

## INSTRUCTIONS

This is an experiment in the economics of market decision making. Various research organizations have provided funds for conducting this research. The instructions are simple, and if you follow them carefully and make good decisions, you may earn a CONSIDERABLE AMOUNT OF MONEY which will be PAID TO YOU IN CASH at the end of the experiment.

In this experiment, we will create a market in which you will act as bidders in a sequence of auctions.

### **In each auction:**

1. Each bidder will be assigned values for two (2) units of a commodity they wish to purchase. The values of both units will be the same. These values represent the value of the good to you - what we will pay you for any items purchased.
2. Each bidder bids for each of the two (2) units assigned to him/her.
3. Each of you will be bidding in a separate market along with three (3) computerized bidders. Each computerized bidder will be assigned a value for one (1) unit of the commodity. Each computerized bidder will be bidding on its one unit. Thus, in each auction there will be a total of 5 units being bid on (your two units and the 3 computer units).
4. Values for all bidders (including the computers) will be randomly drawn from an interval whose lower bound is \$0 and whose upper bound is \$7.50. Any value within this interval has an equally likely chance of being drawn and being assigned as a value. Note, it is possible (but unlikely) that you will have the same value in a given period as one of the computer bidders. New values will be drawn before each auction.
5. There will be two (2) units for sale in each auction.

### **Assignment rules and profit calculations:**

Items will be allocated using the following "English clock" auction procedure:

Prices will start at 0.00 and will rapidly increase using a "clock" counter located at the bottom of your screen. You are counted as actively bidding on an item until (i) you have dropped out of bidding for that item or (ii) the number of active bids equals the number of items for sale. In the latter case, those still actively bidding will have earned the items they are bidding on and will pay the highest drop-out price. That is, the sale price for all items earned is the drop-out price which equates the number of active bids to the number of items for sale. Dropping out is not reversible, so that once you have dropped out of bidding for an item you can no longer bid on that item.

1. If you earn an item, your earnings will be equal to the value of the unit earned less the sale price (the highest drop-out price). Any unit earned at a price below its value results in a positive profit; any unit earned at a price above its value results in a negative profit. Positive profits will be added to (negative profits subtracted from) your starting balance. If you do not earn an item you neither earn or lose money.
2. All computer bidders are programmed to drop out when the price equals the value of their item.
3. You can drop out of bidding for an item by hitting any key on your key pad. One key stroke drops you from bidding on one item. To stop bidding on the second item hit any key again. If you want to drop out of bidding for both items at the same price you have two options: (i) hit the number 2 key at the top of your key pad or (ii) hit a second key during the pause in the clock price that follows having dropped out of bidding for the first item.

The following examples illustrate the pricing rule and how profits are calculated. The price column shows the price at which bidders dropped out of the bidding. These have been ranked from lowest to highest. Values are shown next to the bids.

Example 1:

Price	Value	Subj
xxxx	7.08	*
xxxx	5.10	C
-----		
<b>4.31</b>	4.31	C
3.07	3.07	C
2.50	7.08	*

A \* under the Subj column indicates the human's drop-out price and a C indicates a computer's drop-out price (note that the computers always drop-out at their value). The two units with x's under the price column earned an item (these items were still being bid on when the drop-out price equated supply and demand).

In this example the human bidder dropped out first on his/her first unit when the price reached 2.50. The computer with value 3.07 dropped out second when the price reached 3.07. And the computer with value 4.31 dropped-out third when the price reached its value. With this third drop out there were two (remaining) active bids and two items for sale so the auction stopped. The price that stopped the bidding, 4.31, is the sale price. The computer still actively bidding and bidder \* each earned an item.

Profits for the unit the human (\*) bidder earned are calculated as follows: the value of the unit less the market price. Thus in this case

Bidder \*'s profits:

Unit 1:  $7.08 - 4.31 = 2.77$

and nothing on unit 2.

In this example, bidder \* could have earned a second unit by waiting to drop out until after the highest valued computer dropped out as our next example shows:

Example 1':

Bid	Value	Subj
xxxx	7.08	*
xxxx	7.08	*
-----		
<b>5.10</b>	5.10	C
4.31	4.31	C
3.07	3.07	C

Now the highest (last) drop-out price is 5.10 so that the market price is 5.10 and bidder \*'s profits are:

Unit 1:  $7.08 - 5.10 = 1.98$

Unit 2:  $7.08 - 5.10 = 1.98$

Total profits = 3.96

In this example \*'s total profits are higher than in example 1.

But life is far from this simple. **In waiting to drop out at a higher price in efforts to earn two (rather than one) unit, \* almost always increases the market price.** In this case, the increase was small enough that waiting increased total profits. But this will not always be the case: Had the highest computerized value been somewhat higher, waiting would have reduced total profits. Further, in cases where \* does not have the highest value, her drop-out price may set the market price, so waiting would reduce earnings in this case as well. The next two examples illustrate these possibilities.

Consider the following modification to example 1, where we have replaced the computerized bidder with value 5.10 with one with value 6.08. In example 2' \* waits to drop out until

after the third computer drops out just as in example 1'.

Example 2:

Bid	Value	Subj
xxxx	7.08	*
xxxx	6.08	C
-----		
<b>4.31</b>	4.31	C
3.07	3.07	C
2.50	7.08	*

\*'s profits:

Unit 1:  $7.08 - 4.31 = 2.77$

Unit 2: nothing

Total profits = 2.77

Example 2':

Bid	Value	Subj
xxxx	7.08	*
xxxx	7.08	*
-----		
<b>6.08</b>	6.08	C
4.31	4.31	C
3.07	3.07	C

\*'s profits:

Unit 1:  $7.08 - 6.08 = 1.00$

Unit 2:  $7.08 - 6.08 = 1.00$

Total profits = 2.00

Note that total profits are lower in this case as a result of \* waiting to drop-out until the last computer dropped out in an effort to earn 2 units.

Consider the following modification to example 1, where \* no longer has the highest value. In example 3' \* waits to drop-out until the price is equal to his value or until all three computers have dropped out (which ever comes first).

