shaded row are where the buyer can input bids. While the buyer's maximum reservation prices are, by program default, automatically filled in the row, you can replace them with alternative bids.

The maximum numbers represent the buyer's maximum allowable offer. If a buyer bids his or her maximum and a seller accepts the bid, the buyer will earn zero profit.

#### **The Meaning of A1, A2, and A3:**

They are the buyer's reservation prices for attributes A1, A2, and A3 of a hypothetical good.

Let us take a job market as an example. In a job market, a job can be regarded as a good and each job has several attributes, such as salary, bonus, vacation days, credits toward promotion,

stock options, etc. The A1, A2, and A3 represent the attributes of a job. In this example, the buyers are recruiters or employers who want to buy the sellers' or job applicants', service or labor.

The maximum values in this auction game will be preset and given to you by the program. It is important to note that:

- You cannot change the maximum values.
- Your offers or sellers' counter-bids should be less than or equal to your preset maximum values for A1, A2, and A3.

Given your maximum values for A1, A2, and A3, in order to maximize your earnings the objective is to extract the lowest price possible from the sellers. (A more detailed discussion about how the buyer's earnings are calculated will be given later.) Remember that if offers are too low, sellers may decide simply not to participate in the auction at all, which consequently produces no earning.

As mentioned earlier, the default numbers in the buyer's offer row may be changed to smaller ones by clicking on the row and tabbing over to the A1, A2, and A3 cells or simply by clicking on the value to change. Let us assume that you want to change the default values to  $A1 = 2000$ ,  $A2 = 200$ ,  $A3 = 20$ , as shown below.

### Buyer Offer Review

Session ID: 2	Time Remaining: 0 seconds
Auction ID: 1	Job ID: Exp. Market
Auction Type: First Priced	Job Title: Experimental Market
Status: Auction Not Started	Location: Exp. Lab
No. Of Openings: 1	Current Round: 0
Remaining Openings: 1	

Round Details						
Round ID	User ID	A1 (Max = 4000)	A2 (Max = 400)	A3 (Max = 40)	Manual Select	
1					<input type="checkbox"/>	

Start Round
End Auction
Accept Bid
Manual Select

Once you set up the values, start the auction process by pressing **Start Round** (Some other features of the **Round Detail** window, such as **End Auction**, **Accept Bid**, and **Manual Select** in the header, will be discussed later.) Then, the screen will turn back to the initial greeting screen, as shown below.



The next thing to do is to review sellers' counter-bids to your offer. You can do this by clicking the **Offer Review** menu.

## How to Negotiate with Sellers:

Clicking on the **Offer Review** menu immediately after initiating an auction by pressing the **Start Round** button, will reveal the screen shown below.

### Buyer Offer Review

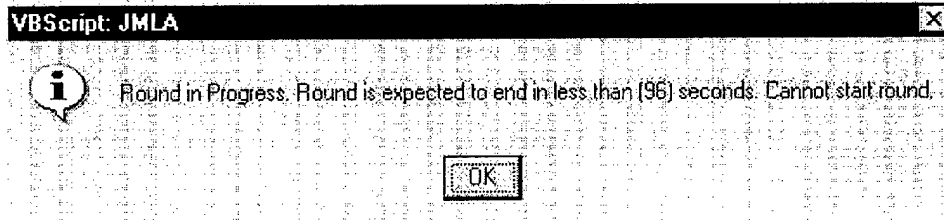
Session ID: <input type="text" value="2"/>	Time Remaining: <input type="text" value="180 seconds"/>
Auction ID: <input type="text" value="1"/>	Job ID: <input type="text" value="Exp. Market"/>
Auction Type: <input type="text" value="First Priced"/>	Job Title: <input type="text" value="Experimental Market"/>
Status: <input type="text" value="Auction In Progress"/>	Location: <input type="text" value="Exp. Lab"/>
No. Of Openings: <input type="text" value="1"/>	Current Round: <input type="text" value="1"/>
Remaining Openings: <input type="text" value="1"/>	

Round Details						
▶	Round ID	User ID	A1 (Max = 4000)	A2 (Max = 400)	A3 (Max = 40)	Manual Select
	2					<input type="checkbox"/>
	1	BUYER_OFFER	2000	200	20	<input type="checkbox"/>

Although this screen is quite similar to the previous one where the current auction was initiated, there are several changes to note. First, some items in the upper part of the screen now display different information. For example, the auction program counts down the **Time Remaining** (180 seconds); the **Status** is now "Auction In Progress" and the **Current Round** displays 1.

