

## INSTRUCTIONS FOR PART 2

[NOTE: This instruction document has been modified for Treatment 1: M=3,N=2,K=2 Uniform Auction Format]

- (1) We will create a market in which you will act as bidder in a sequence of auctions. There are three identical units up for sale in which you and one other bidder are competing to win. You and your rival both demand two of these three identical units.
- (2) Each bidder will be assigned valuations for the two identical units they demand. These valuations represent the value of the good to you if you obtain it, i.e., what we will pay you for any items purchased. The values of each of the two units will be different from each other. If won, the first unit will provide you with a valuation denoted by:  $(v_1)$ . If both units are won, your valuation from earning only one of the units will be increased by  $(v_2)$ . You can think of  $(v_2)$  as the incremental value you get for winning a second unit above your initial value for the first unit won. Your valuations are known only to you and are completely independent of the valuations assigned to your competitors. Your valuations will be drawn anew before each auction.
- (3) The incremental value for the second unit  $(v_2)$  will be randomly drawn from an interval where the lowest possible value is \$0 and the highest possible value is \$10.00. This is the same for all bidders. Any value within this interval has an equally likely chance of being drawn and being assigned as your valuation. Values for the first unit  $(v_1)$  will be drawn from an interval where the lowest possible value is equal to the incremental valuation drawn for winning the second unit and the highest possible value is \$10.00. Any value within this interval has an equally likely chance of being drawn and being assigned as your valuation. Note that it is possible, but unlikely, that you will have the same valuation(s) as one or more of your competitors.
- (4) Each bidder submits two bids (bids must be greater than or equal to zero) - one for each unit corresponding to the valuations they were given.
- (5) After you and your competitors have submitted your bids, the auctioneer will rank them from highest to lowest. The three highest bids will each be awarded one unit and the losing bid (the fourth highest bid) will set the “clearing price” that all winning bidders will have to pay on each of the units they won. This is called a uniform price auction - everyone

pays the same price regardless of your bid.

- (6) The auctions you will play in have been designed to guarantee that you will win at least one unit and that the bid you submit on your highest valued unit will never set the clearing price. In other words, you are guaranteed to always win at least one of the two units you demand and that you will never have to pay your highest bid.
- (7) The experiment will consist of numerous rounds, taking approximately 45 minutes in total. An auction with two bidders will take place in each round. You are one bidder, the second bidder is chosen randomly for each round. So you are bidding against one other person in each round who may or may not be the same person from the previous round.

#### ASSIGNMENT RULES AND PROFIT CALCULATIONS

- (1) After the bids have been submitted, collected and ranked from highest to lowest, we report back to you the outcomes for your market: bids listed from highest to lowest, how many units you won, how much profits you earned on each unit and your total profits. Finally, the highest rejected bid ( the bid that sets the clearing price) - is highlighted within a green background. For your convenience, your bids always have a \* next to them.
- (2) The computer calculates the profits on each of your bids on units that you are awarded. Recall, there are two possible scenarios you may find yourself in:
  - (a) You win two units. This occurs when *both* of your bids are among the 3 highest bids.  
Your profits for unit one are:  $\Pi_1 = v_1 - \text{clearingprice}$   
Your profits for unit two are:  $\Pi_2 = v_2 - \text{clearingprice}$   
Total Profits are  $\Pi_{TOTAL} = \Pi_1 + \Pi_2 = v_1 + v_2 - 2 \times \text{clearingprice}$
  - (b) You only win one unit. This occurs when only one of your bids is among the three highest bids. Note in this case, your second bid is necessarily the only losing bid: Therefore this bid of yours sets the clearing price that you pay for the unit you won.  
Your profits for unit one are:  $\Pi_1 = v_1 - \text{clearingprice}$   
Your profits for unit two are:  $\Pi_2 = 0$   
Total Profits are  $\Pi_{TOTAL} = \Pi_1 = v_1 - \text{clearingprice}$
- (3) 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.

## ILLUSTRATIVE EXAMPLES

The following examples illustrate the uniform pricing rule and how profits are calculated. Each example will be illustrated from the perspective of bidder A who is competing against one rival bidder: Bidder B. Each of the two bidders with demand for two units are competing in one auction in which there are three units of a homogeneous good to be auctioned.

TABLE 1. Auction Outcomes

	Bid	Value	Bidder ID
won	6.3	6.3	A
won	5.6	5.6	B
won	2.8	4.8	B
lost	<b>2</b>	4.4	A

TABLE 2. Auction Outcomes

	Bid	Value	Bidder ID
won	6.3	6.3	A
won	5.6	5.6	B
won	4.0	4.4	A
lost	2.8	4.8	B

**Example 1.** First, we focus on Table 1 in Example 1. Note bids have been sorted from highest to lowest, values are shown next to the bids. The bid that determines the market price (the 4th highest bid) has been highlighted and is the only bid below the dashed line - separating winning and losing bids. The 3 highest bids above the dashed line each earn an item. Note, the clearing price is always set by the only losing bid. In the example depicted in Table 1, bidder A earned 1 unit while bidder B earned 2 units. Thus in the case of Table 1, Bidder A's profits are calculated as