Example 3:

Bid	Value	Subj
xxxx	7.08	C
xxxx	6.08	*
-----		
<b>4.31</b>	4.31	C
3.07	3.07	C
2.50	6.08	*

\*'s profits:

Unit 1:  $6.08 - 4.31 = 1.77$

Unit 2: nothing

Total profits = 1.77

Example 3':

Bid	Value	Subj
xxxx	7.08	C
xxxx	6.08	*
-----		
6.08	6.08	*
4.31	4.31	C
3.07	3.07	C

\*'s profits:

Unit 1:  $6.08 - 6.08 = 0.00$

Unit 2: nothing

Total profits = 0.00

Here too total profits are lower as a result of \* waiting to drop out until a higher price on his second unit in an effort to earn 2 units.

In summary, with our pricing rule earning 2 instead of 1 units almost always increases the price you pay on your first unit (the exception is the unlikely event that 2 or more computers have the same value). The net result is that in some cases it will be profitable to wait to drop-out later (example 1') and in some cases it will not be profitable to wait to drop-out later (examples 2' and 3'). And remember, you do not know the computers' values until they have dropped out, when it is too late to take advantage of the information about their values.

Consider the following example where bidder \* does not earn anything since the drop-out price on her last unit sets the market price.

Example 4:

Bid	Value	Subj
xxxx	7.08	C
xxxx	5.10	C
-----		
<b>4.31</b>	4.31	*
3.07	3.07	C
0.00	4.31	*

Suppose that in an effort to earn an item \* waited until at least 2 computers had dropped out before dropping out on her last unit even though this drop-out price was greater than her value.

Example 4':

Bid	Value	Subj
xxxx	7.08	C
xxxx	4.31	*
-----		
<b>5.10</b>	5.10	C
3.07	3.07	C
0.00	4.31	*

Now the price is 5.10 and \* earns 1 unit and

Bidder \*'s profits:

Unit 1:  $4.31 - 5.10 = -0.79$  and nothing on unit 2

That is bidder \* earns a negative profit (remember drop-out prices determine if you earn an item; but your profits are determined by your value less the sale price). These negative profits would be subtracted from \*'s starting cash balance (or positive profits she earned in other auction periods).

Any time it is **necessary** to drop-out at a price above your value in order to earn an item, you don't want to earn it! You can only lose money compared to the alternative of dropping out at the value of the item and not earning it.

Note that it is possible to drop-out during the pause in the clock that follows when one of the computers drops out or you drop out. If you do this you will be counted as having dropped out at the price the clock has paused at, but be counted as dropping out after the computer has dropped out or after you have dropped out on your first unit.

**Additional Remarks:**

1. You are free to bid whatever you think will bring you the most earnings. In thinking about bidding, earning an item is of no intrinsic value. Your sole objective should be to maximize your earnings.
2. You will all be given a starting capital balance of \$5.00. Any losses will be subtracted from this balance, any profits added to it. Your final balance will be paid to you in cash at the end of the experiment.
3. Each of you will be operating in your own market with 3 (different) computerized bidders. You will not know a computer's bid/value until it has dropped out of the bidding.
4. We will conduct 3 dry runs to familiarize you with the procedures and accounting rules. This will be followed by 25 periods played for cash.

Are there any questions?

(To be read to subjects - they do not have a copy of this)

Housekeeping details: This is a dry run. Don't do anything yet, just look at the right hand side of your computer screens. At the top of the screen we show the "no. of computers" - the number of computers bidding in each market (3). Next is the "supply" - the number of items for sale in each market (2). Next is "demand" - the total number of units actively bid on in the market (5 - your 2 bids + 3 computer bids). Next is "balance" - your starting cash balance. Next is "auction fee" - this is the cost of participating in the auction (there is no cost - ignore this). Next is shown the upper and lower bound of the uniform distribution from which values are drawn - \$7.50 and \$0.

Next is shown the value of your first unit. Further down is the value of your second unit (the same as the value of your first unit). The blank spaces below your unit values will be filled in as the auction proceeds and you either drop out or earn an item. The computer automatically computes any profits earned and updates your cash balance.

The very bottom of the screen shows the clock price. Its set to 0.00 right now. It will increase very quickly at increments of .01

I will start the clock in a moment. Remember, in order to drop out of the bidding hit any key. To drop out on both items at the same price hit the number 2 key at the top of the key pad or hit a second key during the pause following your first key hit (this pause is for 3 seconds, long enough for you to drop out on the second unit if you wish).

OK I'm going to start the clock now.

OK all markets have closed now (remember you all operate in your own market with your own computerized bidders so some markets will close before other markets).

Look just to the left of where your values were first reported. We have reported back to you the outcomes for your market: Shown above the solid line are the values of the bidders who have earned an item. If a computer earns an item there is a C next to the value, if you have earned an item there is a \* next to the value. The price paid for items earned is the highest drop-out price, highlighted with green background and reported just below the solid line.

Below the solid line are shown the values for those who did not earn an item along with the corresponding drop-out prices. These are listed from highest to lowest. Note, the computers always drop out at a price equal to their value.

Results for the items you have been bidding on are shown to the right of your screens just below the value of the item. First is shown your bid - the price you dropped out of the bidding or x's in case you earned an item. Next is shown the price paid for any items earned (the highest drop-out price) and last is shown profit or losses earned on that item.

At the very bottom right hand side of your screen you will see total profits - the sum of the profits on your 2 units. Just below this is net profits - total profits less the auction fee. Note, the auction fee will always be 0, so this number will be the same as total profits.

Finally, your cash balance will be updated following each auction period - positive profits added to it, negative profits subtracted from it.

Are there any questions?

You all have record sheets. You must fill these in during the dry runs so that we can check if you understand the pricing rules and the profit calculations. (The better you understand the pricing rules and profit calculations the more money you are likely to make). After the dry runs we recommend that you continue to keep these records but do not

require that you do so.