Second, the **Round Details** window lists two **Buyer-Offer** rows: one with Round ID #1, another with Round ID #2. While the one with Round ID #1 is what was just offered to sellers, the one with Round ID #2 is for the next round. The **Buyer-Offer** row for the next round will be shown only when the next round is available. By default, the auction program automatically fills the row for the next round with the same number offered in the previous round. Although you can change the numbers of your second offer for the next round before the time remaining for the

current round hits 0, you cannot start another round by pressing the **Start Round** button before the current round ends. If you attempt to do so, you will get the error message shown below.



Third, since no seller has yet responded to your offer, the screen above does not display counter-bids. To display counter-bids in your **Buyer-Offer Review** window, click the **Offer Review** menu button regularly to update sellers' counter-bids.

After sellers submit their counter-bids in response to a buyer's offer, the bids will appear in the **Buyer Offer Review** window as shown below.

### Buyer Offer Review

Session ID: <input type="text" value="2"/>	Time Remaining: <input type="text" value="0 seconds"/>
Auction ID: <input type="text" value="1"/>	Job ID: <input type="text" value="Exp. Market"/>
Auction Type: <input type="text" value="First Priced"/>	Job Title: <input type="text" value="Experimental Market"/>
Status: <input type="text" value="Auction In Progress"/>	Location: <input type="text" value="Exp. Lab"/>
No. Of Openings: <input type="text" value="1"/>	Current Round: <input type="text" value="1"/>
Remaining Openings: <input type="text" value="1"/>	

Round ID	User ID	A1 (Max = 4000)	A2 (Max = 400)	A3 (Max = 40)	Manual Select
▶ 2					<input type="checkbox"/>
1	BUYER_OFFER	2000	200	20	<input type="checkbox"/>
1	SELLER1	3500	350	35	<input type="checkbox"/>
1	SELLER2	3300	330	33	<input type="checkbox"/>

There are several alternative actions to take at this point.

The first alternative is to continue the negotiation process. This means moving on to the next round by inputting new offers. In this case, 1) review the sellers' counter-bids, 2) change the offer/bid, 3) press **Start Round**, and 4) wait for the sellers' response. Obviously, this course of actions is available only when another round is available.

The second alternative is to accept a seller's offer. Do this by 1) reviewing the sellers' offers, 2) selecting one or more sellers bids to accept (click the boxes in the **Manual Select** column), and 3) pressing the **Accept Bid** button. In this case, select as many sellers as there are remaining openings. To deselect a seller once selected, simply click the box beside the seller again.

If there are no remaining openings, then there is no room for further negotiation. However, even in this case the program still waits for a command to end the auction. To end the auction, you **MUST** press the **End Auction** button. Otherwise, the program will consider the auction still in process.

The third alternative is simply to stop the negotiation process. You may consider this alternative if you feel that neither the sellers' current counter-bids nor their future offers would be satisfactory. You can do this by simply pressing the **End Auction** button. However, you should note that no earnings will be generated from this auction, since it is incomplete. Whenever you end an auction without selecting any winner, the auction will be totally invalid as shown below.

Session	Auction	Auction Type	Job ID	Job Title	Location	Max	Secs	# of	Status	Completion	Start Time
2	2	First Priced	Exp. Mark	Experimental IV	Exp. Lab	3	240	2	Auction Complete	Totally Invalid	whenever
2	1	First Priced	Exp. Mark	Experimental IV	Exp. Lab	2	240	1	Auction Complete	Valid Auction	whenever

Besides these alternatives, there may be a situation in which one or more sellers were pre-selected when the **Buyer Offer Review** window was opened. If this happens you will not be allowed to deselect the sellers. This may occur whenever the sellers accepted your previous bid. If there are any remaining openings and you wish to continue the auction in order to fill all job openings you may do so by initiating another round. If not, simply end the auction, by clicking the **End Auction** button.