- Unit 1:  $6.3 - 2 = 4.3$
- and nothing on unit 2
- Total profit = 4.3

In this example, Bidder A could have earned a second unit by bidding more, provided that bid was sufficiently high to edge out Bidder B. Table 2 illustrates the case in which Bidder A changes her bid on her second unit from 2 to 4; and all other bids are held constant. Focusing on Table 2, we see that the clearing price is now 2.8. Bidder A wins two units and bidder B now only wins one and her losing bid sets the clearing price. Thus in the case of Table 2, Bidder A's profits are calculated as

- Unit 1:  $6.3 - 2.8 = 3.5$
- Units 2:  $4.4 - 2.8 = 1.6$
- Total profits = 5.1

In comparing the auction outcomes in Table 1 and Table 2, we see that Bidder A was able to increase her profits by bidding marginally more on her second unit in order to win two units rather than one. However, it is important to point out in this example that in earning two (rather than one) unit, Bidder A caused the market clearing price to increase from 2.0 to 2.8. This directly affects the price that Bidder A had to pay for her higher valued unit. In the scenario represented in Table 1 and Table 2, the increase in clearing price was small enough such that winning two

units rather than one unit increased total profits. It should be noted that this will not always be the case.

**Example 2.** The next set of examples in Table 3 and 4 illustrates an alternative scenario in which Bidder A bids higher on her second unit in order to win two rather than one unit and actually resulted in her earning lower profits.

TABLE 3. Auction Outcomes

	Bid	Value	Bidder ID
won	6.3	6.3	A
won	5.6	5.6	B
won	3.9	5.4	B
lost	<b>2</b>	4.4	A

TABLE 4. Auction Outcomes

	Bid	Value	Bidder ID
won	6.3	6.3	A
won	5.6	5.6	B
won	4.0	4.4	A
lost	<b>3.9</b>	5.4	B

Focusing on Table 3, we see that Bidder A earned 1 unit while bidder B earned 2 units. Profits for bidder A on this unit are calculated as follows: the valuation of the unit less the market price. Thus in the case of Table 3, Bidder A's profits are calculated as:

- Unit 1:  $6.3 - 2 = 4.3$
- and nothing on unit 2
- Total profits = 4.3

As in the previous example, we are interested to see if Bidder A could increase her profits by winning two (rather than one) unit . Table 4 illustrates this case when Bidder A changes her bid from 2 to 4 on her lower valued unit while keeping her bid on the higher valued unit constant as well as bids from Bidder constant. This change in bidding strategy resulted in the clearing price now being set by Bidder B's bid of 3.9. Bidder A wins two units and bidder B now only wins one and her losing bid sets the clearing price. Thus in the case of Table 4, Bidder A's profits are calculated as:

- Unit 1:  $6.3 - 3.9 = 2.4$
- Units 2:  $4.4 - 3.9 = 0.5$
- Total profits = 2.9

Consequently, total profits are lower in Table 4 where Bidder A won two units relative to Table 3 where Bidder A won only one unit. To summarize, examples 1 and 2 illustrated the effect of Bidder A using different strategies on total profits. As was the case in example 1, Bidder A earned more profit when she won two units compared to the case when she won one unit. However, example 2 illustrates an equally likely scenario when Bidder A actually earned **less** revenue when she won two rather than one unit. Underlying these two illustrative examples is the fact that winning two units instead of one unit will almost surely increase the clearing price and thus directly reduce the profits you can earn on the first unit. 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 (example 2).

## ADDITIONAL REMARKS

- (1) In case of a tie - for example the 3rd and 4th 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.
- (2) In cases where the 4th highest bid is zero (0), the price everyone pays is also zero. That is, the 4th highest bid sets the market price no matter what the bid is.
- (3) You are free to bid whatever you think will bring you the most earnings. However, for programming purposes we have restricted all bids to be greater than or equal to zero in addition to the bids for the second unit to be less than or equal to the bid on the first unit listed.
- (4) Your starting balance of \$5 does not restrict how much you can bid. 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.
- (5) Your final payoff will be determined by only one of the 25 auctions you will play. More specifically, one of the 25 auction rounds will be chosen at random and your profits (losses) earned from that auction will be added (subtracted) to your starting balance of \$5 to determine your final balance. All final balances will be paid to you in cash at the end of the experiment.
- (6) To ensure that you never lose money, you may consider restricting your bids to never exceed your valuation. However, if in any case your final balance falls below \$0, you will not be asked to pay the balance owing.
- (7) We will conduct 2 dry runs to familiarize you with the procedures and accounting rules. This will be followed by 25 periods played for cash.
- (8) Please feel free to ask questions as we go along. You are not permitted to talk to each other until the experiment is over.

## PRACTICE ROUNDS $\times 2$

This is a dry run. You are not required to 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 rival bidders” - the number of other bidders that you are competing against in your market (1). Next is the “supply” - the number of items for sale in each market (3). Next is “demand” - the total number of bid submitted in this market (4: consisting of your 2 bids plus 2 bids from your competitor). Note, there will always be only one bid that loses. This means that you are guaranteed to win at least one unit in every auction you play. Finally, “balance” - your starting cash balance is reported on the screen. Your balance will be automatically updated after each auction once this “dry-run” is completed.

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).

Please enter your bid now. Next is shown the value of your second unit and the space for your bid. Recall, the second unit your demand will always be strictly lower than the first unit you demand (refer back to section 2 to review the exact procedure we use to randomly draw your two valuations.) Please enter the bid on your second unit now.

All the bids have been collected, sorted, and prices and profits calculated. 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 3 highest bids are listed in order above it. (Remember, your bids always have a \* next to them).