Please feel free to ask questions as we go along. Let me assure you, if you have a question about what's going on, you can bet that there are at least two other bidders who have the same or a similar question in mind. Please direct all of your comments to me or one of the assistants. You are not permitted to talk to each other until the experiment is over.

After 2nd dry run - add the following:

Before continuing with the next dry run let me ask and answer some questions others have asked in this experiment:

1. How much money can I earn? We don't know exactly since your earnings depend in part on how you bid and in part on luck (the values the computers draw and the values you draw). All we can tell you is that most of our subjects elect to return for additional experiments.

2. Can I bid above my starting balance of \$5.00? Yes - you can bid whatever you like. Recall that your value is what you will get for any items earned, so that you do not have to "secure" your bid with your cash balance. The latter is just designed to provide you with some minimum earnings and a fund from which any negative earnings will be subtracted to begin with.

3. How can I lose money in this auction? The only way you can lose money is by earning an item at a price above your value for that item.

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In this experiment, we will create a market in which you will act as bidders in a sequence of auctions.

**In each auction:**

1. Each bidder will be assigned values for two (2) units of a commodity they wish to purchase. The values of both units will be the same. These values represent the value of the good to you - what we will pay you for any items purchased.
2. Each bidder bids for each of the two (2) units assigned to him/her (bids must be greater than or equal to zero).
3. Each of you will be bidding in a separate market along with three (3) computerized bidders. Each computerized bidder will be assigned a value for one (1) unit of the commodity. Each computerized bidder will submit a bid on its one unit. Thus, in each auction there will be a total of 5 values and 5 bids.
4. Values for all bidders (including the computers) will be randomly drawn from an interval whose lower bound is \$0 and whose upper bound is \$7.50. Any value within this interval has an equally likely chance of being drawn and being assigned as a value. Note, it is possible (but unlikely) that you will have the same value in a given period as one of the computer bidders. New values will be drawn before each auction.
5. There will be two (2) units for sale in each auction.

**Assignment rules and profit calculations:**

1. Bids will be ranked from highest to lowest and the two (2) highest bids will each be awarded one unit of the commodity.
2. The price paid by those earning an item is equal to the highest rejected bid; the 3rd highest bid. This is called a uniform price auction - everyone pays the same price.
3. If you earn an item, your earnings will be equal to the value of the unit earned (not the amount bid) less the market price (the 3rd highest bid). Any unit earned at a price below its value results in a positive profit; any unit earned at a price above its value results in a negative profit. Positive profits will be added to (negative profits subtracted from) the owner's capital balance. If you do not earn an item you neither earn or lose money.
4. The computers' bids will always equal their value.

The following examples illustrate the pricing rule and how profits are calculated.

Example 1:

Bid	Value	Subj
7.06	7.08	*
5.10	5.10	C
-----		
<b>4.31</b>	4.31	C
3.07	3.07	C
2.50	7.08	*

Note bids have been sorted from highest to lowest, values are shown next to the bids. A \* under the Subj column indicates the human's bids and a C indicates a computer's bid (note that the computers always bid their value).

The bid that determines the market price (the 3rd highest bid) has been highlighted. The 2 highest bids (the bids above the highlighted bid and the dashed line) each earn an item.

In this example the human (\*) bidder earned 1 unit. Profits on this unit are calculated as follows: the valuation of the unit less the market price. Thus in this case

Bidder \*'s profits:

Unit 1:  $7.08 - 4.31 = 2.77$

and nothing on unit 2.

In this example, bidder \* could have earned a second unit by bidding more, provided that bid was sufficiently high to edge out the computerized bidder with valuation 5.10. So, for example, consider the case where \* bid 6.50 for her second unit:

Example 1':

Bid	Value	Subj
7.06	7.08	*
6.50	7.08	*
-----		
<b>5.10</b>	5.10	C
4.31	4.31	C
3.07	3.07	C

Now the price is 5.10.

Bidder \*'s profits:

Unit 1:  $7.08 - 5.10 = 1.98$

Unit 2:  $7.08 - 5.10 = 1.98$

Total profits = 3.96

In this example \*'s total profits are higher than in example 1.

But life is far from this simple. **In earning two (rather than one) unit, \* almost always increases the market price.** In this case, the increase was small enough that the higher bid on the second unit increased total profits. But this will not always be the case: Had the highest computerized value been somewhat higher, increasing the bid on the second unit would have reduced total profits. Further, in cases where \* does not have the highest value, the bid on her second unit may set the market price, so increasing the bid on this second unit will reduce earnings. The next two examples illustrate these possibilities.

Consider the following modification to example 1, where we have replaced the computerized bidder with value 5.10 with one with value 6.08. In example 2' \* increases her bid on the second unit just as in example 1'.

Example 2:

Example 2':



Bid	Value	Subj	Bid	Value	Subj
7.06	7.08	*	7.06	7.08	*
6.08	6.08	C	6.50	7.08	*
-----					
<b>4.31</b>	4.31	C	<b>6.08</b>	6.08	C
3.07	3.07	C	4.31	4.31	C
2.50	7.08	*	3.07	3.07	C

\*'s profits:

Unit 1: 7.08 - 4.31 = 2.77

Unit 2: nothing

Total profits = 2.77

\*'s profits:

Unit 1: 7.08 - 6.08 = 1.00

Unit 2: 7.08 - 6.08 = 1.00

Total profits = 2.00

Note that total profits are lower in this case as a result of a higher bid on the second unit in an effort to earn 2 units.

Consider the following modification to example 1, where \* no longer has the highest value. In example 3' \* increases her bid on the second unit just as in example 1'.

Example 3:

Bid	Value	Subj
7.08	7.08	C
6.08	6.08	*
-----		
<b>4.31</b>	4.31	C
3.07	3.07	C
2.50	6.08	*

Example 3':

Bid	Value	Subj
7.08	7.08	C
6.08	6.08	*
-----		
5.80	6.08	*
4.31	4.31	C
3.07	3.07	C

\*'s profits:

Unit 1: 6.08 - 4.31 = 1.77

Unit 2: nothing

Total profits = 1.77

\*'s profits:

Unit 1: 6.08 - 5.80 = 0.28

Unit 2: nothing

Total profits = 0.28

Here too total profits are lower as a result of a higher bid on the second unit in an effort to earn 2 units.