Let us assume that you decided to continue the negotiation process and initiated another round. When you reopen the **Offer Review** window, you will see a screen, like the one shown below.

### Buyer Offer Review

Session ID: 2	Time Remaining: 232 seconds
Auction ID: 3	Job ID: Exp. Market
Auction Type: First Priced	Job Title: Experimental Market
Status: Auction In Progress	Location: Exp. Lab
No. Of Openings: 1	Current Round: 2
Remaining Openings: 1	

Round ID	User ID	A1 (Max = 4000)	A2 (Max = 400)	A3 (Max = 40)	Manual Select
▶ 2	BUYER_OFFER	2900	290	29	<input type="checkbox"/>
2	SELLER1	3500	350	35	<input type="checkbox"/>
2	SELLER2	3300	330	33	<input type="checkbox"/>
1	BUYER_OFFER	2000	200	20	<input type="checkbox"/>
1	SELLER1	3500	350	35	<input type="checkbox"/>
1	SELLER2	3300	330	33	<input type="checkbox"/>

END OFFER
END AUCTION
OFFER REVIEW
PRINT

As you may already note, the sellers' counter-bids for the second offer are exactly the same as their first counter-bids. It may be the case that the sellers have not responded to the second offer yet. Until they submit their counter-bids, the **Buyer Offer Review** window will show the old values in the new counter-bid rows. So, constantly update the **Offer Review** window by clicking the **Offer Review** menu button. After the offer review window has been refreshed, the **Buyer Offer Review** window will display the sellers' actual second round counter-bids as shown below.

## Buyer Offer Review

Session ID: 2	Time Remaining: 0 seconds
Auction ID: 1	Job ID: Exp. Market
Auction Type: First Priced	Job Title: Experimental Market
Status: Auction In Progress	Location: Exp. Lab
No. Of Openings: 1	Current Round: 2
Remaining Openings: 1	

Round Details						
Round ID	User IC	A1 (Max = 4000)	A2 (Max = 400)	A3 (Max = 40)	Manual Select	
▶ 2	BUYER_OFFER	2900	290	29	<input type="checkbox"/>	
2	SELLER1	3300	330	33	<input type="checkbox"/>	
2	SELLER2	3000	300	30	<input type="checkbox"/>	
1	BUYER_OFFER	2000	200	20	<input type="checkbox"/>	
1	SELLER1	3500	350	35	<input type="checkbox"/>	
1	SELLER2	3300	330	33	<input type="checkbox"/>	

Since this is the second round and the maximum number of rounds for this auction is only two, the first alternative (i.e., extending the negotiation process to the next round) described earlier is no longer viable. Note that the **Start Round** button is now disabled in the above screen, reflecting this situation. Now you can only either select a seller or end the auction without selecting any seller. NOTE: Neither the seller nor the buyer has information on the maximum number of rounds.

Let us assume that you want to select a seller. In this specific auction, Seller2's counter-bid is closer to your offer than Seller1's. So, you may select Seller2 as the winner by clicking the box beside the seller's bid, as shown below.



## Buyer Offer Review

Session ID: 2	Time Remaining: 0 seconds
Auction ID: 1	Job ID: Exp. Market
Auction Type: First Priced	Job Title: Experimental Market
Status: Auction In Progress	Location: Exp. Lab
No. Of Openings: 1	Current Round: 2
Remaining Openings: 1	

Round ID	User ID	A1 (Max = 4000)	A2 (Max = 400)	A3 (Max = 40)	Manual Select
2	BUYER_OFFER	2900	290	29	<input type="checkbox"/>
2	SELLER1	3300	330	33	<input type="checkbox"/>
2	SELLER2	3000	300	30	<input checked="" type="checkbox"/>
1	BUYER_OFFER	2000	200	20	<input type="checkbox"/>
1	SELLER1	3500	350	35	<input type="checkbox"/>
1	SELLER2	3300	330	33	<input type="checkbox"/>

If you select more than one winner in this specific auction, then you will get an error message shown below. As aforementioned, this is because the maximum number of remaining openings is just 1. You cannot select more sellers than the maximum number of job openings.