In summary, with our uniform price rule earning 2 instead of 1 units almost always increases the price you pay on your first unit (the exception is the unlikely event that 2 or more computers have the same value). The net result is that in some cases it will be profitable to increase your bid on the second unit (example 1') and in some cases it will not be profitable to increase your bid on the second unit (examples 2' and 3').

Consider the following example where bidder \* does not earn anything since the bid on her first unit sets the market price.

Example 4:

Bid	Value	Subj
7.08	7.08	C
5.10	5.10	C
-----		
<b>4.31</b>	4.31	*
3.07	3.07	C
0.00	4.31	*

Suppose that in an effort to earn an item \* increased the bid on her first unit. For example, suppose she bid \$6.75 (for an item whose value is 4.31).

Example 4':

Bid	Value	Subj
7.08	7.08	C
6.75	4.31	*
-----		
<b>5.10</b>	5.10	C
3.07	3.07	C
0.00	4.31	*

Now the price is 5.10 and \* earns 1 unit and

Bidder \*'s profits:

Unit 1:  $4.31 - 5.10 = -0.79$  and nothing on unit 2

That is bidder \* earns a negative profit (remember bids determine if you earn an item; but your profits are determined by your valuation less the 3rd highest bid). These negative profits would be subtracted from \*'s starting cash balance (or positive profits she earned in other auction periods).

Note that these negative profits for \* are not the result of how much higher than her value she bid. Rather, negative profits result from having to bid higher than your value in order to earn an item. For example, suppose \* bid just enough to beat the third highest bid, a bid of \$5.11. The price paid is not affected by \*'s higher bid, so that she still earns a negative profit of 0.79 as the next example illustrates:

Example 4'':

Bid	Value	Subj
7.08	7.08	C
5.11	4.31	*
-----		
<b>5.10</b>	5.10	C
3.07	3.07	C
0.00	4.31	*

Bidder \*'s profits:

Unit 1:  $4.31 - 5.10 = -0.79$  and nothing on unit 2.

Any time it is **necessary** to bid above your value in order to earn an item, you don't want to earn it! You can only lose money compared to the alternative of bidding your value and not earning the item.

In case of a tie for the second highest bid - for example the 2nd and 3rd highest bid are the same - the computer will randomly determine which of the two bids is the second highest and earns an item and which of the two bids sets the price but does not earn an item. Finally, in cases where the 3rd highest bid is zero (0), the price everyone pays is also zero. That is, the 3rd highest bid sets the market price no matter what the bid is.

**Additional Remarks:**

1. You are free to bid whatever you think will bring you the most earnings. However, for programming purposes we have adopted the convention that the bid for the second unit listed on your computer screen must be less than or equal to the bid on the first unit listed. Finally, in thinking about bidding, earning an item is of no intrinsic value. Your sole objective should be to maximize your earnings.
2. You will all be given a starting capital balance of \$5.00. Any losses will be subtracted from this balance, any profits added to it. Your final balance will be paid to you in cash at the end of the experiment.
3. Each of you will be operating in your own market with 3 (different) computerized bidders.
4. We will conduct 3 dry runs to familiarize you with the procedures and accounting rules. This will be followed by 25 periods played for cash.

Are there any questions?

Housekeeping details: This is a dry run. Don't do anything yet, just look at the right hand side of your computer screens. At the top of the screen we show the "no. of computers" - the number of computers bidding in each market (3). Next is the "supply" - the number of items for sale in each market (2). Next is "demand" - the total number of units bid on in the market (4 - your 2 bids + 3 computer bids). Next is "balance" - your starting cash balance. Next is "auction fee" - this is the cost of participating in the auction (there is no cost - ignore this). Next is shown the upper and lower bound of the uniform distribution from which values are drawn - \$7.50 and \$0.

Next is shown the value of your first unit. Just below this is the place to enter your bid. To bid type in the amount you want to bid on the first unit (including the decimal point but not the \$ sign) followed by hitting the enter key. If you type in a wrong number just hit the back-space key and type your bid in again. Please enter your bid now.

Next is shown the value of your second unit (the same as the resale value of your first unit) and the space for your bid. Please enter the bid on your second unit (remember, you must hit the enter key).

Finally we ask you to confirm your bids by typing Y followed by hitting the enter key again. If you want to change your bids this is the last time to do so - so look them over. If you want to change your bid(s) type N at the confirm prompt followed by hitting the enter key and you can start over again with your bids.

All the bids have been collected, sorted, and prices and profits calculated for the various markets. Look just to the left of where you made your bids. We have reported back to you the outcomes for your market: Bids listed from highest to lowest, the values that go with those bids, and bidder IDs. The highest rejected bid - the bid that sets the market price - is highlighted within a green background. The 2 highest bids are listed in order above it. (Remember, your bids always have a \* next to them).

The price market price (the 3rd highest bid) is also repeated on the

right hand most side of your computer screens, just below your bid (next to the word "price"). The computer calculates the profits on each of your bids just below this. Take a moment to check these profit calculations: (i) you only earn an item if your bid is one of the two highest (your bid is above the dashed line), (ii) if your bid is one of the two highest profits are equal to the resale value of the item less the market price (the bid highlighted with the green background); (iii) if your bid is not one of the 2 highest then profits are 0.

On the bottom right hand side of your screen you will see total profits - the sum of the profits on your 2 units. Just below this is net profits - total profits less the auction fee. Note, the auction fee will always be 0, so this number will be the same as total profits.

Finally, your cash balance will be updated following each auction period - positive profits added to it, negative profits subtracted from it.

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1. How much money can I earn? We don't know exactly since your earnings depend in part on how you bid and in part on luck (the values the computers drew). All we can tell you is that most of our subjects elect to return for additional experiments.

2. Can I bid above my starting balance of \$5.00? Yes - you can bid whatever you like. Recall that your value is what you will get for any items earned, so that you do not have to "secure" your bid with your cash balance. The latter is just designed to provide you with some minimum earnings and a fund from which any negative earnings will be subtracted to begin with.

3. How can I lose money in this auction? The only way you can lose money is by bidding above your value in order to beat out one of the computerized bidders (recall examples 4' and 4").

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1. Each bidder will be assigned values for two (2) units of a commodity they wish to purchase. The values of both units will be the same. These values represent the value of the good to you - what we will pay you for any items purchased.
2. Each bidder bids for each of the two (2) units assigned to him/her.
3. Each of you will be bidding in a separate market along with three (3) computerized bidders. Each computerized bidder will be assigned a value for one (1) unit of the commodity. Each computerized bidder will be bidding on its one unit. Thus, in each auction there will be a total of 5 bids (your 2 and the 3 computer bids).
4. Values for all bidders (including the computers) will be randomly drawn from an interval whose lower bound is \$0 and whose upper bound is \$7.50. Any value within this interval has an equally likely chance of being drawn and being assigned as a value. Note, it is possible (but unlikely) that you will have the same value in a given period as one of the computer bidders. New values will be drawn before each auction.
5. There will be two (2) units for sale in each auction.

### **Assignment rules and profit calculations:**

Items will be allocated using the following “English clock” procedures:

Prices will start at 0.00 and will increase rapidly using a “clock” counter located at the bottom of your screen. You are counted as actively bidding on an item until you have dropped out of the bidding. That is, your bid for each item will be equal to the clock price at which you decide to drop out of the bidding. Dropping out is not reversible, so that once you have dropped out of bidding for an item you can no longer bid on that item.

After you and all the computers in your market have dropped out, bids will be ranked from highest to lowest and the two (2) highest bids will each be awarded one unit of the commodity.

The price paid by those earning an item is equal to the highest rejected bid; the 3rd highest bid. This is called a uniform price auction - everyone pays the same price.

If you earn an item, your earnings will be equal to the value of the unit earned (not the amount bid) less the market price (the 3rd highest bid). Any unit earned at a price below its value results in a positive profit; any unit earned at a price above its value results in a negative profit. Positive profits will be added to (negative profits subtracted from) the owner's capital balance. If you do not earn an item you neither earn or lose money.

The computers' will always drop out at a price equal to their value. You will not know the computers drop out prices until after the auction is over.

You can drop out of bidding for an item by hitting any key on your key pad. One key stroke drops you from bidding on one item. To stop bidding on the second item hit any key again. If you want to drop out of bidding for both items at the same price you have two options: (i) hit the number 2 key at the top of your key pad or (ii) hit a second key during the brief pause in the clock price after you have dropped out of bidding on the first item.

The following examples illustrate the pricing rule and how profits are calculated.

Example 1:

Bid	Value	Subj
7.06	7.08	*
5.10	5.10	C
-----		
<b>4.31</b>	4.31	C
3.07	3.07	C
2.50	7.08	*

Note bids have been sorted from highest to lowest, values are shown next to the bids. A \* under the Subj column indicates the human's drop out price and a C indicates a computer's drop out price (note that the computers always drop out at their value).

The bid that determines the market price (the 3rd highest drop out price) has been highlighted. The 2 highest bids (the bids above the highlighted bid and the dashed line) each earn an item.

In this example the human (\*) bidder earned 1 unit. Profits on this unit are calculated as follows: the valuation of the unit less the market price. Thus in this case

Bidder \*'s profits:

Unit 1:  $7.08 - 4.31 = 2.77$

and nothing on unit 2.

In this example, bidder \* could have earned a second unit by dropping out later, provided that bid was sufficiently high to edge out the computerized bidder with valuation 5.10. So, for example, consider the case where \* bid 6.50 for her second unit:

Example 1':

Bid	Value	Subj
7.06	7.08	*
6.50	7.08	*
-----		
<b>5.10</b>	5.10	C
4.31	4.31	C
3.07	3.07	C

Now the price is 5.10.

Bidder \*'s profits:

Unit 1:  $7.08 - 5.10 = 1.98$

Unit 2:  $7.08 - 5.10 = 1.98$

Total profits = 3.96

In this example \*'s total profits are higher than in example 1.

But life is far from this simple. **In earning two (rather than one) unit, \* almost always increases the market price.** In this case, the increase was small enough that the higher bid on the second unit increased total profits. But this will not always be the case: Had the highest computerized value been somewhat higher, increasing the bid on the second unit would have reduced total profits. Further, in cases where \* does not have the highest value, the bid on her second unit may set the market price, so increasing the bid on this second unit in this case would reduce earnings. The next two examples illustrate these possibilities.

Consider the following modification to example 1, where we have replaced the computerized bidder with value 5.10 with one with value 6.08. In example 2' \* increases her bid on the second unit just as in example 1'.

<u>Example 2:</u>			<u>Example 2':</u>		
Bid	Value	Subj	Bid	Value	Subj
7.06	7.08	*	7.06	7.08	*
6.08	6.08	C	6.50	7.08	*
-----			-----		
<b>4.31</b>	4.31	C	<b>6.08</b>	6.08	C
3.07	3.07	C	4.31	4.31	C
2.50	7.08	*	3.07	3.07	C

\*'s profits:  
 Unit 1:  $7.08 - 4.31 = 2.77$   
 Unit 2: nothing  
 Total profits = 2.77

\*'s profits:  
 Unit 1:  $7.08 - 6.08 = 1.00$   
 Unit 2:  $7.08 - 6.08 = 1.00$   
 Total profits = 2.00

Note that total profits are lower in this case as a result of a higher bid on the second unit in an effort to earn 2 units.

Consider the following modification to example 1, where \* no longer has the highest value. In example 3' \* increases her bid on the second unit just as in example 1'.