VBScript: JMLA X



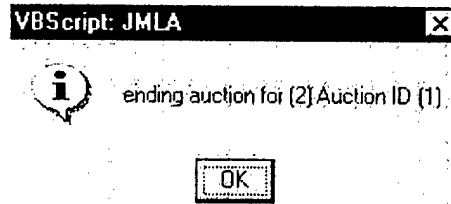
Cannot Assign. Reason: Number of openings is less than the number of Sellers



Once a seller or sellers are selected, press the **Accept Bid** button to accept the selected sellers' bids. Once the button is pressed, it will also be disabled. Now only one thing can be done: end the auction. Finally, you must click on the **End Auction** button in order to end the auction. If you fail to end the auction, your earnings will not be recorded.

## Ending an Auction

To end an auction, press the **End Auction** button. Once the button is pressed, the following message will appear.



By doing this, the auction is complete. The following two graphics contrast the auction status of auction #1 before and after ending the auction. Note that the auction status of auction #1 is "Auction Complete" after the auction is ended.

### Before the auction is ended -

Session	Auction	Auction Type	Job ID	Job Title	Location	Max Rounds	Secs Per	# of	Status	Completion	Start Time
2	2	First Priced	Exp. Mark Experimental N	Exp. Lab	3	240	2	Auction Not Started		whenever	
2	1	First Priced	Exp. Mark Experimental N	Exp. Lab	2	240	1	Auction In Progress		whenever	

### After the auction is ended -

Session	Auction	Auction Type	Job ID	Job Title	Location	Max	Secs	#	Status	Completion	Start Time
2	2	First Priced	Exp. Mark Experimental N	Exp. Lab	3	240	2	Auction Not Started		whenever	
2	1	First Priced	Exp. Mark Experimental N	Exp. Lab	2	240	1	Auction Complete	Valid Auction	whenever	

Another auction status that may occasionally appear is "**Totally Invalid**" or "**Partially Invalid**." In the following graphic, the auction status of auction #2 is "Totally Invalid." This means that the auction ended and no job openings were filled, that is no seller's offer was accepted. If the status is "**Partially Invalid**," then the auction ended with non-zero **Remaining Openings**. For example, if the auction ended after selecting only two sellers when the **No. of Openings** was three, there is still one **Remaining Openings**.

Session	Auction	Auction Type	Job ID	Job Title	Location	Max	Secs	#	Status	Completion	Start Time
2	2	First Priced	Exp. Mark Experimental N	Exp. Lab	3	240	2	Auction Complete	Totally Invalid	whenever	
2	1	First Priced	Exp. Mark Experimental N	Exp. Lab	2	240	1	Auction Complete	Valid Auction	whenever	

## How to Check Auction History

Check the history of auctions participated in by using the **History Menu**.

History

**Browse History**

Session ID:

Auction ID	Type	Completion Status	Job ID	Round ID	My A1 Bid	My A2 Bid	My A3 Bid	Winning A1 Bid	Winning A2 Bid	Winning A3 Bid
(Empty table body)										

Legend:  
( ): Price  
\*: Won by me

The screen shown above is what you will see after entering the History menu. Currently, no information is displayed. To retrieve the history information, enter the session ID and click the **Retrieve** button.