<u>Example 3:</u>			<u>Example 3':</u>		
Bid	Value	Subj	Bid	Value	Subj
7.08	7.08	C	7.08	7.08	C
6.08	6.08	*	6.08	6.08	*
-----			-----		
<b>4.31</b>	4.31	C	5.80	6.08	*
3.07	3.07	C	4.31	4.31	C
2.50	6.08	*	3.07	3.07	C

\*'s profits:  
 Unit 1:  $6.08 - 4.31 = 1.77$   
 Unit 2: nothing  
 Total profits = 1.77

\*'s profits:  
 Unit 1:  $6.08 - 5.80 = 0.28$   
 Unit 2: nothing  
 Total profits = 0.28

Here too total profits are lower as a result of a higher bid on the second unit in an effort to earn 2 units.

In summary, with our uniform price rule earning 2 instead of 1 units almost always increases the price you pay on your first unit (the exception is the unlikely event that 2 or more computers have the same value). The net result is that in some cases it will be profitable to increase your bid on the second unit (example 1') and in some cases it will not be profitable to increase your bid on the second unit (examples 2' and 3').

Consider the following example where bidder \* does not earn anything since the bid on her first unit sets the market price.

Example 4:

Bid	Value	Subj
7.08	7.08	C
5.10	5.10	C
-----		
<b>4.31</b>	4.31	*
3.07	3.07	C
0.00	4.31	*

Suppose that in an effort to earn an item \* increased the bid on her first unit. For example, suppose she bid \$6.75 (for an item whose value is 4.31).

Example 4':

Bid	Value	Subj
7.08	7.08	C
6.75	4.31	*
-----		
<b>5.10</b>	5.10	C
3.07	3.07	C
0.00	4.31	*

Now the price is 5.10 and \* earns 1 unit and

Bidder \*'s profits:

Unit 1:  $4.31 - 5.10 = -0.79$  and nothing on unit 2

That is bidder \* earns a negative profit (remember bids determine if you earn an item; but your profits are determined by your valuation less the 3rd highest bid). These negative profits would be subtracted from \*'s starting cash balance (or positive profits she earned in other auction periods).

Note that these negative profits for \* are not the result of how much higher than her value she bid. Rather, negative profits result from having to bid higher than your value in order to earn an item. For example, suppose \* bid just enough to beat the third highest bid, a bid of \$5.11. The price paid is not affected by \*'s higher bid, so that she still earns a negative profit of 0.79 as the next example illustrates:

Example 4'':

Bid	Value	Subj
7.08	7.08	C
5.11	4.31	*
-----		
<b>5.10</b>	5.10	C
3.07	3.07	C
0.00	4.31	*

Bidder \*'s profits:

Unit 1:  $4.31 - 5.10 = -0.79$  and nothing on unit 2.

Any time it is **necessary** to bid above your value in order to earn an item, you don't want to earn it! You can only lose money compared to the alternative of bidding your value and not earning the item.



In case of a tie for the second highest bid - for example the 2nd and 3rd highest bid are the same - the computer will randomly determine which of the two bids is the second highest and earns an item and which of the two bids sets the price but does not earn an item. Finally, in cases where the 3rd highest bid is zero (0), the price everyone pays is also zero. That is, the 3rd highest bid sets the market price no matter what the bid is.

**Additional Remarks:**

1. You are free to bid whatever you think will bring you the most earnings. In thinking about bidding, earning an item is of no intrinsic value. Your sole objective should be to maximize your earnings.
2. You will all be given a starting capital balance of \$5.00. Any losses will be subtracted from this balance, any profits added to it. Your final balance will be paid to you in cash at the end of the experiment.
3. Each of you will be operating in your own market with 3 (different) computerized bidders.
4. As long as you are actively bidding on one or more items, the clock will run until it reaches 7.50 (the maximum possible value), at which point it will stop and this will be counted as your bid on the items you're still bidding on. When you drop out on both items prior to the clock reaching 7.50, the clock will stop once two or less than two computers remain active, and all bid prices will be announced (stopping early in this way simply saves a bit of time).
5. We will conduct 3 dry runs to familiarize you with the procedures and accounting rules. This will be followed by 25 periods played for cash.

Are there any questions?

(To be read to subjects - they do not have a copy of this)

Housekeeping details: This is a dry run. Don't do anything yet, just look at the right hand side of your computer screens. At the top of the screen we show the "no. of computers" - the number of computers bidding in each market (3). Next is the "supply" - the number of items for sale in each market (2). Next is "demand" - the total number of units actively bid on in the market (5 - your 2 bids + 3 computer bids). Next is "balance" - your starting cash balance. Next is "auction fee" - this is the cost of participating in the auction (there is no cost - ignore this). Next is shown the upper and lower bound of the uniform distribution from which values are drawn - \$7.50 and \$0.

Next is shown the value of your first unit. Further down is the value of your second unit (the same as the value of your first unit). The blank spaces below your unit values will be filled in as the auction proceeds. The computer automatically computes any profits earned and updates your cash balance.

The very bottom of the screen shows the clock price. Its set to 0.00 right now. It will increase very quickly at increments of .01

I will start the clock in a moment. Remember, in order to drop out of the bidding hit any key. To drop out on both items at the same price hit the number 2 key at the top of the key pad or hit a second key following the brief pause in the clock price that follows having dropped out of the bidding for the first item. Note, there will be no pause in the clock price following a computer dropping out of the bidding. You will only learn the computers drop out prices after the auction is finished.

OK I'm going to start the clock now.

OK all markets have closed now (remember you all operate in your own market with your own computerized bidders so some markets will close before other markets).

Look just to the left of where your values were first reported. We have reported back to you the outcomes for your market: Shown above the solid line are the values of the bidders who have earned an item along with their drop-out prices. If a computer earns an item there is a C next to the value, if you have earned an item there is a \* next to the value. The price paid for items earned is the highest drop-out price, highlighted with green background and reported just below the solid line.