History

**Browse History**

Session ID:

Auction ID	Type	Completion Status	Job ID	Round ID	My A1 Bid	My A2 Bid	My A3 Bid	Winning A1 Bid	Winning A2 Bid	Winning A3 Bid
3	Second Priced	Valid Auction	Exp. Mat.	1	2000	200	20			
				2	2030	260	20			
				3	2230	22	22	2300 (2900)	230 (290)	23 (29)
2	First Priced	Totally Invalid	Exp. Mat.	1	2200	220	22			
				2	2500	250	25			
				3	2900	290	29			
1	First Priced	Valid Auction	Exp. Mat.	1	2000	200	20			
				2	2900	290	29	3000	300	30

Legend:  
( ): Price  
\*: Won by me

In order to browse the history for a particular auction, you must specify the Session ID number. This is the retrieval result screen for session ID #2. This screen shows both you're the sellers' bids for a given auction and the winner's bid, if any, for the auction. Take a quick look at this history information during the game so you can change your bidding strategy in subsequent auctions.

As aforementioned, there is no winning bid for the second auction (Auction #2), because it was totally invalid.

Another thing that you may notice is the third auction. Unlike the first and the second auctions, which are both **First-Priced**, the third auction is **Second Priced** and the winning bid columns shows two different numbers, including the one with parentheses. The buyer interacts with sellers in a similar way in both the **First Priced** and **Second Priced** auctions. However, the auction types (rules) are different with respect to how to select winners and earnings are calculated. The rules for the winner selection and earnings calculation will be discussed more detail in the section called **Auction Types and Rules**.

Please click on the **NEXT** button to advance to instructions for the “Earnings” menu.

## How to Check Earnings

To check earnings for the auctions participated in, press the **Earnings** menu. The following screen will appear.

Auction ID	Type	Job ID	Round Assigned	Experimental Earning	Actual Earning
Total Earnings:				\$0	

No information is currently displayed. To retrieve earnings information, enter the session ID desired (for example, "2") and click the **Retrieve** button. This menu only provides earnings information after an auction has ended.

Once a Session ID is entered earnings information will be displayed as follows. Please click on the **NEXT** button to see earnings information.

Earnings  
**Browse Earnings**

Session ID: 2

Auction ID	Type	Job ID	Round Assigned	Experimental Earning	Actual Earning
3	Second Priced	Exp. Market	3	\$221	\$12.21
1	First Priced	Exp. Market	2	\$110	\$11.1
<b>Total Earnings:</b>					<b>\$23</b>

The earnings retrieval result window shows the earnings information of the auctions in Session #2. Note that in this example the buyer had zero earnings from the second auction, because it was **Totally Invalid**. Earnings are only accrued for valid auctions. This rule is applied to both buyers and to sellers.

In the next sections, two types of auctions will be discussed; First Price and Second Price, and the rules employed by each of the auction types will be revealed. Please click on the **NEXT** button to advance to the next menu.

## Auction Types and Rules

There are two types of auctions: a first-price auction and/or a second-price auction. The type of auction determines the winning bids and hence earnings. The “**Offer Review**” screen indicates which type of auction is being conducted. While the program will predetermine the type of auction, it is important to note that the auction type does not change for a given auction, but can change across auctions.

Each auction type as well as its rules will be discussed in the following section.

Click on the **NEXT** button to learn what a valid (or an invalid) first-price auction is and how to maximize earnings from this type of auction.

In selecting winning sellers, buyers **MUST** follow rules for a given auction type and additional rules described in **Special Instructions**. The rules are not automatic and deviation from the rules can jeopardize the experimental outcomes.

### First-Price Auction

The buyer’s role in this auction experiment is to maximize earnings from the auctions. As a buyer, there are three conditions to remember in a first-priced auction.

- Select at least one winner. Earnings are only accrued if one or more sellers or is selected. The number of job openings determines the maximum number of sellers that can be selected. It is important to remember that the number of job openings can vary across auctions and that the buyer can choose not to select any sellers. If the buyer does not choose any winner (seller), the auction will be **totally invalid**; if the buyer chooses fewer sellers than the number of openings, then the auction will be **partially valid**. Buyers and sellers can accrue earnings only from a (totally or partially) valid auction.
- The seller's bid should be less than or at least equal to the buyer’s maximum reservation values. This condition is also required for an auction to be valid.
- To maximize earnings from an auction, select a seller whose bid is lowest.