Below the solid line are shown the values for those who did not earn an item along with the corresponding drop-out prices. These are listed from highest to lowest. Note, the computers always drop out at a price equal to their value.

Results for the items you have been bidding on are shown to the right of your screens just below the value of the item. First is shown your bid - the price you dropped out of the bidding. Next is shown the price paid for any items earned (the highest drop-out price) and last is shown profit or losses earned on that item.

At the very bottom right hand side of your screen you will see total profits - the sum of the profits on your 2 units. Just below this is net profits - total profits less the auction fee. Note, the auction fee will always be 0, so this number will be the same as total profits.

Finally, your cash balance will be updated following each auction period - positive profits added to it, negative profits subtracted from it.

Are there any questions?

You all have record sheets. You must fill these in during the dry runs so that we can check if you understand the pricing rules and the profit calculations. (The better you understand the pricing rules and profit calculations the more money you are likely to make). After the dry runs we recommend that you continue to keep these records but do not require that you do so.

Please feel free to ask questions as we go along. Let me assure you, if you have a question about what's going on, you can bet that there are at least two other bidders who have the same or a similar question in mind. Please direct all of your comments to me or one of the assistants. You are not permitted to talk to each other until the experiment is over.

After 2nd dry run - add the following:

Before continuing with the next dry run let me ask and answer some questions others have asked in this experiment:

1. How much money can I earn? We don't know exactly since your earnings depend in part on how you bid and in part on luck (the values the computers draw and the values you draw). All we can tell you is that most of our subjects elect to return for additional experiments.

2. Can I bid above my starting balance of \$5.00? Yes - you can bid whatever you like. Recall that your value is what you will get for any items earned, so that you do not have to "secure" your bid with your cash balance. The latter is just designed to provide you with some minimum earnings and a fund from which any negative earnings will be subtracted to begin with.

3. How can I lose money in this auction? The only way you can lose money is by earning an item at a price above your value for that item.

## INSTRUCTIONS

This is an experiment in the economics of market decision making. Various research organizations have provided funds for conducting this research. The instructions are simple, and if you follow them carefully and make good decisions, you may earn a **CONSIDERABLE AMOUNT OF MONEY** which will be **PAID TO YOU IN CASH** at the end of the experiment.

In this experiment, we will create a market in which you will act as bidders in a sequence of auctions.

### **In each auction:**

1. Each bidder will be assigned values for two (2) units of a commodity they wish to purchase. The values of both units will be the same. These values represent the value of the good to you - what we will pay you for any items purchased.
2. Each bidder bids for each of the two (2) units assigned to him/her.
3. Each of you will be bidding in a separate market along with three (3) computerized bidders. Each computerized bidder will be assigned a value for one (1) unit of the commodity which they will be bidding on. Thus, in each auction there will be a total of 5 units being bid on (your 2 units and the 3 computer units).
4. Values for all bidders (including the computers) will be randomly drawn from an interval whose lower bound is \$0 and whose upper bound is \$7.50. Any value within this interval has an equally likely chance of being drawn and being assigned as a value. Note, it is possible (but unlikely) that you will have the same value in a given period as one of the computer bidders. New values will be drawn before each auction.
5. There will be two (2) units for sale in each auction.

### **Assignment rules and profit calculations:**

Items will be allocated using the following “English clock” auction procedure:

Prices will start at 0.00 and will rapidly increase using a “clock” counter located at the bottom of your screen. You are counted as actively bidding on an item until you have dropped out or have “clinched” an item. Dropping out is not reversible so that once you have dropped out of bidding for an item you can no longer bid on that item. Once you have clinched an item, it is yours and you pay the “clinching” price.

Before discussing clinching let's discuss dropping out.

1. All computer bidders are programmed to drop out when the price equals the value of their item.
2. You can drop out of bidding for an item by hitting any key on your key pad. One key stroke drops you from bidding on one item. To stop bidding on the second item hit any key again. If you want to drop out of bidding for both items at the same time (price) you have two options: (i) hit the number 2 key at the top of your key pad or (ii) hit a second key during the pause in the clock price that follows dropping out of bidding on the first item.

Clinching works just like in a football, baseball, or basketball league when a team clinches a spot in the playoffs, only in this case clinching involves earning an item, and the price paid for the item..

Once you have clinched an item it is yours and the price you pay is the drop-out price which assured you of clinching the item.

Clinching is easiest to explain via some examples:

Suppose you and the computer(s) have drawn the following values for items (we've ranked the computers' values from highest to lowest) (Remember, the values for your two items are always the same.)

Example 1:

Computers' values	Your values
5.10	7.08
4.31	7.08
3.07	

The clock (price) will start at 0.00 and will increase very rapidly.

Suppose the price hits 3.07 and you have not dropped out of the bidding. The computer with value 3.17 is programmed to drop out at this point. Once the computer drops out at 3.07 there will be 4 items still being bid on (your two items and the two remaining computer bids) and 2 items for sale so nothing has been clinched yet (you are still not assured of earning an item). After a brief pause the clock price will continue moving up.

Suppose the price hits 4.31 and you have not dropped out of the bidding. With the second computer dropping out there are now 3 items being bid on and 2 items for sale. Since you are bidding on 2 of the 3 items, and there are 2 items for sale, you are assured of earning 1 item (you have clinched one item). With clinching you pay the drop-out price which assured you of clinching the item, 4.31. You would earn profits for that one item of  $7.08$  (your value) less  $4.31$  (the clinching price) =  $2.77$ .

Now again, after a brief pause, the price continues to increase. There are now 2 items being bid on (the remaining computer bid and your remaining item) and 1 item remaining to be sold.

If you drop-out before the price hits 5.10 (the remaining computer's drop-out price) the computer clinches the remaining item and your total earnings from the auction would be  $2.77$  (what you earned on the first item).

If the computer drops out before you do, you earn the second item and pay the clinching price for that item, 5.10. This would produce profits on the second item of  $7.08$  (your value) less  $5.10$  (the clinching price) =  $1.98$ . In this case your total earnings for this auction would be  $2.77 + 1.98 = 4.75$ .