Assume that the initial bids and the sellers' counter bids are as follows:

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
You (Buyer)	1000 (Max=4000)	100 (Max=400)	10 (Max=40)
Seller 1	3000 (Min=2500)	300 (Min=250)	30 (Min=25)
Seller 2	4000 (Min=2500)	400 (Min=250)	40 (Min=25)
Seller 3	5000 (Min=2500)	500 (Min=250)	50 (Min=25)

Note: Although the table above shows all the sellers' minimum reservation prices and the buyer's maximum reservation price, it is just for instruction sake; buyers will not be informed of the sellers' minimum in actual auction games and the sellers will not be informed of a buyer's maximum reservation prices.

In this specific example, Seller3 cannot be selected, because the bid is beyond the buyer's maximum budget. While both Seller1's and Seller2's bids are within the buyer's budget, earnings can be maximized by selecting Seller1 over Seller2, because earnings are calculated based on the difference between the buyer's maximum reservation values and the winner's bid. The following instruction will show you the calculation process.

### How to Maximize Earnings in First-Price Auctions

The graphic shown below is a part of the **Earnings** window seen earlier. As shown in the graphic, experimental earnings and a conversion rate determine actual earnings from a valid auction as follows:

$$\text{actual earnings} = \text{experimental earnings} \times \text{conversion rate (for example, 0.01)}$$

where the conversion rate is preset by the program.

Session ID: 2

Auction ID	Type	Job ID	Round Assigned	Experimental Earning	Actual Earning
3	Second Priced	Exp. Market	3	1221	\$12.21
1	First Priced	Exp. Market	2	1110	\$11.1
<b>Total Earnings:</b>					<b>\$23</b>

In turn, experimental earnings are the difference between winning bids and the buyer's reservation price:

$$\text{experimental earnings} = (\text{maximum reservation price} - \text{winning offers}).$$

The following table is what you saw in the previous page.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
You (Buyer)	1000 (Max=4000)	100 (Max=400)	10 (Max=40)
Seller 1	3000 (Min=2500)	300 (Min=250)	30 (Min=25)
Seller 2	4000 (Min=2500)	400 (Min=250)	40 (Min=25)
Seller 3	5000 (Min=2500)	500 (Min=250)	50 (Min=25)

If the buyer selected Seller2's bid, then earnings would be determined as follows:

	<u>Your Maximum</u>	-	<u>Seller 1's bid</u>	=	
A1	4000	-	4000	=	0
A2	400	-	400	=	0
A3	40	-	40	=	0
Total					0

If the buyer selected Seller1's bid, then earnings would be determined as follows:

	<u>Your Maximum</u>	<u>Seller 1's bid</u>
--	---------------------	-----------------------



A1	4000	-	3000	=	1000
A2	400	-	300	=	100
A3	40	-	30	=	10
Total					<u>1110</u>

The greater the difference between the buyer's maximum reservation prices and the seller's bid, the greater the buyer's earnings.

Similarly, the sellers' earnings are determined by the difference between their reservation prices and the winning bid. While a buyer's objective is to obtain the good at the lowest possible price, sellers wish to obtain the highest possible price. That is,

$$\text{Seller's experimental earning} = (\text{a winning bid} - \text{seller's minimum reservation prices})$$

Assuming that the buyer selected Seller1, the seller's earnings are:

	<u>A winning bid</u>	-	<u>Seller's minimum</u>	=	
A1	3000	-	2500	=	500
A2	300	-	250	=	50
A3	30	-	25	=	5
Total					<u>555</u>

Although the buyer's goal is to maximize earnings and this can be done by lowering the sellers' bids through the negotiation, remember that the sellers are also trying to maximize their earnings. This means that if sellers believed that their earnings were insufficient, they could simply choose not to participate in the auction.

Click on the **NEXT** button to learn about a second-price auction.

### Second-Price Auctions

In a first-price auction, the buyer generally selects a seller with the lowest bid. The buyer's earnings are then determined by the difference between the winning seller's bid and the buyer's reservation price. This is not the case in a second-price auction. In a second price auction, the buyer still expected to select the lowest possible bid, however, earnings are determined not only by the prices, but also indirectly by the rules that determine the winning bid.

There are two different cases of second-price auctions. In the first case, the buyer selects a seller based on the A1 value. In the second case a buyer's selection is not based on the value of A1. What follows is the general description for each of these cases.

#### Case 1: Lowest A1 Wins

If the buyer selects a seller whose A1 bid is the lowest among all competing sellers, the earnings of the winner will be computed as described below:

- The winner's A1
  - Remove the winner's A1 and compare A1 values of remaining bids.
  - The winner gets the lowest A1 of all remaining bids.

- If the lowest A1 of all remaining bids is higher than the buyer's maximums for A1, then it is an invalid auction.
- The winner's A2
  - Remove the winner's A2 and compare A2 values of remaining bids.
  - The winner gets the lowest A2 of all remaining bids.
  - If the lowest A2 of all remaining bids is lower than the winner's A2 minimum, then the winner gets his minimum value for A2 and hence zero earnings.
  - If the lowest A2 of all remaining bids is higher than the buyer's maximum for A2, then it is an invalid auction.
- Determine the winner's A3 credit as A2

Complicated? Assume that the sellers' bids, the buyer's offer, and their maximums and minimums are like the following, and that the buyer decided to select a winning bid based on the A1, as described above. This means that the buyer will select Seller1 as the winner.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
You (Buyer)	1000 (Max=1300)	100 (Max=130)	10 (Max=13)
Seller 1	<del>1000</del> (Min=500)	<del>100</del> (Min=50)	<del>10</del> (Min=5)
Seller 2	<b>1200</b> (Min=550)	<b>120</b> (Min=45)	20 (Min=6)
Seller 3	3000 (Min=600)	300 (Min=10)	<b>9</b> (Min=7)

However, the prices (A1, A2, & A3) that will be used for calculating your earnings are not what Seller1 bid (1000, 100, & 10). Instead, they will be 1200 for A1, 120 for A2, and 9 for A3 in accordance with the rules described above. In this case, the values of A1 and A2 come from Seller2's bid; while the value of A3 comes from Seller3's bid. Since each of these values are lower than the buyer's maximum, this auction will be valid. And, the buyer's earnings will be:

	<u>Your maximum</u>		<u>Prices taken for earning calculation</u>		
A1	1300	-	1200	=	100
A2	130	-	120	=	10
A3	13	-	9	=	4
Total					<u>114</u>

While Seller1's earnings will be:

	<u>Prices taken for earning calculation</u>		<u>Seller's Minimums</u>		
A1	1200	-	500	=	700
A2	120	-	50	=	70
A3	9	-	5	=	4
Total					<u>774</u>

Some points to remember:

1. For an auction to be considered valid, the winning bids A1, A2, and A3 must be less than or at least equal to the buyer's maximum reservation price.
2. Since the buyer's earnings are affected not only by the lowest bidder but also by the second best bidder, consider both bids simultaneously.
3. As illustrated above, it is possible that different sellers may have different reservation prices. This implies that even if the buyer put more pressure on the sellers to lower their bids through the negotiation process, some sellers may not be able to do so because of their minimum reservation values, and therefore, the auction itself may likely become invalid.

If the buyer does not accept the lowest A1 bid, the earnings are calculated slightly differently. This is the second case of a second-price auction.

Click on the **NEXT** button for an example of Case #2.

### Case 2: Lowest A1 Does Not Win

To see the case in which a buyer may not select a winner to be the one with the lowest A1 value, take a look at the following table.

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
You (Buyer)	1000 (Max=1500)	100 (Max=230)	10 (Max=15)
Seller 1	1200 (Min=700)	60 (Min=50)	10 (Min=5)
Seller 2	<b>1100</b> (Min=550)	200 (Min=45)	15 (Min=5)
Seller 3	1450 (Min=600)	300 (Min=55)	11 (Min=6)
Seller 4	3000 (Min=800)	110 (Min=50)	5 (Min=5)

In this case, seller2 offers the lower A1 (1100) than does seller1 (1200). However, the buyer's earnings may be maximized with Seller1's offer instead of Seller2's. Take a look at the comparison of potential earnings with each of these bids.