Note, it is possible to drop-out during the pause in the clock that follows when one of the computers drops out or you drop out. If you do this you will be counted as having dropped out at the price the clock has paused at but be counted as dropping out after the computer has dropped out.

Of course you can't always earn money in the auction and it is possible to lose money as the following example illustrates.

Example 2:

Computers' values	Your values
7.20	5.75
6.80	5.75
3.07	

As before the clock starts at 0 and the first computer drops out at price 3.07. There are now 4 items being bid on and 2 items for sale. Suppose the clock price hits 5.75 and you decide to remain active bidding on an item until you've clinched one. When the clock price hits 6.80 you have clinched an item, but the clinching price is now above your value so you earn 5.75 (your value) less 6.80 (the clinching price) = -1.05.

Now again, after a brief pause, the clock continues to tick up. There are now 2 items being bid on (the remaining computer bid and your remaining item) and 1 item remaining to be sold.

If you drop-out before the price hits 7.20 (the computer's drop-out price) the computer clinches the remaining item and your total earnings from the auction are -1.05 (what you earned on the first item)

If the computer drops out before you do, you earn the second item and pay the clinching price for that item, 7.20. This would produce profits on the second item of 5.75 (your value) less 7.20 (the clinching price) = -1.45. In this case your total earnings for this auction would be -1.05 - 1.45 = -2.50.

Any negative profits earned will be subtracted from your starting cash balance (or positive profits earned in other auction periods).

Of course there is no reason you have to lose money in a case like this. Had you dropped out on both items when the price reached your value, or at least before you clinched an item at a price above your value (a price of 6.80 in this case), the computers would have clinched the two items and you would earn 0.00 for the auction rather than losing money.

**Additional Remarks:**

1. You are free to bid whatever you think will bring you the most earnings. In thinking about bidding, earning an item is of no intrinsic value. Your sole objective should be to maximize your earnings.
2. You will all be given a starting capital balance of \$5.00. Any losses will be subtracted from this balance, any profits added to it. Your final balance will be paid to you in cash at the end of the experiment.
3. Each of you will be operating in your own market with 3(different) computerized bidders. You will not know a computer's bid/value until it has dropped out of the bidding.
4. We will conduct 3 dry runs to familiarize you with the procedures and accounting rules. This will be followed by 25 periods played for cash.

Are there any questions?

(To be read to subjects - they do not have a copy of this)

Housekeeping details: This is a dry run. Don't do anything yet, just look at the right hand side of your computer screens. At the top of the screen we show the "no. of computers" - the number of computers bidding in each market (3). Next is the "supply" - the number of items for sale in each market (2). Next is "demand" - the total number of units bid on in the market (4 - your 2 bids + 3 computer bids). Next is "balance" - your starting cash balance. Next is "auction fee" - this is the cost of participating in the auction (there is no cost - ignore this). Next is shown the upper and lower bound of the uniform distribution from which values are drawn - \$7.50 and \$0.

Next is shown the value of your first unit. Further down is the value of your second unit (the same as the value of your first unit). The blank spaces below your unit values will be filled in as the auction proceeds and you either drop out or clinch an item. The computer automatically computes any profits earned and updates your cash balance.

At the very bottom of the screen is shown the clock price. It is set to 0.00 right now. It will increase very quickly at increments of .01

I will start the clock in a moment. Remember to drop out of the bidding hit any key. To drop out on both items at the same price hit the number 2 at the top of the key pad or hit a second key during the pause following your first key hit (this pause is for 3 seconds, long enough for you to drop out on the second unit if you wish).

Notice that if you clinch an item before the auction ends that supply will drop from 2 to 1 unit, along with a reduction of 1 unit in the number of items being bid on, since once you've clinched an item, it is no longer available for anyone else to earn.

OK I'm going to start the clock now.

OK all markets have closed now (remember you all operate in your own market with your own computerized bidders so some markets will clinch all the items before other markets).

Look just to the left of where your values were first reported. We have reported back to you the outcomes for your market: Shown above the solid line are the values of the bidders who have clinched an item. If a computer has clinched an item there is a C next to the value, if you have clinched an item there is a \* next to the item. The prices at which these units were clinched are shown next to the value of the item.

Below the solid line are shown the values for those who did not clinch an item along with the corresponding drop-out prices. These are listed with the last drop-out price first, and the first drop-out price last. Note, the computers always drop out at a price equal to their value.

Profits of the items you have been bidding on are shown to the right of your screens just below the value of the item. If you have clinched an item there are x's in the space next to the entry - your bid. Below this is shown the price at which you clinched the item and below this the profits earned on the item.

If you dropped out without clinching an item on the "your bid" line the computer shows the price at which you dropped out and that you earned zero profits on that item.

At the very bottom right hand side of your screen you will see total profits - the sum of the profits on your 2 units. Just below this is net profits - total profits less the auction fee. Note, the auction fee will always be 0, so this number will be the same as total profits.

Finally, your cash balance will be updated following each auction period - positive profits added to it, negative profits subtracted from it.

Are there any questions?

You all have record sheets. You must fill these in during the dry runs so that we can check if you understand the pricing rules and the profit calculations. (The better you understand the pricing rules and profit calculations the more money you are likely to make). After the dry runs we recommend you continue to keep these records but do not require that you do so.

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After 2nd dry run - add the following:

Before continuing with the next dry run let me ask and answer some questions others have asked in this experiment:

1. How much money can I earn? We don't know exactly since your earnings depend in part on how you bid and in part on luck (the values the computers draw and the values you draw). All we can tell you is that most of our subjects elect to return for additional experiments.

2. Can I bid above my starting balance of \$5.00? Yes - you can bid whatever you like. Recall that your value is what you will get for any items earned, so that you do not have to "secure" your bid with your cash balance. The latter is just designed to provide you with some minimum earnings and a fund from which any negative earnings will be subtracted to begin with.

3. How can I lose money in this auction? The only way you can lose money is by clinching an item at a price above your value for that item.