	<u>With Seller1's offer</u>				<u>With Seller2's offer</u>					
A1:	1500	-	1200	=	300	1500	-	1100	=	400
A2:	230	-	60	=	170	230	-	200	=	30

	<u>With Seller1's offer</u>				<u>With Seller2's offer</u>					
A1:	1500	-	1200	=	300	1500	-	1100	=	400
A2:	230	-	60	=	170	230	-	200	=	30
A3:	15	-	10	=	<u>5</u>	15	-	15	=	<u>0</u>
Your potential earnings:					475					430

If the buyer does not select the winner to be the one with the lowest A1 value, the buyer's earnings as well as the earnings of the winner will be computed as described below:

- The winner's A1
  - Remove the winner's bid and all bids with lower A1 values than the winner's.
  - If there are no remaining bids, then it is an invalid auction.
  - Otherwise, compare the A1 values of all remaining bids.
  - The winner gets the lowest A1 of all remaining bids.
- The winner's A2
  - Remove the winner's bid and all bids with lower A2 values than the winner's.
  - Compare A2 values of all remaining bids.
  - The winner gets the lowest A2 of all remaining bids.
  - If the lowest A2 of all remaining bids is lower than the winner's A2 minimum, then the winner gets his minimum value for A2 and hence zero earning.
  - If the lowest A2 of all remaining bids is higher than the buyer's maximum for A2, then it is an invalid auction.
- The winner's A3
  - Determine the winner's A3 credit as A2 (same as A2).

Assuming that the buyer's offer, the sellers' bids, and their respective maximums and minimums are as depicted in the table below and that the buyer has selected Seller1 as the winner, (although Seller1's A1 price is higher than Seller2's), the buyer would receive the following earnings for A1, A2, and A3:

Buyer/Seller	A1 (Max/Min)	A2 (Max/Min)	A3 (Max/Min)
You (Buyer)	1000 (Max=1500)	100 (Max=230)	10 (Max=15)
Seller 1	<del>1200</del> (Min=700)	<del>60</del> (Min=50)	<del>10</del> (Min=5)
Seller 2	<del>1100</del> (Min=550)	<del>200</del> (Min=45)	<del>15</del> (Min=5)
Seller 3	<b>1450</b> (Min=600)	300 (Min=55)	11 (Min=6)
Seller 4	3000 (Min=800)	<b>110</b> (Min=50)	<b>5</b> (Min=5)

As described above, first strike out Seller1's prices, because it is the winning bid. Also, all the bids in which the A1 prices are below Seller1's A1 price should be struck out. So, all the prices of Seller2's bid should be struck out. Then, the lowest prices of the remaining A1, A2, and A3 are 1450 (A1) from Seller3, 110 (A2) and 5 (A3) from Seller4. These values will be used to calculate the buyer's earnings as well as the winner's earnings. Since these values are under the buyer's maximum, this auction is valid.

With these credits, the buyer's earnings will be:

	<u>Your maximum prices</u>		<u>Prices taken for earning calculation</u>		
A1	1500	-	1450	=	50
A2	150	-	110	=	40
A3	15	-	5	=	10
Total					<u>100</u>

If the buyer believes that these earnings are too low then the buyer can continue to negotiate with the sellers as long as the next round is available. However, when the buyer puts pressure on the sellers to lower their bids through negotiation, some sellers may not be able to do so because of their minimum reservation values or they do not want to continue the negotiation because of their diminished earnings. In either case, the possibility that the auction itself becomes invalid increases. Once the auction becomes invalid, earnings cannot be accrued to either the seller or the buyer.

Click on **NEXT** for **Special Instructions**.

## Special Instructions

To review some parts of this instruction, click the **Instruction** menu after logging in to the auction program.

Click on the **PLAY** button to start playing the game.

## Distribution

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